# Monitoring amenity tree health in England

## The Condition Survey of Non-woodland Amenity Trees

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For over a decade, numerous volunteers have been involved in a Forest Research (FR)-led survey which enables us to monitor the condition of amenity trees in parks, city streets and stately homes across England. The concept behind the project grew from the *Forest Condition Survey* – a pan-European annual survey of forest condition which has been carried out across the UK and other European countries since 1987 (Hendry, 2005). Whilst the *Forest Condition Survey* concentrates on forest trees, *The Condition Survey of Non-woodland Amenity Trees* focuses on 16 genera of amenity trees commonly found in urban and rural environments within England. The aim is to identify, assess and publicise problems relating to pests, pathogens and other factors affecting the condition of non-woodland trees. In addition, participation in the survey encourages a greater awareness of the health and landscape value of amenity trees, while enabling the volunteer assessors to feel a greater ownership of the trees within their environments. This article provides an overview of the history, structure and findings of the survey.

## Background

Since its inception in 1993-4, the condition survey has run in a number of slightly different forms and has been supported by various government departments. The first generation of the survey, funded by the Department of the Environment, grew from the government's growing awareness of the importance of trees within the urban environment, and also increasing public concern following the Dutch elm disease epidemic, recent drought problems and the Waldsterben debate (forest death attributed to acid rain) in Germany. Prior to this, the collection of data on tree health relied upon people contacting diagnostic services, such the Disease, Diagnosis and Advisory Service (DDAS) of FR, and the advisory services of the Royal Horticultural Society at Wisley. Consequently, the data tended to be patchy, occasionally unreliable and not very comprehensive. In an attempt to collect data on the health of amenity trees in a more systematic and rigorous way, plots were set up in 1993 to monitor tree condition. This was the first national scheme in the UK to attempt to monitor the health of non-woodland amenity trees, and also the first government sponsored tree health monitoring exercise to involve volunteer observers.

Tree plots containing pre-existing, mature trees were set up in both 'rural' and 'urban' situations. In some cases they mirrored those used in the initial survey *Trees in towns* (Department of the Environment and Land Use Consultants, 1993) and the *Countryside survey* (Department of the Environment, Institute of Terrestrial Ecology and Institute of Freshwater Ecology, 1993). Many rural plots were set up in the grounds of National Trust properties. Overall, a network of 106 plots was established. These first plots followed a fairly loose prescription, including between 100 and 200 trees, encompassing at least 12 genera, with as wide a range of species as possible. This gave the opportunity to study problems in species that would otherwise receive little attention. The emphasis at that time was on 'variety,' and some plots encompassed almost as many species as trees! In addition to recording any unusual or striking symptoms, the basic information collected included: tree species, estimated height and girth, foliar and shoot characteristics and crown density. Assessments were conducted twice yearly in June and September by volunteer observers. The volunteers came from a wide range of backgrounds, and included professional arboriculturists, local authority tree officers and parish tree wardens, as well as interested amateurs. The very general nature of this first generation of the survey meant that the data collected provided a valuable but rather qualitative picture of tree condition. In combination with the growing casebook of advisory data, such information formed the backbone of the reference book *Diagnosis of ill health in trees* (Strouts and Winter, 2000). A copy of this text is now made available to volunteers to encourage and reward participation in the survey.

## The current amenity tree survey

Following a review of the project in 1998 there was a move towards more quantitative data collection, and perhaps a greater awareness of the potential social benefits of participation. Some of the main aims of the survey are detailed in Box 1.

**Box 1** Main aims of the amenity tree health survey.

- Identify significant tree problems and promote awareness amongst tree managers.
- Identify trends in tree health and factors that may cause changes in them.
- Highlight issues that warrant further detailed investigation and reporting.
- Disseminate information to assist and enhance the personal development of all those involved in the management of amenity trees.

Survey design was streamlined to achieve replication and focus. A restriction was placed on the number of different tree genera; only the 16 genera most commonly found in the existing plots (see Table 1) were chosen for inclusion within the new survey. Each new plot had to contain at least five representatives of six of these genera, resulting in plots of around 30 trees. Many of the old plots proved suitable for inclusion within the new survey, but a number of new plots had to be set up in other locations to maintain a total of around 100 active plots across England. Active plots in 2005 are illustrated in Figure 1.

