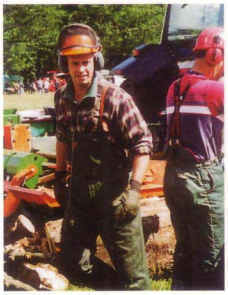
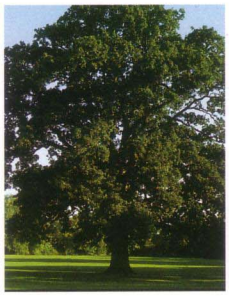
Arboricultural Association®
cares for trees

# TREES 2003
## CHANGING THE FUTURE

37th National Arboriculture Conference
Technical Seminar & Trade Exhibition



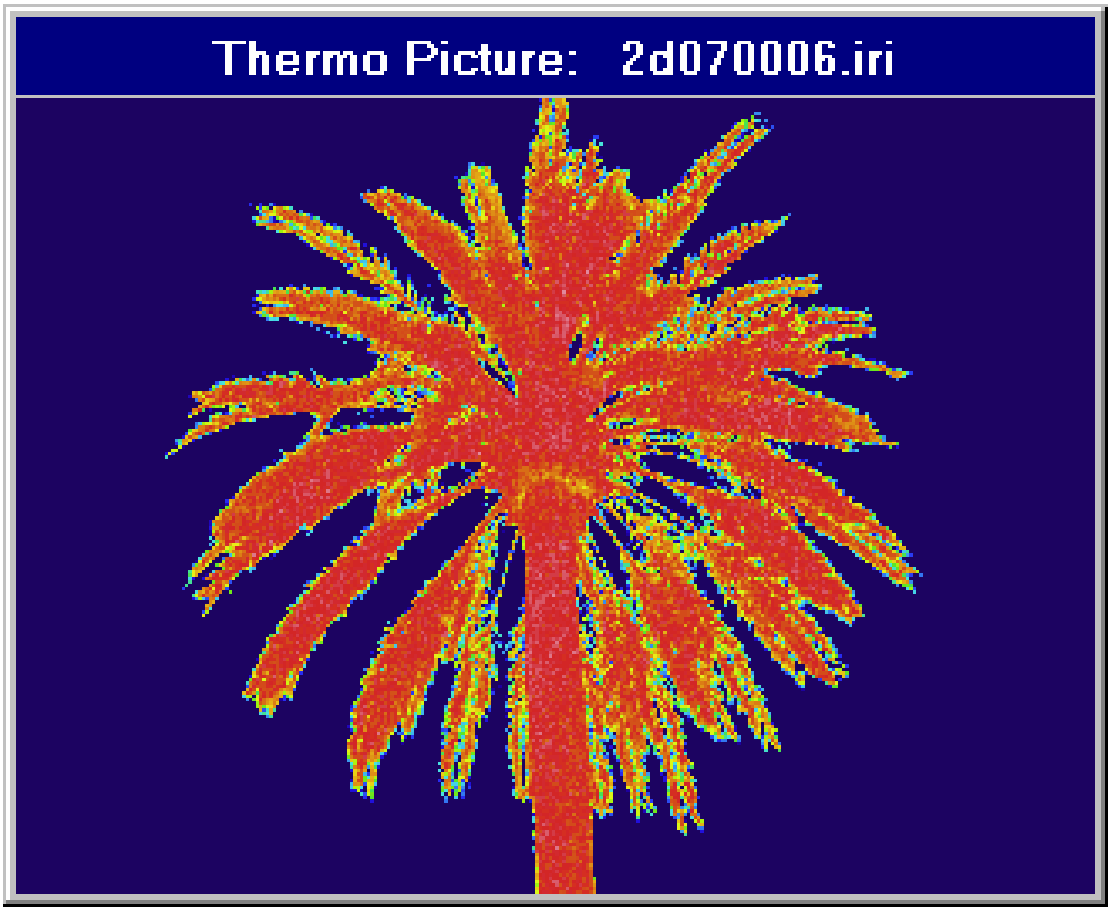
**University College of Northampton, England 15th - 17th September 2003**

## wednesday 17th september

| Time | Event | Who |
|---|---|---|
| 08:00 | **Breakfast** | |
| 09:00 | **Registration (day delegates only)** | |
| 09:35 | **CABE Space – Implementing the Governments Community Plan** | **Public Tree Asset Valuation.** An approach to developing a system to value populations of trees based on a rational, cost-benefit basis to be used for day to day and strategic management. **Chris Neilan** entered arboriculture in 1978 as a practising arborist and self tutored his way through to the N.D. (Arb) RFS. He is now a Fellow of the Association and works in landscape planning. |
| 10:10 | **Thermal Imaging for Tree Assessment.** Thermography is a non invasive technique that shows the presence of damage with objects thanks to the different thermal properties of damaged and healthy parts. In trees thermography reveals the presence of tree decay and damage from a distance, even in the root system. **Dr. Giorgio Catena** is an expert in thermography and has introduced technique to tree assessment. Born in Rome and a chemistry graduate Dr. Catena has been Director of the Remote Sensing Unit at the National Institute of Health for 29 years. | **Derby Arboretum – a Restoration Challenge.** Claimed to be Britains first public park (1840) the Arboretum was a nationally important tree collection. It now contains a limited selection of trees. The challenge is to restore it without destroying it as a public amenity. **Jonathan Oakes** arboricultural consultant and lecturer, currently chair of AA's Education and Training Committee and co-ordinator of the Technicians Certificate. |
| 10:45 | **Coffee** | |
| 11:20 | **A defendable system of tree inspection for Local Authorities.** Examining the practical factors involved in proposing such a system and the role of the Crown Prosecution Service and Health and Safety Executive. | **Dave Dowson** Director of Treelife Arboricultural Consultancy Ltd, he holds ICF Chartered Status, is a Fellow of the Association and a registered expert witness. He has written the AALGO syllabus, sits as an Arb assessor for the ICF and is the European Liaison Officer for the Certified Arborist Exams. |
| 11:55 | **THREATS (Tree Hazard Rating Evaluation And Treatment System)** – a method for recording, classifying and managing hazards form trees. The system has currently completed a review with help from the AA. The system has been updated and is now launched in its current form. | **Julian Forbes-Laird** is senior consultant for Colin Bashford Associates, an arboriculturalists chartered forester with over 13 years experience. He is currently on both BSI 3998 and 5837 drafting panels. |
| 12:30 | **Lunch** | |
| 13:50 | **Biosecurity Risks to the New Zealand Urban Forest.** Outlining the problems and methods of controlling the biosecurity risks of New Zealands urban forest. | **Martin Herbert** senior academic staff member of the Waikato Institute of Technology with over 30 years experience of global arboriculture. |
| 14:35 | **Eco Warriors – Friend or Foe to Arboriculture** | |
| 15:15 | **Raffle** | |
| 15:30 | **Chairman's Concluding Speech** | **Jonathan Hazell** |
| 15:40 | **Tea** | |
| 16:15 | **Insurance Open Forum (open to non delegates free of charge)** | |

