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International Consortium of Geo-Scientists, Landuse Planners, Forest Engineers and Computer Experts

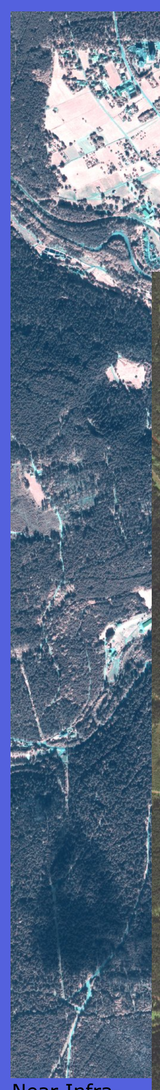
The Forests of Freudenstadt from Space

Forest and Individual Tree Taxation with Satellite Imagery and Laser Scanning Technology

Demonstrated on the example of the „Palmenwald" forest, one of Freudenstadt`s favourite selection stands (Plenterwald). The 1 ha sample plot test site within the „Palmenwald" is marked with a black and white rectangle.

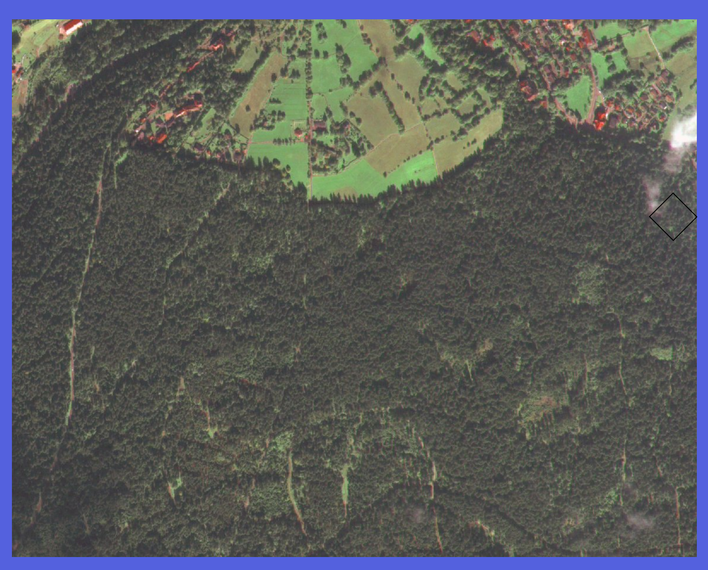
Presented at the ProSilva Conference in Freudenstadt 2008 and on http://landConsult.de/ProSilva.

Data processing and copyrights: Dr. Markus Weidenbach and Dr. Roeland de Kok, landConsult.de, Spannstattstraße 40, D – 77773 Schenkenzell, email: office@landconsult.eu

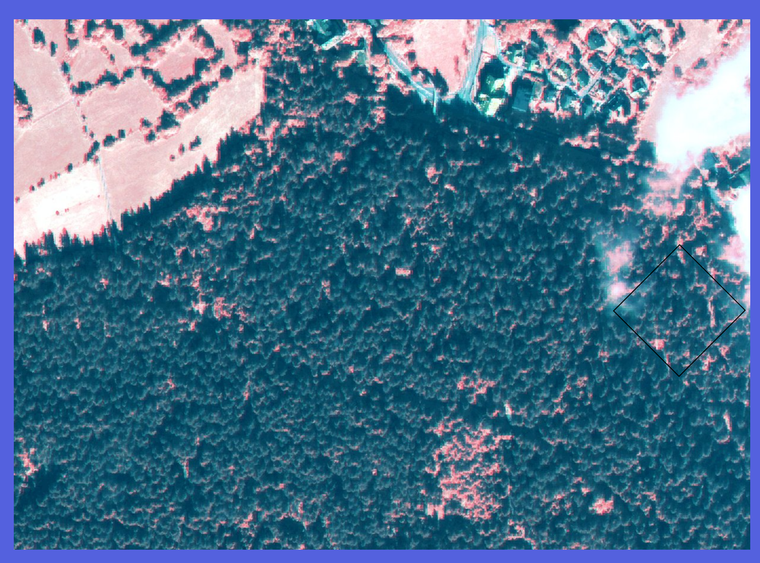


Near Infra-red (NIR)