**Table 1** Genera of trees included in the current survey.

| Common name | Genus |
|---|---|
| Sycamore and Norway maple | *Acer* |
| Horse-chestnut | *Aesculus* |
| Birch | *Betula* |
| Hawthorn | *Crataegus* |
| Lawson cypress | *Chamaecyparis* |
| Beech | *Fagus* |
| Ash | *Fraxinus* |
| Holly | *Ilex* |
| Plane | *Platanus* |
| Poplar | *Populus* |
| Cherry | *Prunus* |
| Oak | *Quercus* |
| Willow | *Salix* |
| Swedish whitebeam and rowan | *Sorbus* |
| Yew | *Taxus* |
| Lime | *Tilia* |

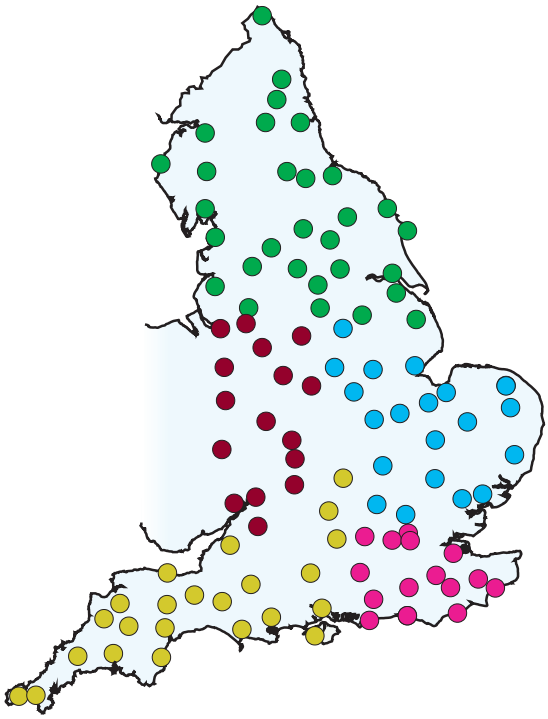

**Figure 1** Distribution of amenity tree plots across England in 2005. The different colours illustrate how the survey is divided into distinct 'management areas' for easier administration.

Just as before, the trees continued to be assessed by volunteers, but rather than ask for two assessments, just one a year was carried out in mid-summer, as even some of the most dedicated volunteers had found it difficult to commit to more than one assessment. Although the numbers of trees within the plots was reduced in the new survey, volunteers were now asked to perform a much more detailed and systematic examination of each tree. The incidence and severity of a range of pests and diseases was recorded and, as tree condition in quite a broad sense was of interest, the new system also allowed the recording of abiotic disorders and even anthropogenic damage. Figure 2 shows an example of the assessment form used in the survey.

## Amenity tree assessment form

The front of each form is split into sections, the first containing basic information such as the tree number and diameter at breast height. This allows easy identification of the trees for annual assessment in future years, to allow monitoring of ongoing changes in condition. In the main section of the form, volunteers are asked to submit information on the condition of the wood and bark, the condition of the crown and the state of individual leaves. For certain genera volunteers are also asked to look out for specific pests and diseases of interest. These tend to be relatively easily identifiable disorders which are specific to just one genus within the survey, and which may vary between years, perhaps in relation to local climatic conditions. For example, volunteers assessing *Acer* species look for signs of tar spot and sooty bark disease caused respectively by the fungi *Rhytizma acerinum* and *Cryptostroma corticale*. Both can cause striking symptoms (see Figure 3), and although the former is only really of aesthetic significance, following periods of very hot dry weather the latter can occasionally be the cause of tree death. In most cases volunteers are asked to judge the severity of any symptoms present using a very simple scale running from 0 (no symptoms) through to 3 (severe symptoms). Given the wide variation in the volunteers' experience of tree assessments, this simple system was chosen because it was practical and easy to use, while still yielding reliable data. A more complex system requires further training on the part of the volunteers, and this could deter some people from taking part.