G. CATENA

# THERMAL IMAGING FOR TREE ASSESSMENT




TREES 2003 – CHANGING THE FUTURE

Northampton, 15th – 17th September 2003

My presentation deals with tree assessment using thermal images by means of Thermography. Before showing you several thermal images of damaged trees, I'll very briefly illustrate the method. A thorough description of it can be found in Arboricultural Journal 2003, vol. 27, pp. 27-42

- Thermography is a well-known investigative method, widely used in many scientific and technical sectors.
  It is used in medicine and archaeology, in biology and in the Earth sciences, in the car and building industries and in studies of the environment

- The technique is used where experience has shown that a surface temperature different from a "normal" one, or different from that in the neighbouring areas points out the presence of internal discontinuities or anomalies that may be dangerous and deserve further analysis

- Thermography detects the presence of discontinuities and/or heterogeneity in the bodies investigated, thanks to the different thermal properties of the damaged areas in comparison to the healthy ones. Because of this, the surface temperature of a damaged area is different from that of a neighbouring healthy one

- If the surface temperature distribution of the area investigated is homogeneous, no internal damage is present. If the thermal image shows discontinuity (different colours or shades of grey) then internal damage is present. In the case of trees, the damaged area generally has a lower temperature than the healthy areas. It is possible to say “the lower the temperature, the bigger the damage”

- Since the different thermal behaviour is probably caused by a different tissue metabolism, the technique as such can be used only on living trees

- If the difference in surface temperature is only present at the base of the tree, in contact with the ground, or is particularly spread in this area, damage is certainly present at the root system level. But the system cannot “see through” the ground and give direct information on the condition and distribution of the root system

- The system has been successfully tested on conifers, broad-leaved and palm trees

## The camera

- The instrument currently used, an IR camera, measures the surface temperature of trees from the ground at distance and in real time and provides images (thermal images or thermograms) in black-and-white or in preset colour scales (pseudo-colours)

- The images can be stored onto a Compact Flash card and later downloaded and processed on a PC

- It is possible to use almost any IR camera currently on the market provided that it has high geometric resolution, high thermal sensitivity (at least 0,1 °C), can produce and store images and is equipped with a monitor to visualise images

## Precautions

- The IR camera detects all that is on the tree surface, therefore moss, ivy, scars, bark damage, leaves are represented on the image and can be misinterpreted if they are not recognized as surface damage, disturbance or foreign body. This is why the use of Thermography is recommended after an accurate visual tree assessment.

- It is good practice to take a photograph of the area filmed during the Thermography and from the same angle. This is useful when an image is interpreted after some time or when thermograms are shown to other people

## Limits

The limits of the method are mostly due to the nature of the infrared radiation.

- Sundrenched, and therefore heated tree portions cannot be assessed: to an inexperienced operator, this could hide the possible presence of damage. In those cases, it is enough to assess the plant from the side in the shade, due to the very low thermal conductivity of wood

- Water absorbs infrared radiation, therefore assessments cannot be carried out in the rain or on wet tree portions

- The system cannot tell a cavity from damaged tissue, nor can recognise the type of disease present, just like all non-invasive systems.

## Advantages

- Thermography can detect the presence and size of internal damage, even if it is small and/or not visible from the outside. The fundamental importance of the method in the case of healthy-looking trees can be clearly understood.

- The screening of urban areas is time saving, and safety is improved, in that there is no risk of spreading disease.

- An expert user can judge if the damage is serious without resorting to invasive instruments. Anyway, if it is deemed appropriate, an invasive instrument can be used on actually damaged plants and at the very points that provide data on the plant’s stability, not at random

- Thermography can point out the presence of fungi: research is going on to delve into this aspect

- It is possible to diagnose the conditions of branches up to 20-25m above ground. For bigger distances a telephoto lens is available

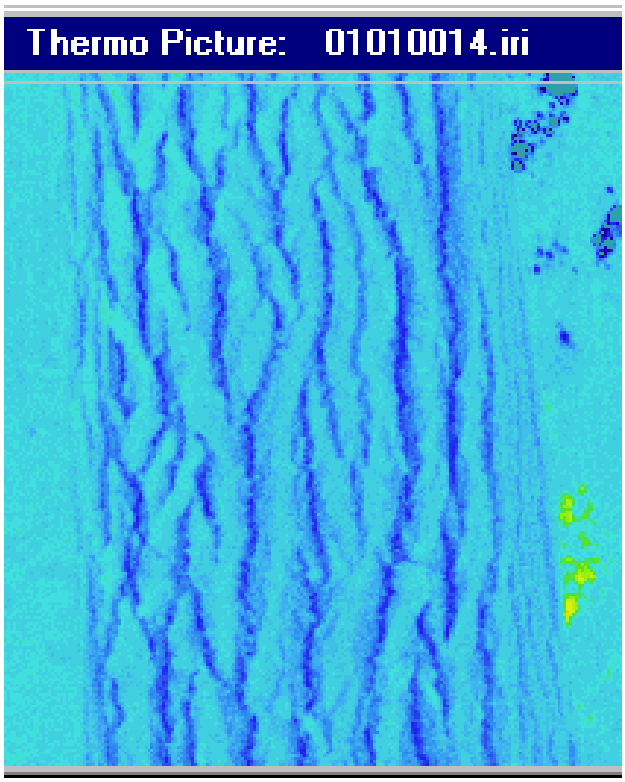
- The system doesn’t suffer from the anomalous presence of water or resin in tissue