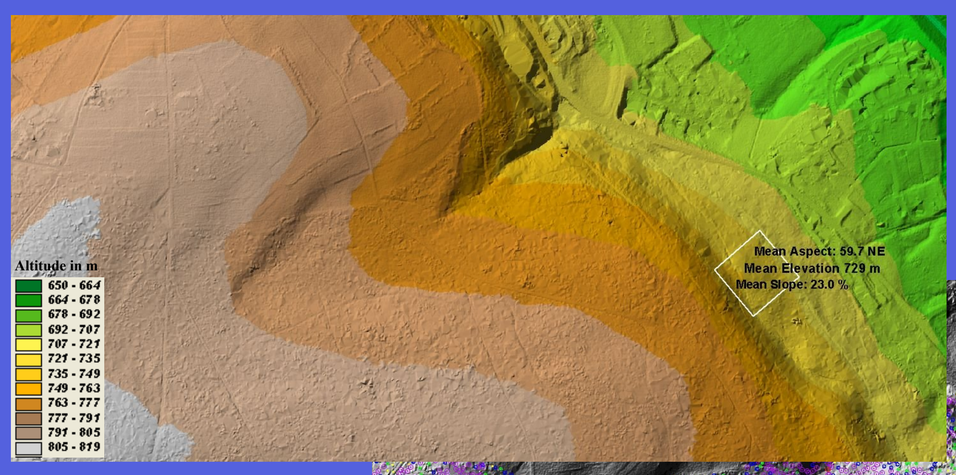
Freudenstadt from Space. Quickbird Satellite Image shot on 14.09.2007 (pansharpened RGB/NIR composite)



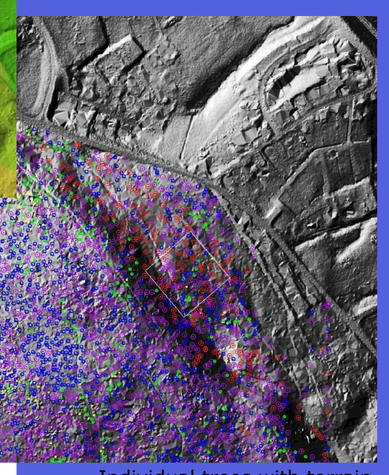
Zoom to the „Kienberg" and the „Stadtwald" south of Freudenstadt. The black rectangle indicates the test site „Palmenwald"



View to the „Palmenwald". The reddish colours stem from the near infrared sensor which can be used to automatically discriminate different tree species and urban structures like roads and other sealed areas.

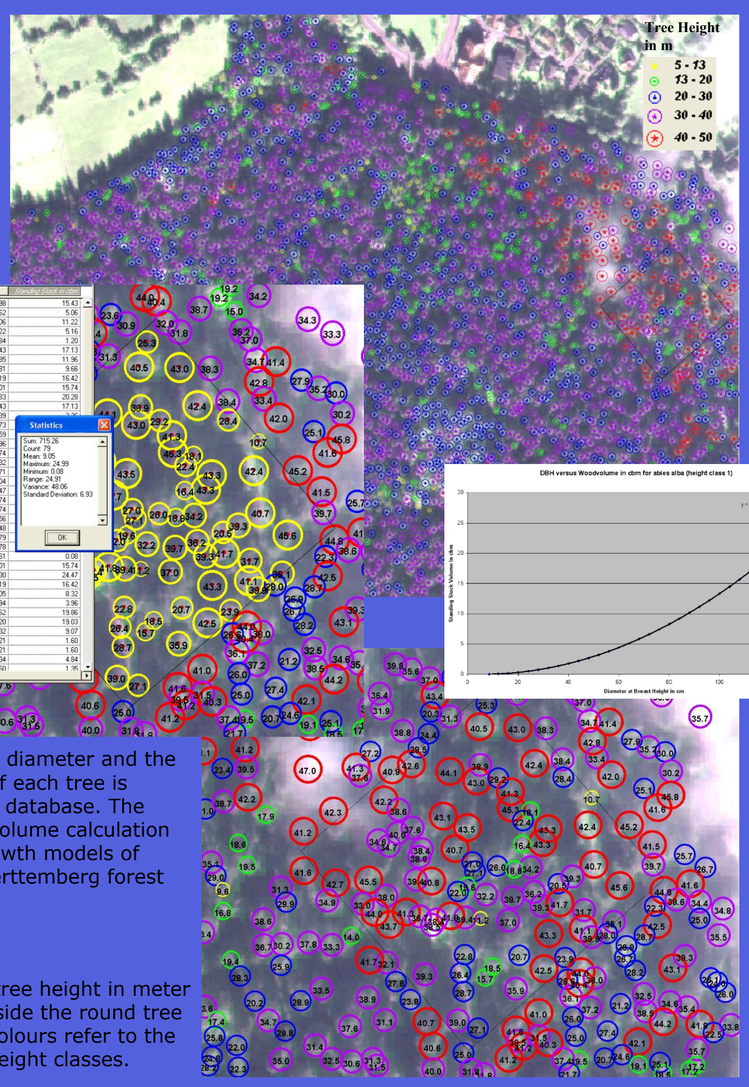


Digital elevation model generated from aerial laser scanning data that reveals „hidden" structures under the forest canopy, such as roads, ditches or deadwood on the ground.