## Condition Survey of Non-woodland Amenity Trees

Year:..**2005**..... Plot Name: ALICE HOLT Plot No: 001 Observer's name: Katherine Tubby

Sheet No:..1.....of..6.... Tree species..***Acer pseudoplatanus***.....

**Part A: Annual assessment of all tree species registered for the survey at the above plot**

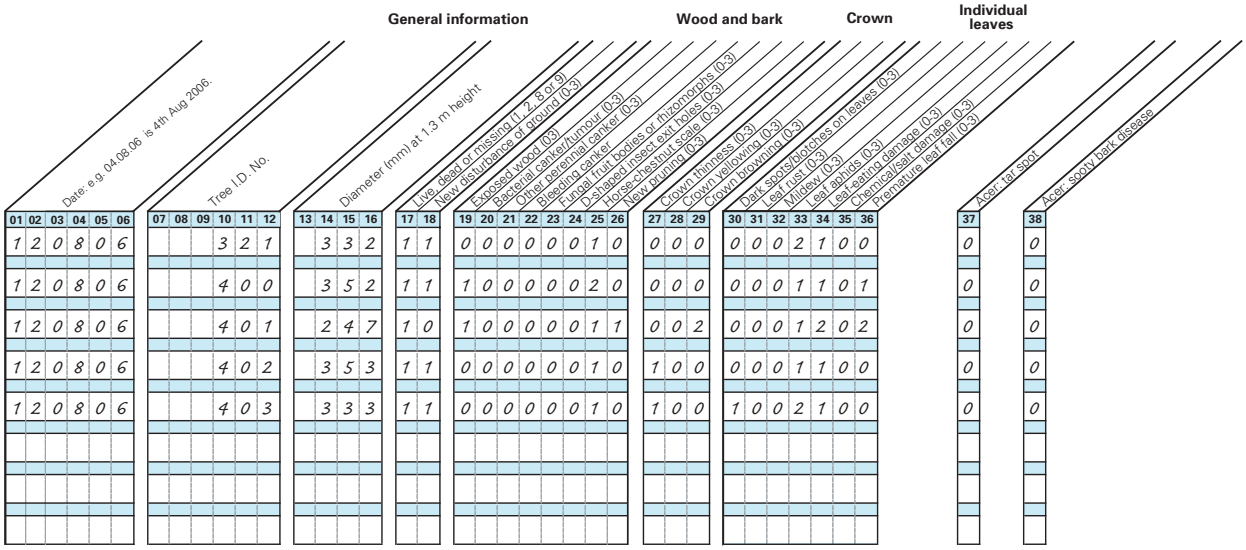


**Figure 2** Example of an assessment form used by volunteers to record condition of *Acer* species. (There is an additional section on the reverse of each form where volunteers can make further notes.)

**Figure 3** Tar spot and sooty bark disease on sycamore – two of the diseases our volunteers look out for.

Assessment forms are updated when necessary to take into account the changing behaviour of some organisms affecting tree health. One particular example is bleeding canker on horse-chestnut. Over the past five years reports of bleeding cankers on *Aesculus* species have risen sharply, and researchers are especially keen to collect as much data on this disorder as possible, particularly as the cause is not yet conclusively identified. An additional column was added to the form in 2004, specifically requesting information on presence and severity of such cankers on all tree species in the survey.

## Training and education

Volunteers come from different walks of life bringing with them great variation in experience and background knowledge. Whilst some, for example arboriculturists and tree officers, must already be able to identify major pests and diseases as part of their work, others need more assistance. Therefore, on beginning the survey all volunteers are offered the opportunity of one-on-one assistance to get them started. Overall management of the survey is centrally co-ordinated through a project leader based at FR's Alice Holt research station. However, day-to-day management of the plots and contact with volunteers is largely devolved to trained liaison officers, one based in each of the sub-regions of the survey area. They offer regular contact with volunteers whenever needed, and are available to help set up plots, identify tree species, pests and diseases, and to answer any queries relating to the running of the survey. Such training is one of the benefits of taking part in this survey. Volunteers receive annual reports based on the data they have collected along with advisory casebook data for that particular year (Thorpe *et al.,* 2006a,b). Topical information leaflets called Tree Damage Alerts are also sent out periodically, flagging up certain pests or diseases prevalent at the time.