- The investigation is totally harmless to trees, and is quick, because in a single image wide tree portions can be examined. Generally 4-5 images are enough to know the situation of the whole tree: it takes only 2-3 minutes

- The system has been used in every season of the year, day and night, in Northern and Central Italy, with temperatures ranging from +2 and +35 °C, with no appreciable differences in results

- Images can be stored in a database. This allows the phenomenon to be monitored over time, by simply comparing the relative series of images

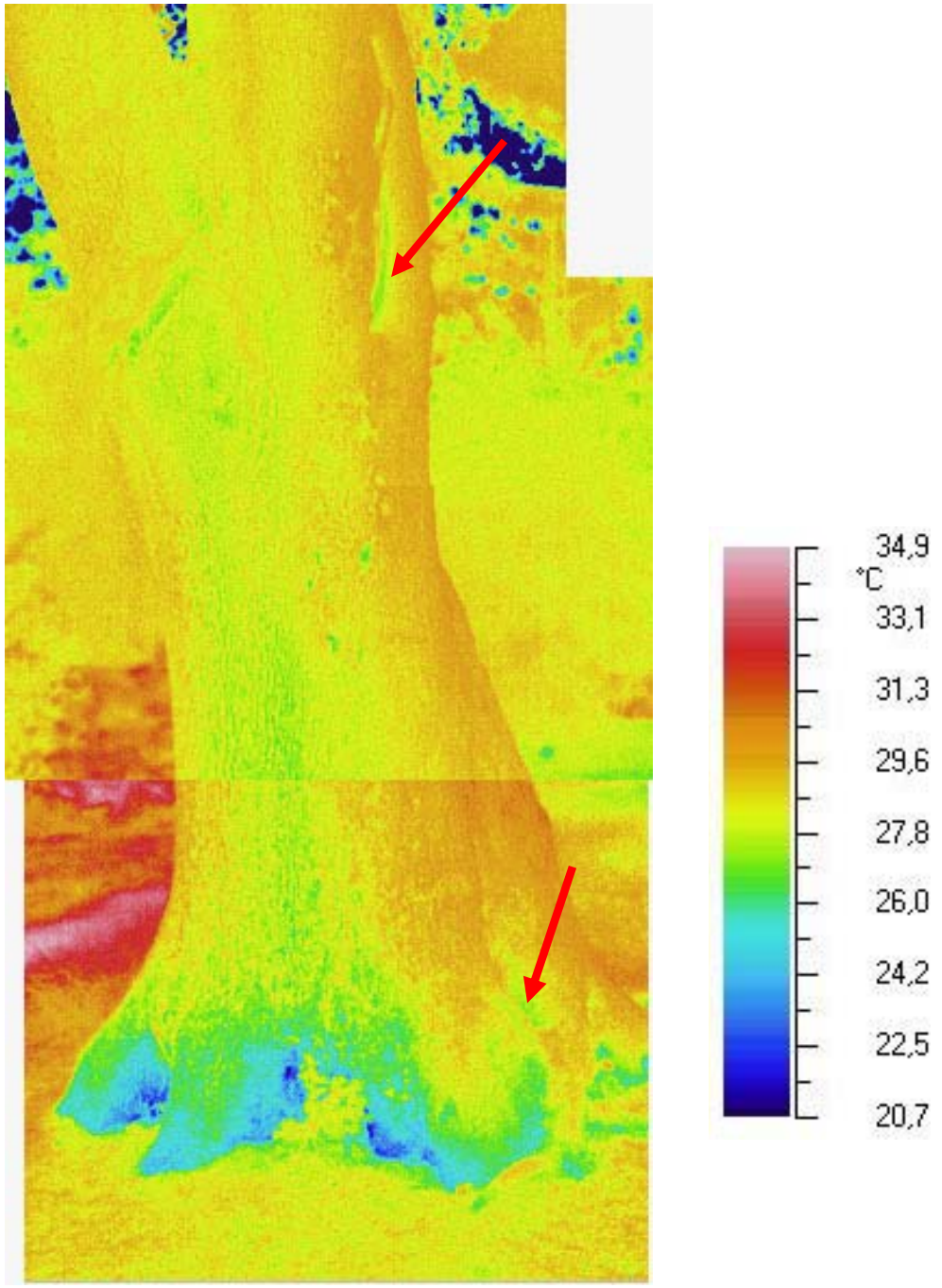
A healthy tree (*Gingko biloba*)

