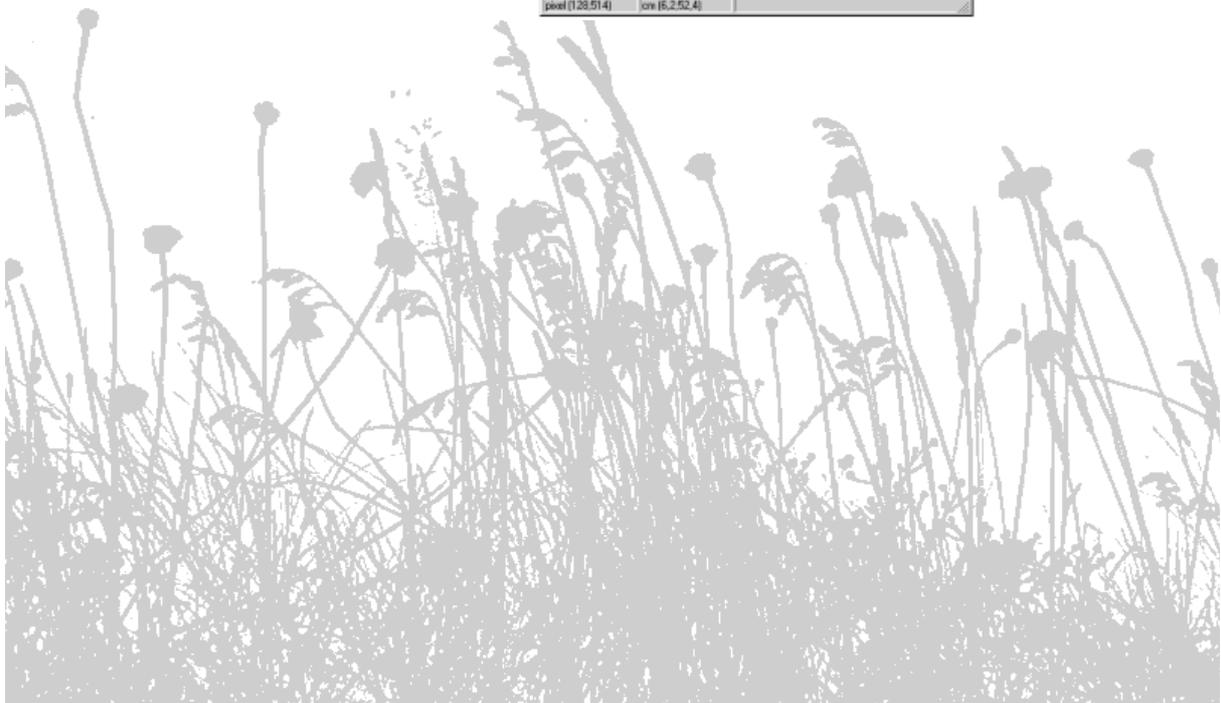
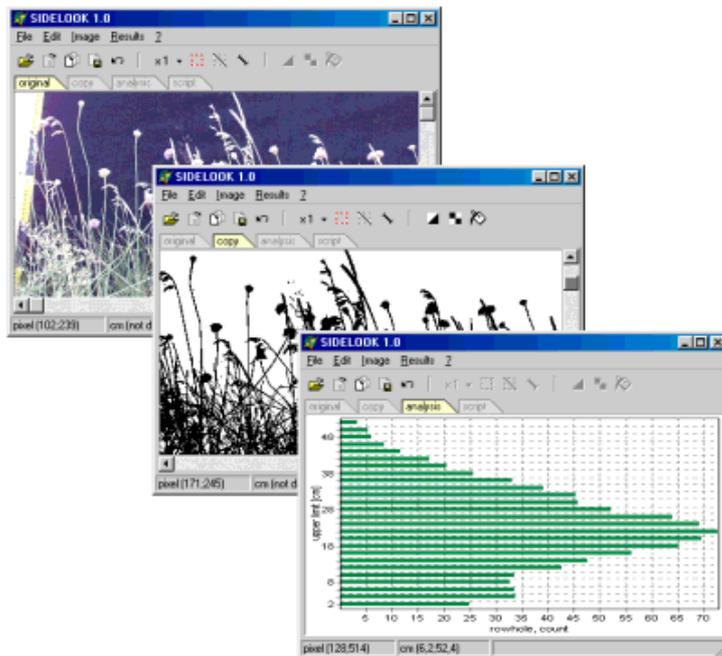


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Program documentation for

# SIDELOOK 1.1

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**Suggested citation**

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The current version of this document and the SIDELOOK software may be downloaded at: <http://www.appleco.ch>

Suggestions for improving SideLook and bug reports are welcome to: [info@appleco.ch](mailto:info@appleco.ch)

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## Introduction

SIDELOOK is a software tool for the analysis of vertical vegetation structure, in particular herbaceous vegetation stands of grassland communities [1]. The analysis is based on digital images which are photographed with a standardized method. The current version includes automatic thresholding, originally developed for the binarisation of true colour hemispherical canopy-photographs [2].