## Results and trends

The survey in its present format allows the data to be analysed and presented more quantitatively, and provides a solid framework for monitoring ongoing changes in the health of amenity trees. Although the new survey has only been fully operational since 2000, year-to-year changes in the overall incidence of certain factors, for example crown browning and premature leaf fall, are becoming apparent as more data are collected (Figure 4a and b). In some cases crown discoloration can be attributed to the presence of a specific disease or insect. The browning apparent in the crowns of nearly half of all plane trees assessed in 2001 reflected high levels of anthracnose. The causal agent, the fungus *Apiognomonia veneta*, was particularly common in the springs of 1999, 2000 and 2001 due to a series of prolonged mild wet springs producing conditions conducive to the spread of this pathogen (Strouts, 1991). In the spring, buds may fail to flush as a result of infections from the previous year. The developing infection can also develop into twig blight, and later in the summer a leaf blight stage occurs, starting with killing of the veins and surrounding leaf tissue. If the fungus spreads down the petiole into the twig, the affected leaves fall early. In 2001 this disorder was reflected in the volunteers' data as 71% of all plane trees were recorded as suffering premature defoliation. It is now relatively common in these abundant urban trees, and it is possible that the observed rise in incidence is related to decreasing levels of sulphurous pollution in our cities. In contrast, crown discoloration in a species such as yew is much more difficult to attribute to a specific cause. The older needles go through a normal process of senescence at about the time when the trees are due to be surveyed, making it difficult to distinguish the perfectly normal change in overall crown colour from, for example, the browning caused by Phytophthora root rot.

Trees differ in their ability to withstand stress, and it was interesting to see how this was reflected in the data obtained during the summer of 2003. Southern parts of England in particular experienced some of the highest temperatures recorded in the UK and the 100 °F 'barrier' was breached east of London with 38.5 °C (101.3 °F) recorded at Brogdale near Faversham. There were many reports of limb shedding by large trees, and the high temperatures in late July/August caused some trees to lose their leaves early. Others suffered crown browning and leaf curling. The survey indicated that different species

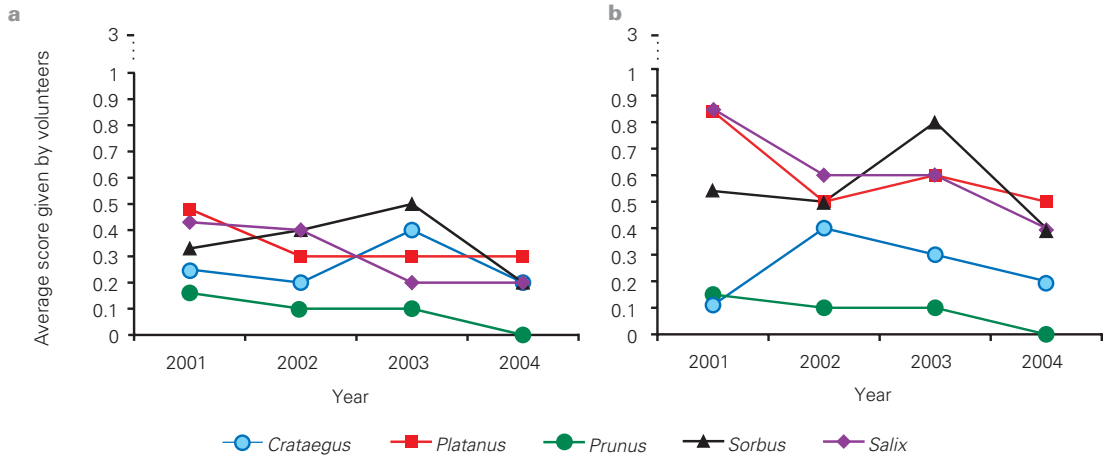


**Figure 4** Examples of results on five species of tree assessed by volunteers taking part in the survey: (a) the appearance of crown browning; (b) the degree of premature leaf fall. Scale: 0 (no symptoms) through to 3 (severe symptoms).