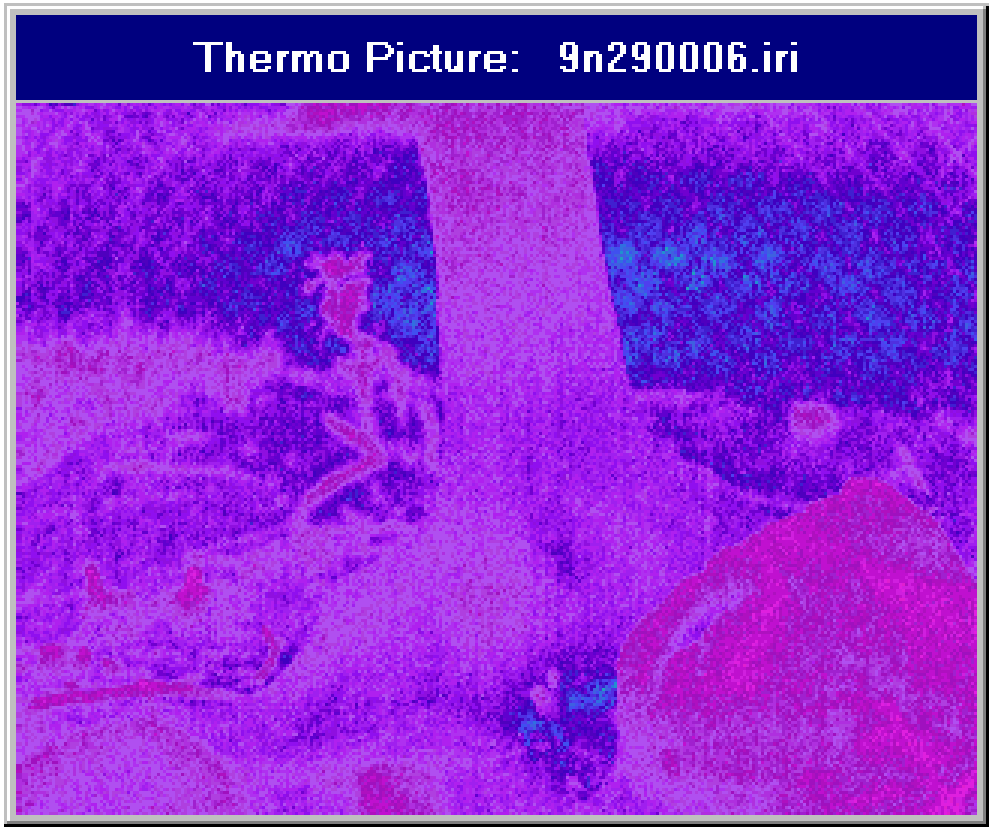



A healthy tree (*Tilia* sp.)

# Damaged trees

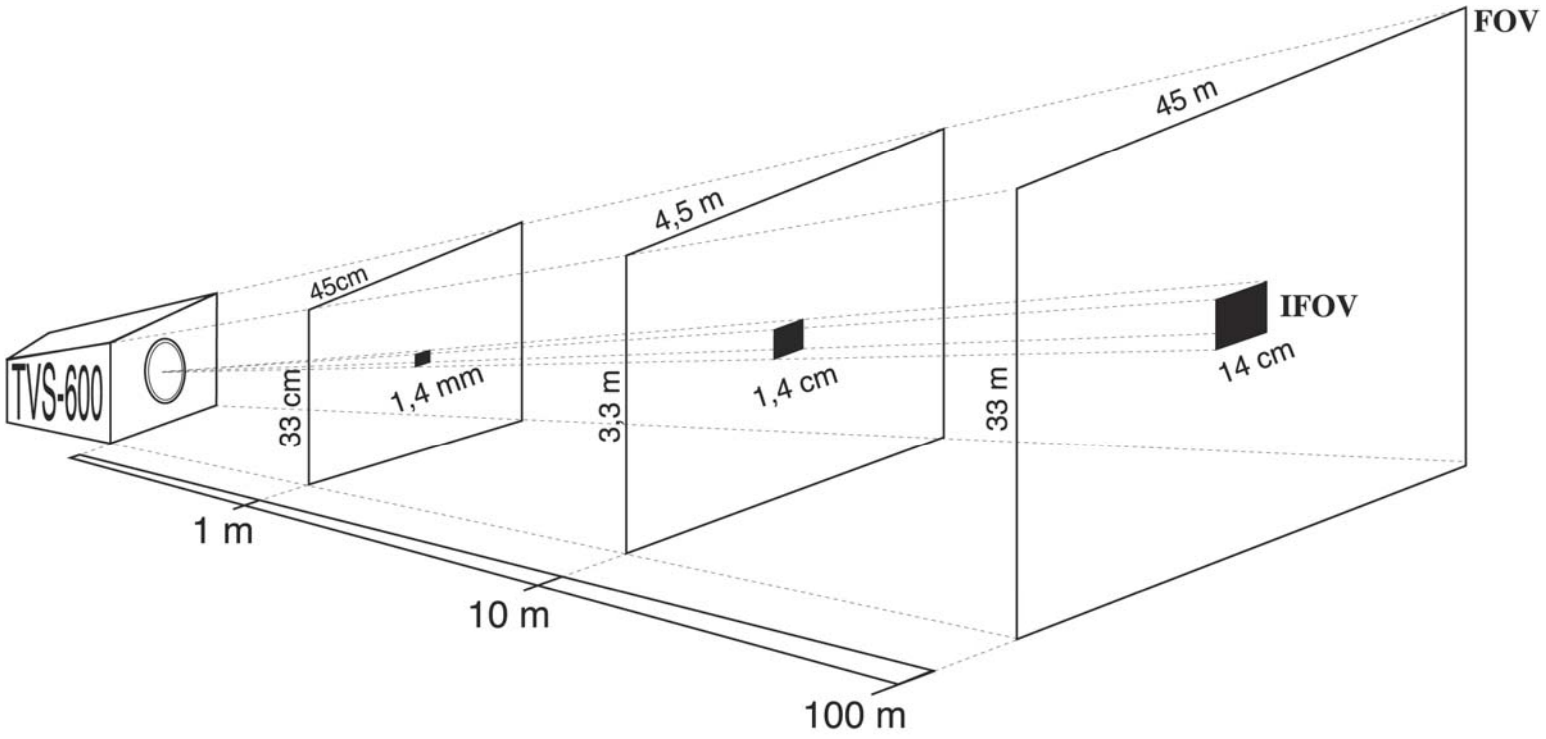
Holm oak (*Quercus ilex*)