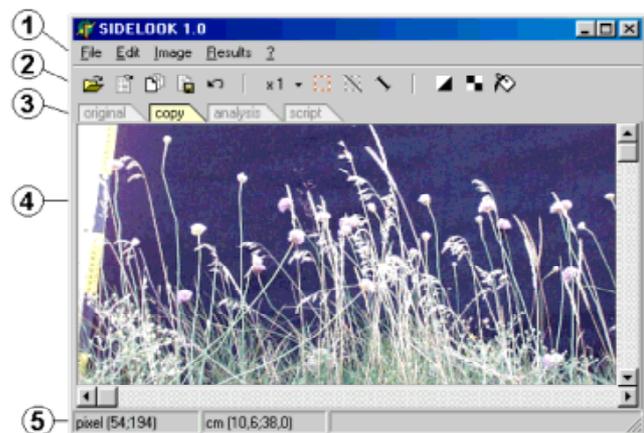
[1] ZEHM, A., NOBIS, M., SCHWABE, A. (2003): Multiparameter analysis of vertical vegetation structure based on digital image processing. *Flora* 198(2): 142-160.

[2] NOBIS, M., HUNZIKER, U. (in press): Automatic thresholding for hemispherical canopy-photographs based on edge detection. *Agricultural and Forest Meteorology*.

Reprints are available as pdf-version by email ([info@appleco.ch](mailto:info@appleco.ch)).

## Main Window

The starting point for picture processing and analysis is the main window of SIDELOOK: Program functions are available in the main menu (1), or within the toolbar (2). Four register cards (3) lead to different areas of operations (4). The status bar indicates the mouse pointer location. Additional windows are ready for use after some main menu or toolbar functions have been selected.



## Analysis scheme for vertical vegetation structure analysis

The analysis of vertical vegetation images has to be carried out in a regular sequence of processes as listed below (*optional steps in italic letters*). The processes are elaborated in detail in the subsequent text sections. You have to:

- (1) Choose and load the digital image to be analysed.
- (2) Set the reference points to a known distance.
- (3) *Save the reference distance to the script.*
- (4) Convert the picture to a black-and-white image.
- (5) *In case of a dark background the whole picture has to be inverted.*
- (6) *Use the fill-function to eliminate background noise or image numbering.*
- (7) Use the selection frame to delimit the area of interest.
- (8) *Save the selection-frame settings to the script.*
- (9) Select the structure parameters to be calculated.
- (10) Enter the interval size for row and column analysis.
- (11) Start parameter calculation.
- (12) View and save the calculation results.
- (13) *Check and save the script file.*

## Loading a digital picture



JPEG (resp. JPG) and BMP pictures can be loaded using FILE/OPEN PICTURE in the main menu or by selecting the toolbar symbol . The picture will be displayed identically within the register cards ORIGINAL and COPY. The image displayed in the ORIGINAL card always remains unchanged; in the COPY card area of operation all image processing will be done.

## Definition of the reference distance



In order to obtain data representing the actual measurements, the reference line for a known distance has to be specified in the picture. After activating the reference symbol  the endpoints of the reference line can be marked with the mouse pointer. Press the left mouse button on the first calibration mark and keep the button pressed until the second mark is reached. The reference distance can be set on the ORIGINAL as well as on the COPY card. To protect the distance settings from further changes a second click on the symbol will stop this mode (symbol appears no longer depressed).

As standard reference a distance of 30 cm is suggested by the program, but in the reference window (EDIT/REFERENCE) any chosen distance can be declared. The endpoints of the reference line can be adjusted at any time with the mouse.

As an additional option it is possible to type in the reference coordinates and distance under EDIT/REFERENCE manually and / or to save the current values to the script.

## Picture processing and conversion to black-and-white images



For parameter calculation the basis is a black-and-white picture, so colour pictures must be converted to this reduced format. For separation of vegetation and background a threshold is specified within the COPY card. The threshold can be manually controlled in an additional window which is activated using IMAGE/THRESHOLD or the toolbar symbol . With the button SWITCH the ORIGINAL card display or the converted COPY picture are visible, so that the separation success (vegetation vs. background) can be checked.

**Automatic thresholding** is available by choosing the EDGE VALUE modus and clicking the MAX button. In the case that the absolute maximum is not appropriate, test local maxima (NEXT button) or another colour channel. Local maxima are detected within a window of  $\pm 20$  threshold units. Automatic thresholding was originally developed for hemispherical canopy-photographs. While most SIDELOOK parameters are not useful for the analysis of such images – except e.g. fractal dimension – the transformed black-and-white images can be saved as bitmaps for analysis with other software tools (EDIT/SAVE B&W-PICTURES). The algorithm and additional information about automatic thresholding is published in NOBIS & HUNZIKER (in press, see introduction).