varied in their susceptibility: *Platanus, Sorbus* and *Salix* suffered the highest levels of premature leaf drop and (excepting the evergreen species in the study) *Prunus* the lowest. The crown condition of beech also varies markedly from year to year and, although long-term drought is known to have affected the condition of some trees (Cannell and Sparks, 1999), heavy masting also has a significant deleterious effect on the crown in following years. Surprisingly perhaps, there were fewer reports of drought-related damage than expected. The dry sunny conditions also reduced the incidence of many leaf and shoot problems.

In addition to annual variation in the patterns of some pests and diseases, the data also illustrate certain geographic trends. Horse-chestnut leaf blotch, caused by the fungus *Guignardia aesculi* has been present in the UK since around 1935, following a probable introduction from the United States. The disease is recognisable by the reddish or dull brown, irregular blotches that are often concentrated at the tips and margins of infected leaflets. The blotches are usually outlined by a conspicuous yellow band (see Figure 5a). Since the beginning of the new survey it has been consistently recorded on at least 50% of all the horse-chestnuts assessed. However, it remains markedly more common in southern areas of the country (see Figure 5b). Of course this may change with global warming.

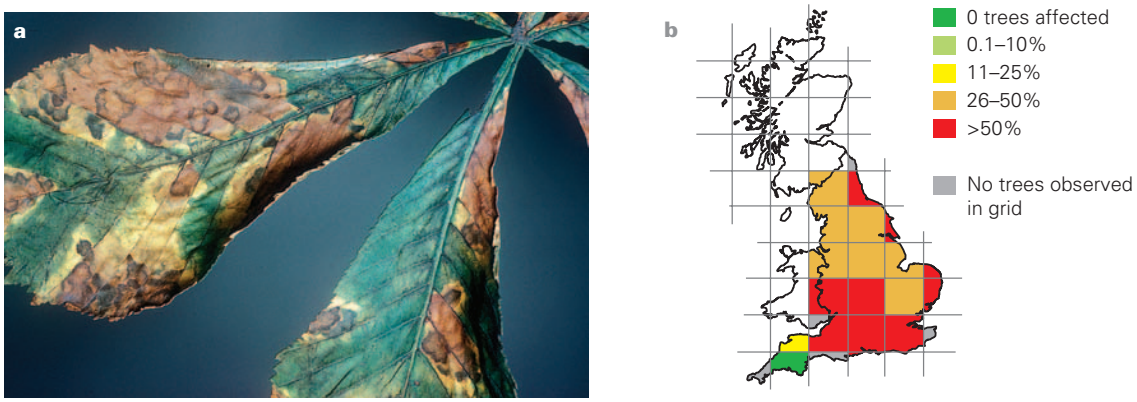


**Figure 5** (a) Horse-chestnut leaf blotch showing yellow band. (b) Distribution of horse-chestnut leaf blotch in 2004, showing the percentage of trees surveyed in each square that were infected with the disease.