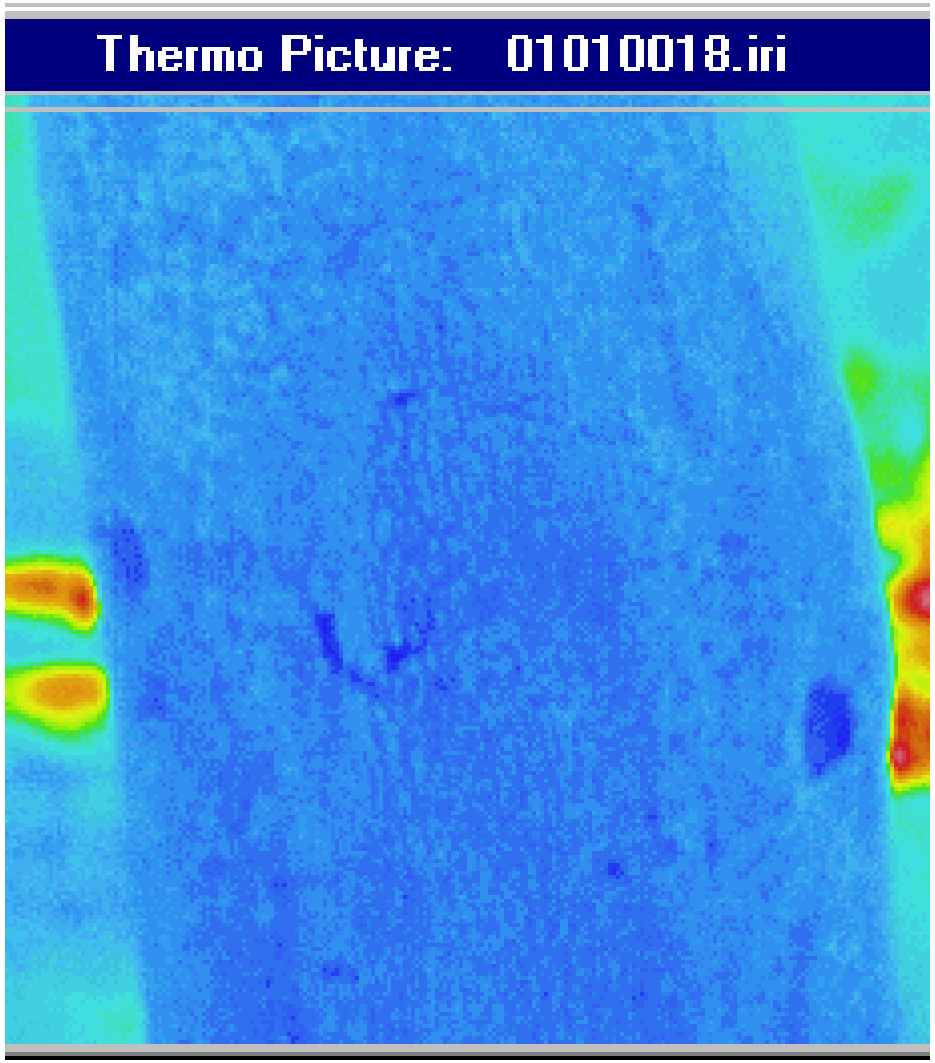




Bay tree (*Laurus nobilis*)

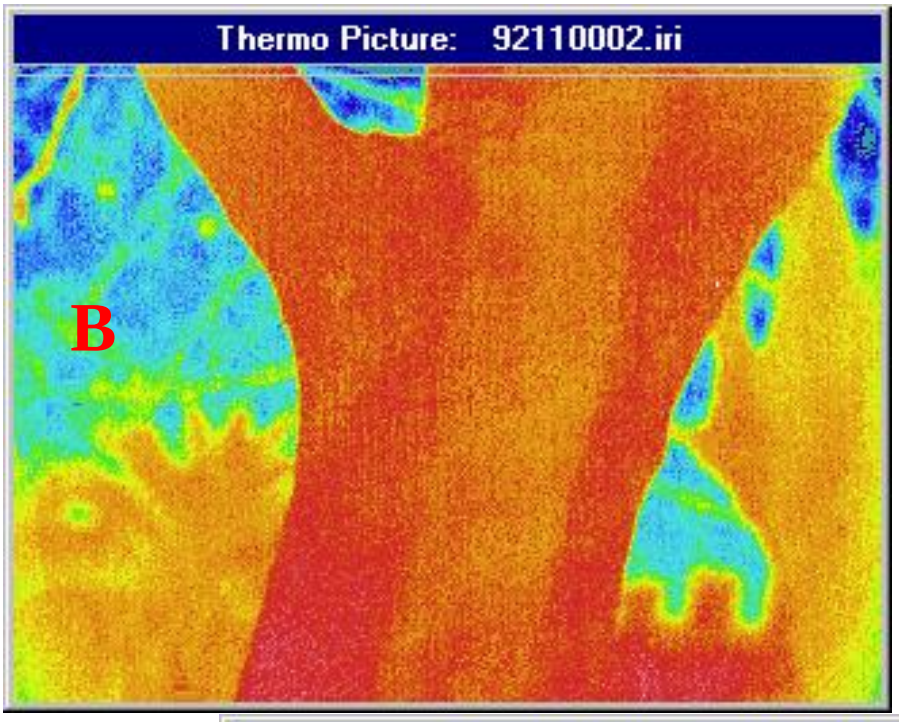
Geometric resolution (Instantaneous Field of View-IFOV)
and Field of View (FOV) of the IR camera in relation to distance



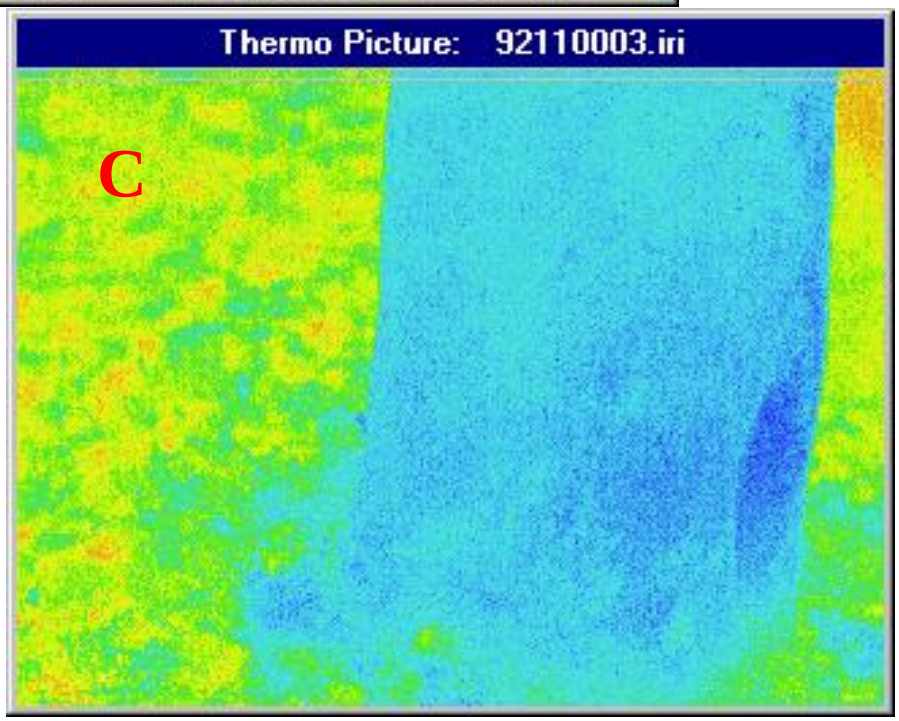
# A healthy tree (*Cedrus* sp.)

