Arboricultural Association cares for trees

NEWSLETTER

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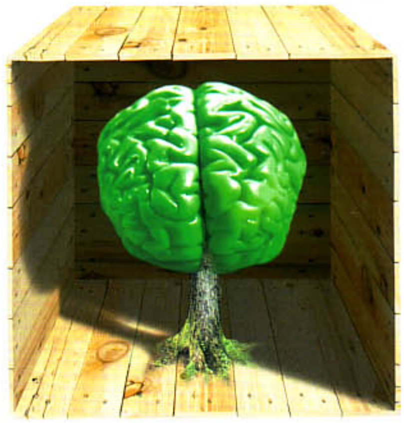
ARBORICULTURE ASSOCIATION 40TH YEAR CONFERENCE




Arboriculture
A new awakening

20th - 22nd September 2004
University College Chester



DON'T MISS

...thinking outside the box!

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A NEW GENERATION THERMOGRAPH

FOR THE ASSESSMENT OF TREE STABILITY

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An article by one of the Authors (A. Catena, 2003) was recently published in the Arboricultural Journal and illustrated the use of Thermography in the assessment of tree stability. The other Author made a presentation and gave a practical demonstration of this non-invasive, reliable, fast and safe technique at the AA's Annual Conference in Northampton. An investigation carried out with a totally new, recently marketed apparatus is presented here. This apparatus weds greater handiness and cost-effectiveness. In fact, the system costs half the price of the old apparatus, though the characteristics necessary to perform tree assessments have remained unchanged. Such characteristics include the following:

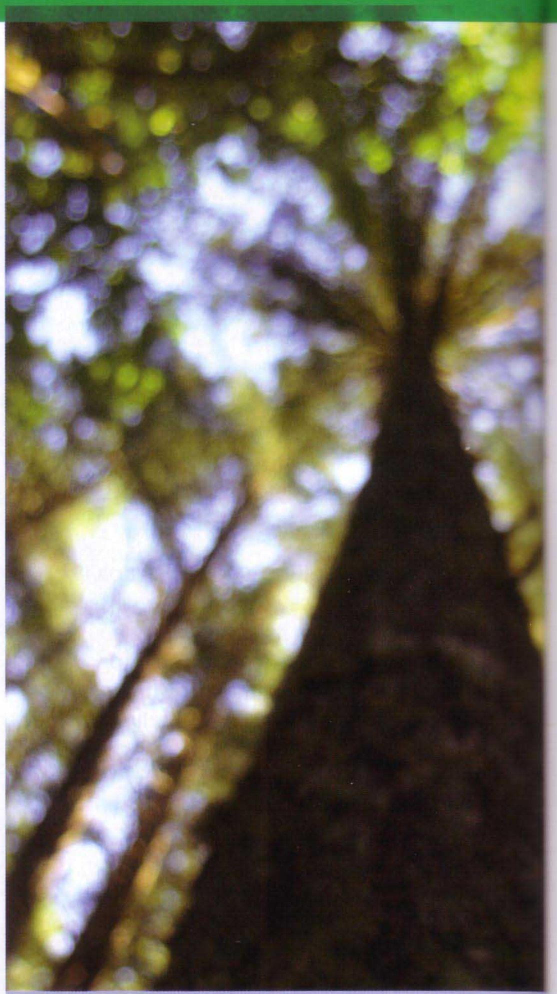
- Provision of the image of the area filmed in b&w and in preset colour scales
- Possibility to store images onto a card
- Possibility to re-process images and print Presentations on paper, thanks to a proprietary software
- Apparatus powered by a battery rechargeable also through car cigarette lighters
- Greater handiness and transportability, etc.

In the belief that a better description of the thermograph lies in the presentation of images filmed while it is used, this camera was used on two *Aesculus hippocastanum* L. in a street in Milan (Italy) in the framework of a comparative study of this and the camera presented in Northampton.

The system that is presented here, the IR-FlexCam™, has a state-of-the-art uncooled microbolometric sensor, made up by a 160x120 flat matrix, working in the 8-14_m wavelength interval (spectral field). The camera is equipped with interchangeable lenses, a 5'' built-in screen and a lithium battery: it weighs less than 2kg, therefore it is extremely handy.

The apparatus is held like a normal camera, and is made up by two modules, linked by a joint that can be oriented independently one from the other. One module films and the other measures. The operator can easily view the display, whereas the sensor-equipped module can be rotated to film the area of interest in the best possible way.

The image appears in real time (50 images/sec.), can be viewed in 8 preset colour scales and stored onto a Compact Flash card (a 16Mb card contains 300 images) and a message can be recorded with the image. The thermal images on the Compact Flash Card can be transferred onto a PC for further analysis. It is possible to measure the surface temperature of any point of the scene filmed both on the live image and in the processing phase on a PC.



A further advantage of this camera is that it is easy to use, i.e. all the functions are activated through easily reachable keys, without moving one's hands from the handle. The operator can fully use that camera in a short time.

The camera's thermal sensitivity is 0.1°C, its geometric resolution is 2.6 mrad: this means that the camera can recognise two points whose temperatures differ from at least 0.1°C and detect decay bigger than 2.6cm x 2.6cm from a distance of 10m. The geometric resolution is lower than the one of the apparatus shown in Northampton but, as the comparison between the respective images will show, it provides good results, anyway.

The system is equipped with a video output to continually record the images produced, and a USB port for remote-controlling with the mouse. Thanks to the proprietary software FlexView™, reports on the work carried out can be automatically produced.

The apparatus and a TVS700 (a newer version than the one used in the above-mentioned article, but the characteristics are the same) were used on two horse-chestnuts, in order to have a direct comparison of the quality of the respective images.

For any information relative to the thermographic investigation, its modes of execution, as well as the precautions to adopt, please see the above-mentioned article, since they will be taken for granted in this article.