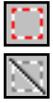


By selecting IMAGE/INVERT in the main menu or the associated symbol, the picture displayed on the COPY card can be inverted if necessary. In order to perform the analysis, black vegetation must be presented against a white background.



All elements present on the background that cannot be classified as vegetation must be eliminated. For this purpose the relevant area(s) is first delimited with a frame (see below) and then matched to the background colour using IMAGE/FILL or the corresponding symbol within the toolbar. In pictures with a white background the area must subsequently be inverted.

## Working with frames



A frame forms the boundary of the area for picture processing or parameter analysis. If no frame is superimposed, the whole picture area is selected. In the ORIGINAL card as well as in the COPY card frames can be set. With one click on the symbol  the frame mode is activated (the symbol appears depressed) and a frame can be outlined with a left mouse click. While the mouse button is held down the frame size will change continuously, when the button is released the frame is fixed in the last position. As is commonly done, the frame border can be adjusted by moving the mouse after clicking on the border, and the whole frame can be moved after a click into the frame area. In order to remove a frame, click outside the frame area or use the symbol . To protect the frame settings from further changes a second click on the symbol  will stop the frame mode (symbol appears no longer depressed).

In the frame window (EDIT/FRAME) the frame size can be edited with numerical data input; after the reference distance has been specified, the frame dimensions are displayed in centimeters and can be edited.

## Selection of structure parameters for calculation

The selection of analysis parameters can be done in the hierarchically ordered IMAGE-PARAMETER list in the ANALYSIS card. The plus and minus symbols enable/disable the display of the detailed parameter list for each category. Each single parameter or a parameter set comprising any combination can be selected with a solitary mouse click. The chosen parameters are marked with a yellow background, parameter categories green.

For a detailed parameter definitions see ZEHM, A., NOBIS, M., SCHWABE, A. (2003) as mentioned in the introduction.

## Calculation of structure parameters

When the parameter set is chosen, the interval for the column analysis (COL.WIDTH) and the interval for the row analysis (ROW HEIGHT) have to be edited in the ANALYSIS card. The analysis frame size should be kept in mind during editing of the interval sizes so that the latter can be optimized (e.g. an interval size of 5 cm is not recommendable when a frame size of 94 cm was delimited). The parameter calculation is initiated with a click on CALCULATE. Several calculations can be performed one after the other for the same or different pictures.

Attention: When the interval size is changed, the previous analysis results are deleted.

## Display of results

The results for different parameters are displayed in the ANALYSIS card as histogram graphics. Above the result graphic it is possible to choose the parameter to be displayed in combination with a processed picture. The numerical data output for all calculated parameters is visible in a separate results window (RESULTS/SHOW RESULTS). The results can be copied to the clipboard or saved as a separate text file. The clipboard content format is compatible with common spreadsheet programs.

## Analysis of point series

Activating MISC/SHOW COORDINATES displays a window for the measurement and saving of point series. When this window is activated, the coordinates of all mouse clicks within the picture area are registered. The results can be edited (e.g. in order to delete mistakes or to add supplementary information) within the window. The opportunity to save to disk or to copy the results into the clipboard enables communication with other programs.

## Working with scripts

Picture processing actions, the selection-frame dimensions and the reference distance should be saved in a small script file for documentation, additional measurements later on or for the work with script lists (see below). It is unnecessary to occupy disk space with the transformed pictures because these can be reproduced later on the basis of the settings stored in the script files.

All processes are logged automatically in the script except the location of the reference distance and the settings of the selection frame. These adjustments have to be saved manually in the reference window (EDIT/REFERENCE: SCRIPT) and the frame windows (EDIT/FRAME: SCRIPT).



The current script is displayed in the SCRIPT card, where editing is possible. Here some kind of UNDO function is available: deleting the last step in the script manually and a click on the REFRESH-symbol  will eliminate the last action (every action is enclosed with the "|" symbols).



The script files have to be located in the same disk directory as the raw pictures and are opened with FILE/LOAD SCRIPT or terminated with FILE/SAVE SCRIPT (or by clicking on the corresponding symbols).

**Attention:** Processes are logged in the script but not the final analysis results. The parameter selection and the interval sizes can only be found in the RESULTS window (see above), not in the scripts.

## Automatic analysis with script lists



In SIDELOOK it is possible to repeat or modify analyses automatically with the help of the script files (BATCH mode). In order to work with several scripts at the same time these files have to be added to a list in an additional window (FILE/OPEN FILELIST). This is done by starting the file browsing dialog with the  symbol of the file list window and importing one or more script files. For the resulting file list use  to save or  to reopen a file list. From the list of the script files a single or a freely chosen combination of files can be activated for calculation (SHIFT + CURSOR UP / DOWN or STRG and mouse click on the target scripts). The activated files are marked with a blue background.



A click on the  symbol starts the automatic processing for the selected files one after the other. When the check box next to the CALCULATE sign is activated, for all the marked files an analysis of the parameters and interval sizes selected in the ANALYSIS card is made.

**Note:** In the file list the full path of the file is recorded, so that files from different directories can be combined.