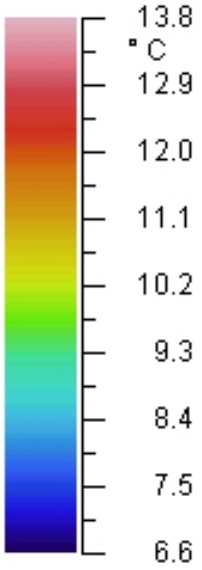


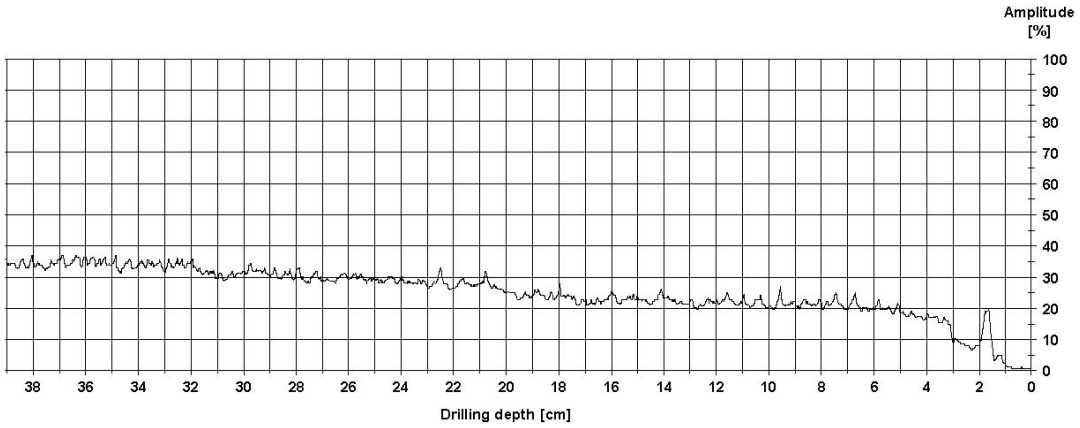





Plane tree
(*Platanus* sp.)





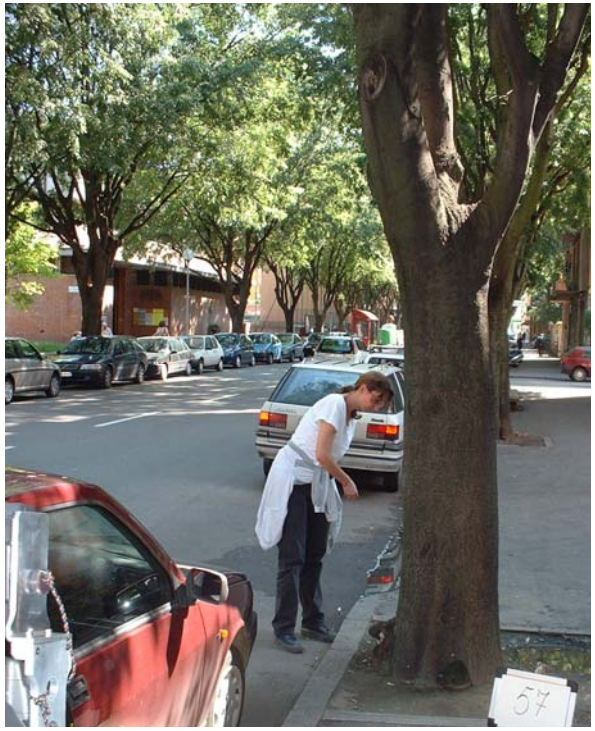

FRATTOMETRO

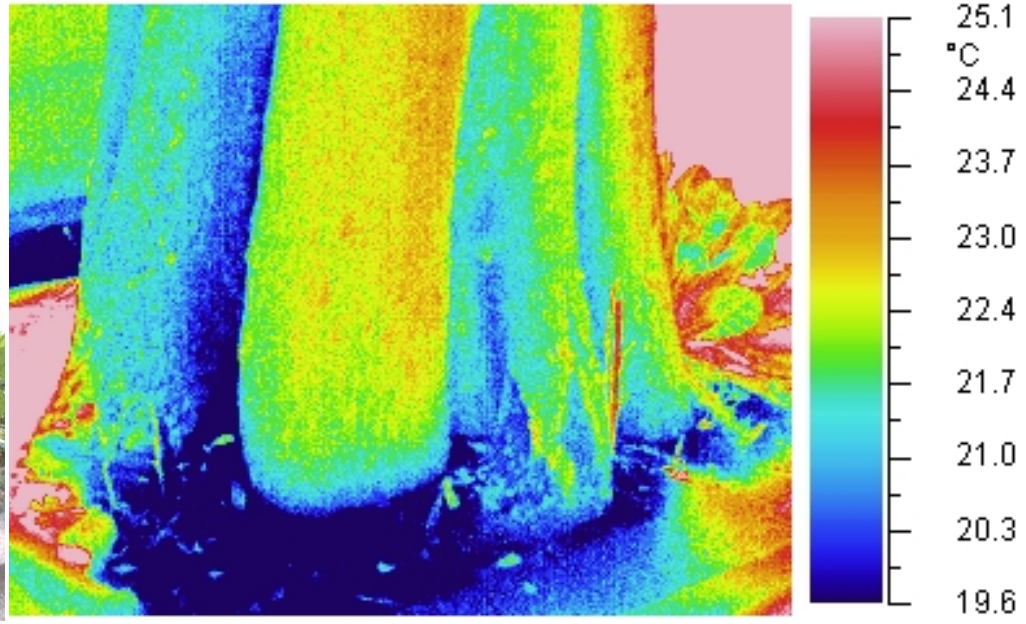
| Zona | H da terra (cm) | Diametro (cm) | L. campione (cm) | T/R | Giudizio |
|---|---|---|---|---|---|
| Fusto | 148 | 88 | 35,00 | 0,57 | Iniziale distruzione della cellulosa |