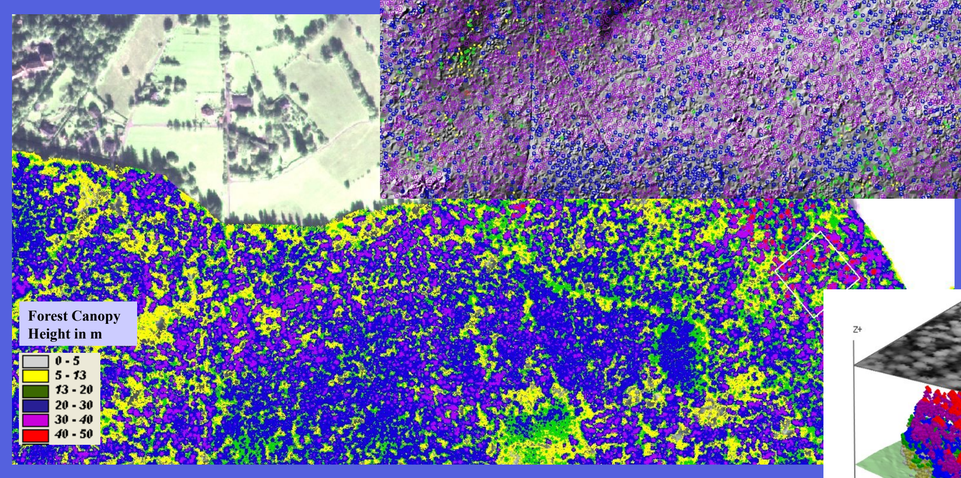
Individual trees with terrain model in the background.

Automatic detection of individual trees visible in the satellite image. The tree height is derived from aerial laser scanning data recorded end of in April 2003.

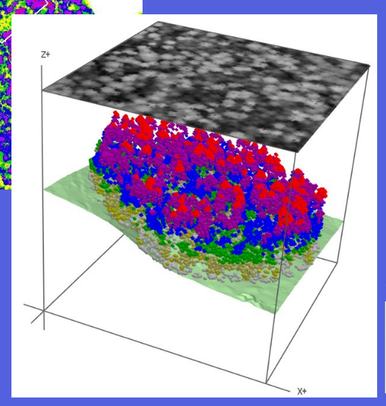


The height, the diameter and the wood volume of each tree is stored in a GIS database. The diameter and volume calculation is based on growth models of the Baden-Wuerttemberg forest administration

The individual tree height in meter is illustrated inside the round tree symbols. The colours refer to the above shown height classes.



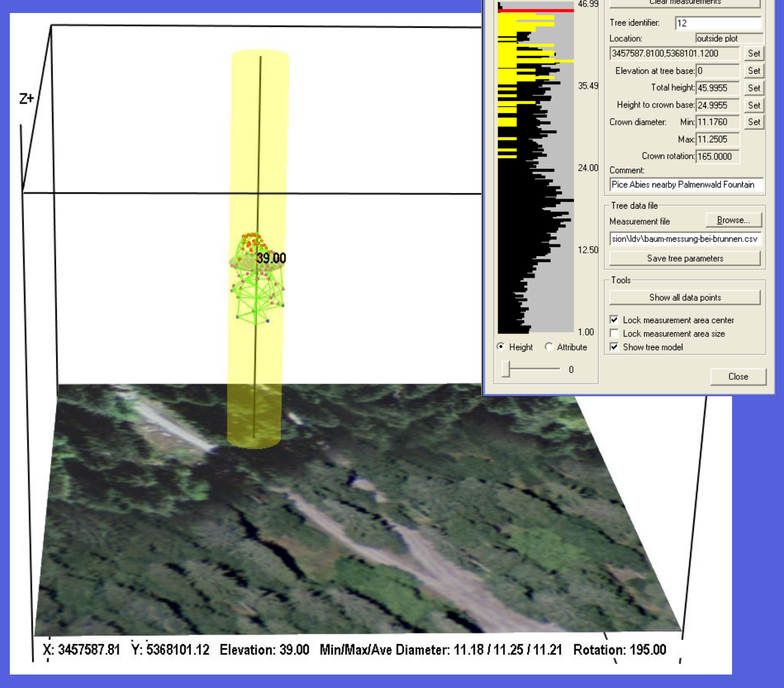
Digital model of the canopy generated from aerial laser data. This model is used to detect and measure individual trees.