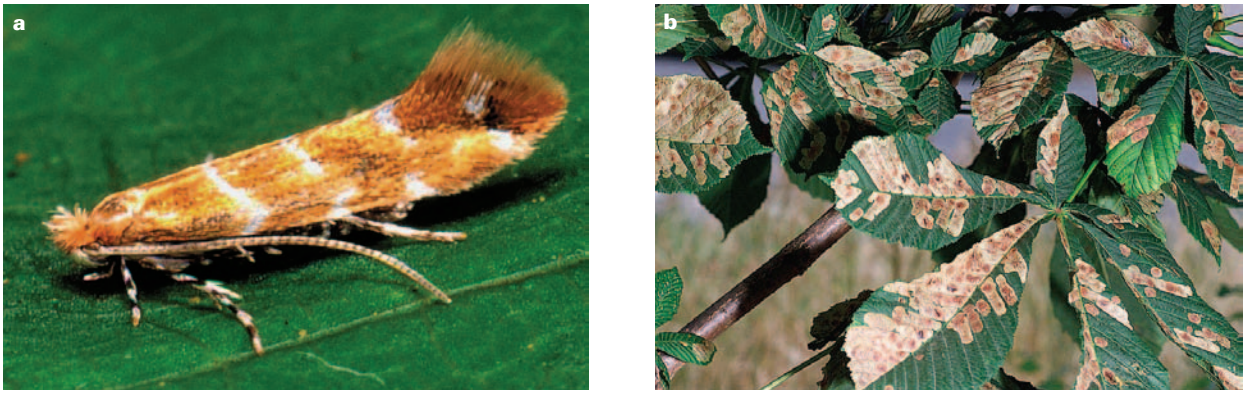


**Figure 6** Horse-chestnut leaf miner *(Cameraria ohridella)* – a recent invader to the UK: (a) adult moth and (b) leaf mines created by the larvae. (a: photo P. Roose)

There is also potential for the survey to act as an early-warning system with respect to new or exotic organisms. Periodically, short leaflets called Exotic Pest Alerts are sent out to volunteers and the wider public to illustrate new threats such as the emerald ash borer *(Agrilus planipennis)* and the Asian long horn beetle *(Anoplophora glabripennis)*. Fortunately there have been no reports as yet and neither beetle is thought to have established in the UK. At the start of the new survey the horse-chestnut leaf miner *Cameraria ohridella* (Figure 6a and b) had not been found in the UK, although it had spread from an initial locus in Macedonia to much of Europe. However, in 2002, *C. ohridella* was found in the London borough of Wimbledon and has since spread to many parts of southeast England (Straw and Bellet-Travers, 2004; see also Tree Health Highlight 2, page 23). Volunteers involved in the survey have reported it in plots as widely spaced as south London and Norwich.

## Limitations

Unfortunately, it must be said that some trends picked up by general advisory casebook data are not apparent in the data collected by the survey volunteers. Bleeding canker on horse-chestnut has become a very significant problem since 2000–2001, and although volunteers are now asked specifically to record presence of bleeding cankers, records are still very scarce compared with the actual numbers of trees that seem to be affected across the UK. Although no widespread systematic survey has been undertaken, Forest Research estimates that some 35 000 to 50 000 trees are affected, and probably a few thousands have already been felled as a result of the disease. Good quality data collected by volunteers would provide an extremely useful additional source of information.

In certain years the advisory casebook data also indicate high levels of rust (*Melampsora* spp.) on poplars and willows, and yet this is very rarely picked up in the survey. Some disease symptoms are difficult for all but the specialist to recognise and there is a fairly widespread failure to recognise rust symptoms or to distinguish between rust and mildew. Assessments of cherry also seem to generate occasional problems. It can be difficult to identify the specific cherry types selected for inclusion in the survey, as *Prunus* is an extremely large genus and exotic species or hybrids are often used in amenity plantings. Volunteers also often have difficulty identifying some of the diseases found on cherry. Consequently survey data do not always reflect the results garnered from advisory casebook data.

Although in most cases tree assessments are carried out with few problems, the possibility of missed or misdiagnosed disorders emphasises the importance of making one-on-one training available to all volunteers starting the survey. It also underlines the relevance of the annual reports and other topical information notes

provided to participants. To increase public access to information, web pages dedicated to the project have been produced setting out the aims of the project. Assessment forms are available for downloading, and copies of annual reports are available to readers (http://www.forestresearch.gov.uk/amenitytreesurvey). Free or discounted places are also made available at annual seminars to augment the professional development of volunteers. All these aids help to educate and enthuse volunteers whose background may not involve tree management at any level.

Undoubtedly the scheme has generated enormous enthusiasm and goodwill – even amongst those who do not get round to sending in their data every year! It encourages a greater sense of ownership and gives participants the feeling of being in touch with a national initiative on a subject about which they care deeply. This is a significant, if unquantifiable benefit of the scheme. The health of most of the amenity trees under assessment remains relatively good, and it is probably not an exaggeration to say that, in many cases, this is because people like the volunteers are looking after these trees and making sure they thrive in their environment.

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