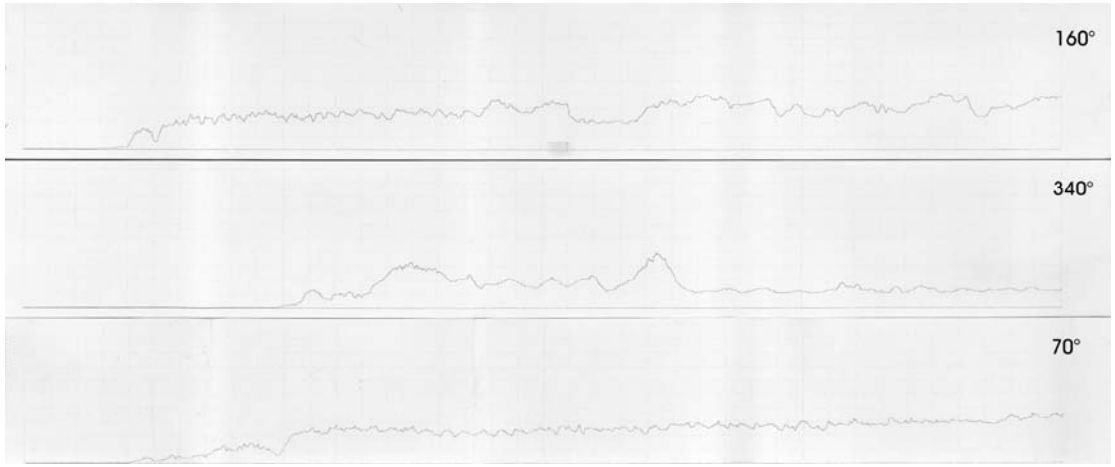
Posizione misura: 290 ° N

| | | | | | |
|---|---|---|---|---|---|
| Carico: | 8 | 8 | 7 | 8 | 15 |
| Angolo: | 13 | 12 | 13 | 12 | 11 |

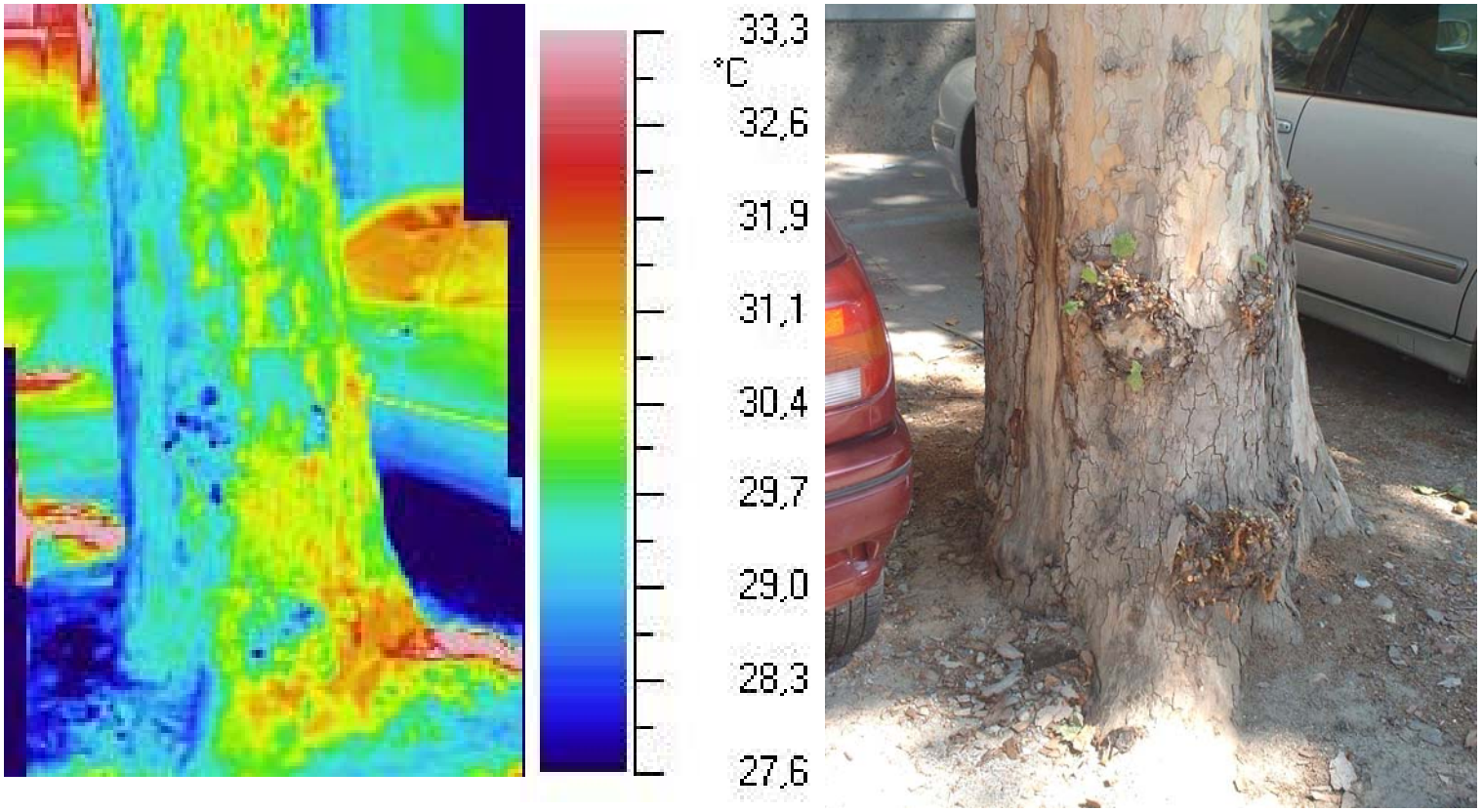
# Horse-chestnut (*Aesculus hippocastanum*)