Figure 1 compares the thermal images of the same trunk portion of a horse-chestnut: on the left, there is the image filmed with the IR-FlexCam™, on the right, the image filmed with the TVS 700, in the middle, the picture of the tree. The leftmost image has bigger pixels than the rightmost one, but is perfectly readable anyway. The red arrows in the three images show the same detail: a surface scar in the bark from which liquid flows out. The black arrows indicate decortications at the base of the trunk. The quality of the two thermal images is in line with the characteristics of the two systems: the thermal sensibility is the same, but the IR-FlexCam™ geometric resolution is a fourth of that of the TVS700, therefore, it is clear that the pixels in the first image are bigger. However, if the object is approached, the quality of the IR-FlexCam™ image is comparable with the TVS700 one, however it is not always possible to assess tree aerial parts, or shots from a distance.

Figure 2 shows an old scar due to the pruning of a big branch. Tissue diversity can be clearly seen: scar tissue, highly damaged tissue in the middle part of the ring, and the existence of internal trunk decay at the height of the scar which moves along the residual branches. The figure indicates the presence of a wire net to close the scar and now partly enclosed by the callus. The net is not visible in the thermogram, because of the size of the pixels. The images in Figure 1 were filmed from 6m, the image in Figure 2 from 2.5m.

The images in **Figure 3** were taken from 9m, the leftmost one was filmed with the IR-FlexCam™, and the rightmost one with the TVS700. The two thermal images perfectly show decay indicated by the black arrows, a long wound with internal decay exposed in the lower part of the slanting branch and the decortications shown by the red arrows along the trunk which is not visible in the picture. Therefore, the IR-FlexCam™ can detect significant decay and show its size.

According to the authors, the analysis of the documentation presented confirms the reliability of the new apparatus which has not only the advantage of being cost-effective, but especially of being handy and compact, so that it can be used without tripod. This will be an advantage for all those who are not only concerned with trees but also with the fauna that takes shelter or nests in them. Therefore, the system can reliably be used, for example, in the study of bats' behaviour, whose roosting sites within tree cavities have to be protected and safeguarded by law.

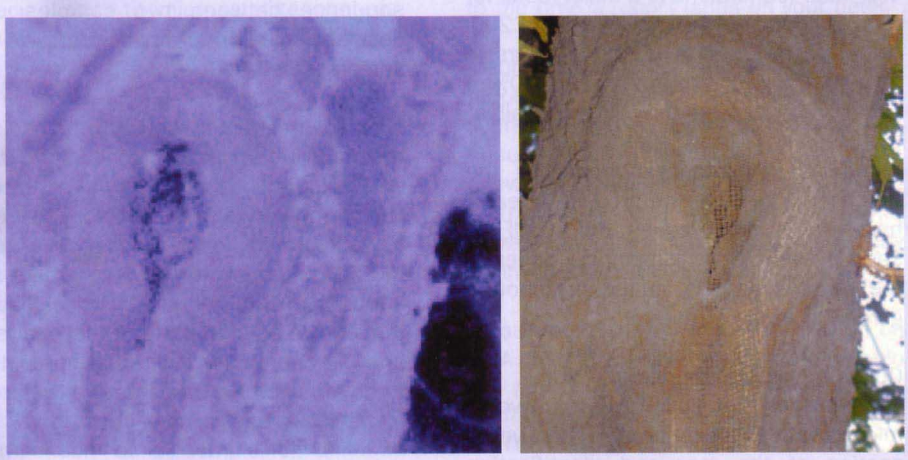


Figure 1

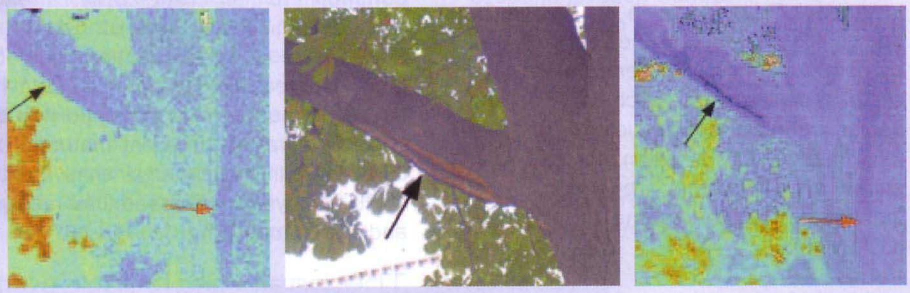


Figure 2

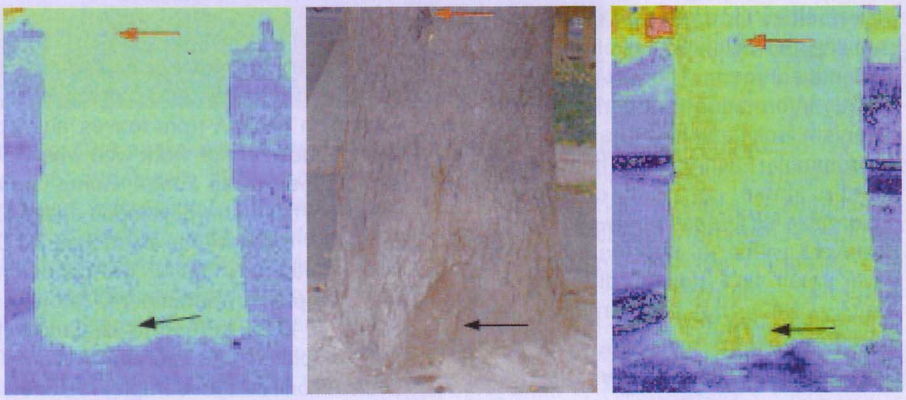


Figure 3