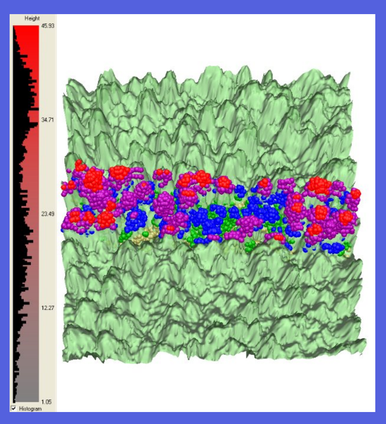
Digital model with trees from the Palmenwald test site overlaid with the canopy model

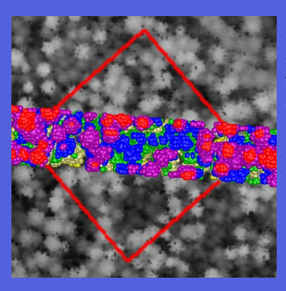
3D canopy model (green) with a 30 m wide cross section of the Palmenwald test plot, showing the vertical and horizontal stand structure.

Individual tree measurement of one of the big firs in the Palmenwald, based on 2003 aerial laser scanning data. Crown diameter, tree height and height to crown base can be measured and recorded together with the exact location of the tree.

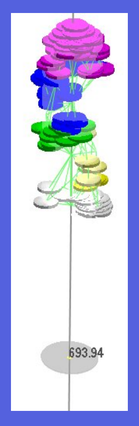


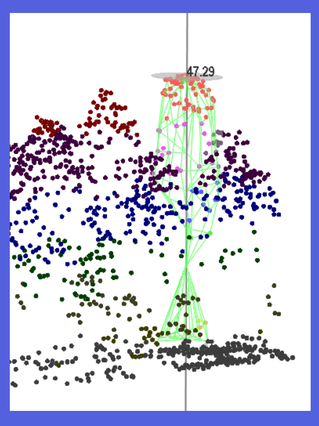
Individual tree measurement, showing the location of the tree above an orthophoto of 2005. The height of each tree segment can be measured (like the crown centre at 39 m as shown in the illustration).

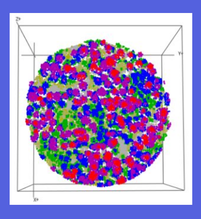


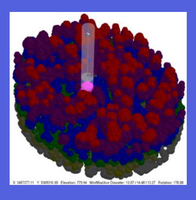


Canopy model in greyscale with the 1 ha test site (red square) and a 30 m wide cross section of coloured trees.

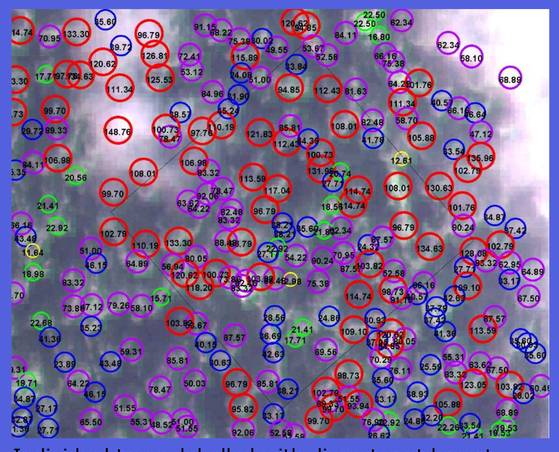




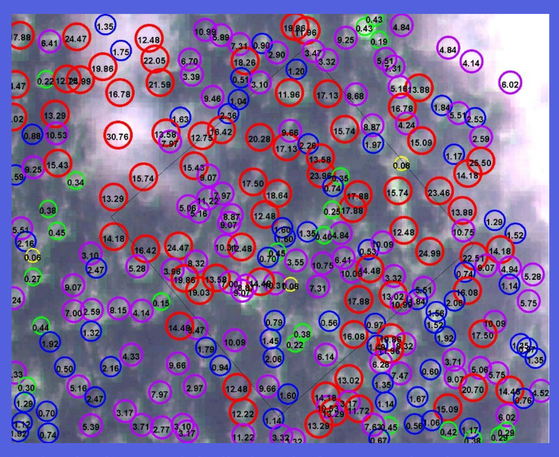




Tree measurement of another big fir in the Palmenwald. The accuracy of the generated crown shape depends on the amount of available laser points.



Individual trees, labelled with diameter at breast height (DBH) in cm.



Individual trees, labelled with their wood volume in cbm (standing stock).