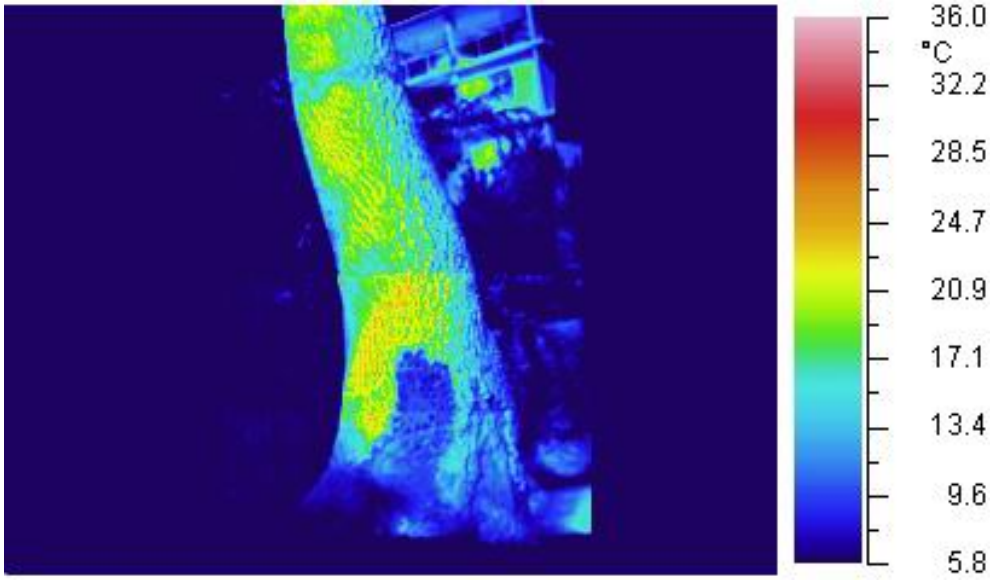


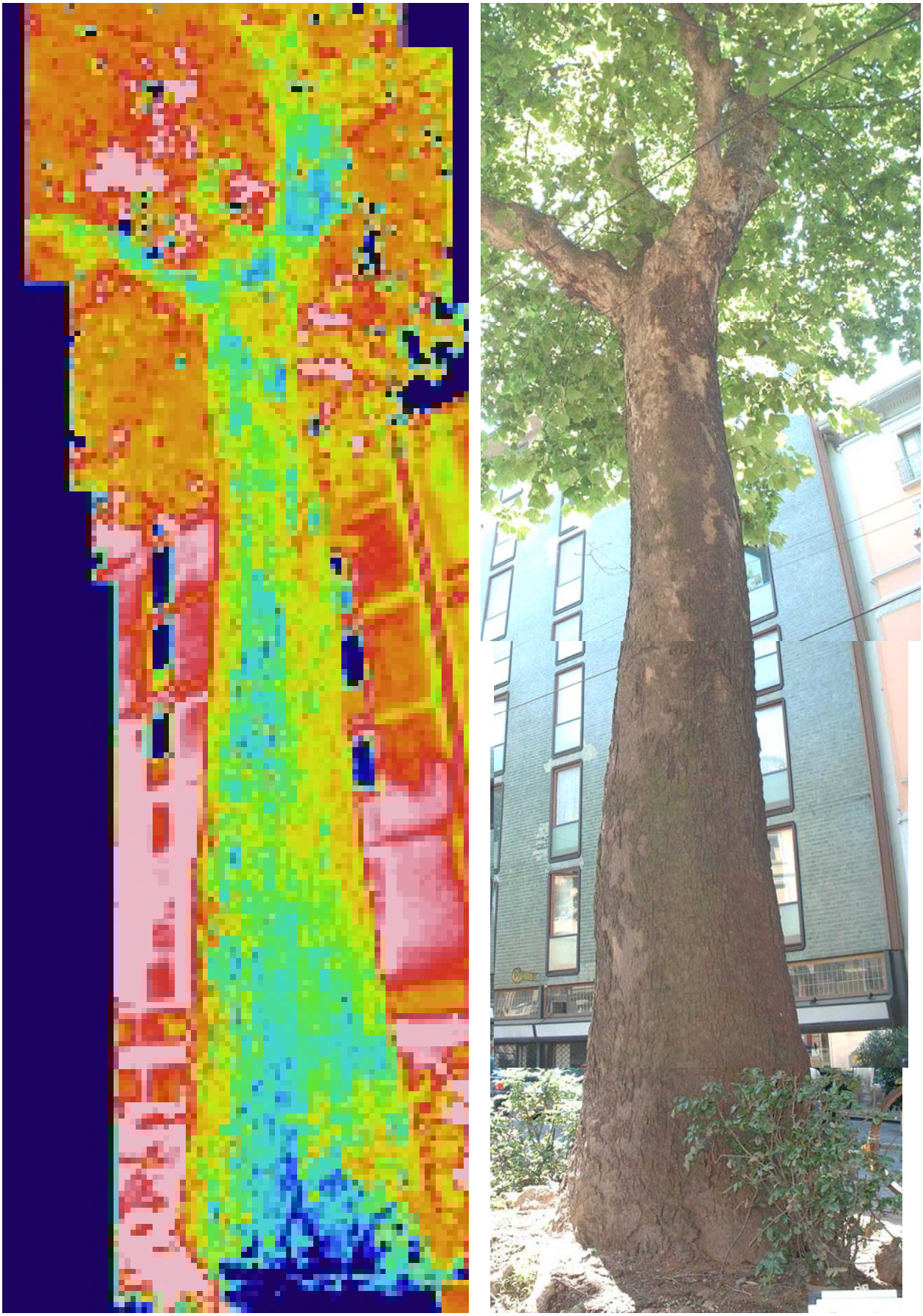

Nettle tree (*Celtis australis*)




Plane tree (*Platanus* sp.) – Stain cancer




Ash (*Fraxinus* excelsior), mycelium of *Armillaria mellea*



A 27 m-high plane tree (*Platanus* sp.)