Estimating Percent Canopy Cover

CIRRIG uses Percent Canopy Cover (PCC) to estimate light interception for evapotranspiration (ET) calculations. In this section we describe two methods for routinely estimating PCC in the field:

1. **GIMP image analysis** of digital photos taken above the canopy
2. **Visual comparison** to a gallery of photos exhibiting a range of PCC (see Percent Canopy Cover Gallery)

Procedures for Estimating % Canopy Cover with GIMP

PCC can be estimated by taking a digital image above the plant canopy and using free image analysis software (GIMP) to estimate the proportion of the photo covered with dense foliage. Below we describe two general methods for using GIMP to analyze photos. Method A entails using the oval selection tool to circle each plant in the photo and then deleting to cause selected area to turn whie. The program can then calculate number of white pixels relative to the total pixels in photo. Method B uses a GIMP tool that divides the photo into two colors: black and white. The user can adjust the threshold to best match the foliage condition. Method A is used when the canopy is dense and well-defined. Method B may be preferable if the canopy is sparse and foliage borders less defined. Below we describe the two methods for estimating PPC and will briefly discuss some limitations of using a 2-dimensional photo for estimating PPC.

1. Take digital photos of representative areas in the irrigation zone

2. Open photo in GIMP, which can be downloaded for free (http://www.gimp.org/). You can open by right-clicking the file and selecting 'Edit with GIMP' or start GIMP program then open file.

3. Under Windows menu, click Dockable Dialogs, and select Histogram. The Toolbox should also be visible, if not Ctrl-B should bring it up.

4. If the photo includes areas which you do not consider to be representative or camera angle is distorted, you should crop the photo first. This can be done by using either the rectangle or oval selection tool followed by right-clicking mouse and selecting 'image'>'crop to selection'.

Fig 1. A simple digital photograph that captures an overhead view of the plant canopy in the irrigation zone can be used to estimate % canopy cover with GIMP software.

Method A - Oval Selection Tool

1. Use the 0val Selection Tool to circle one of the plants in the photo. Click delete and the area selected will turn white. Only encircle areas that have dense foliage.

2. Continue until all plants have been selected and deleted. Your photo should look like Fig. 2.
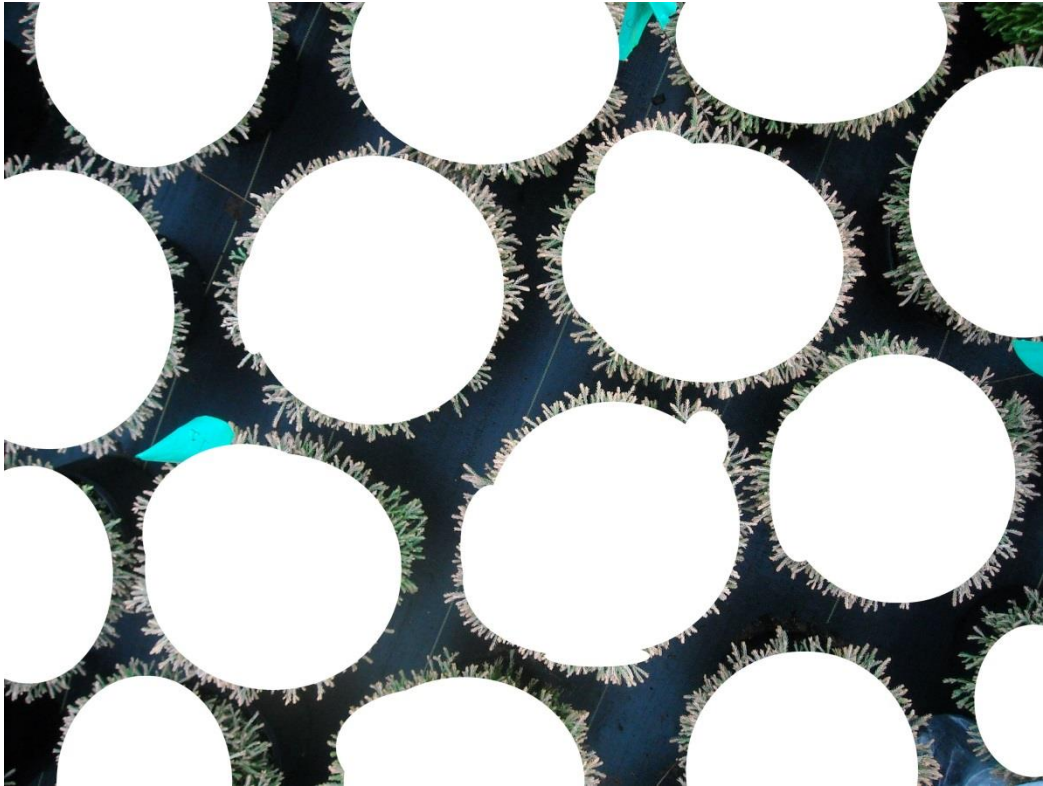
3. The histogram window indicates the percentage of pixels above a certain color threshold. For this procedure, you would select a threshold of 255 or all white. To select this threshold, grab the triangle and move it to the extreme right. At the bottom you will find total pixels, pixels at threshold or above, and percent at or above threshold (value for PCC).

Method B – Color Threshold Tool

1. From Color menu, select Threshold.

2. The Threshold tool automatically divides the image into black and white based on a threshold value. You can accept the threshold value or move the threshold indicator so the white best represents the perceived dense canopy in the original photo (Fig. 3).

3. Move the histogram threshold value to match the threshold value given by the Threshold tool. Then read the percent value displayed at the bottom of histogram.

Notes on GIMP Procedures

1. Method B is very sensitive to background colors. It works best with low reflectance and dark background.

2. It is the goal of both methods to only account for dense areas of foliage. Method A works best for dense, well-defined plant foliage while Method B may be more accurate for other situations.
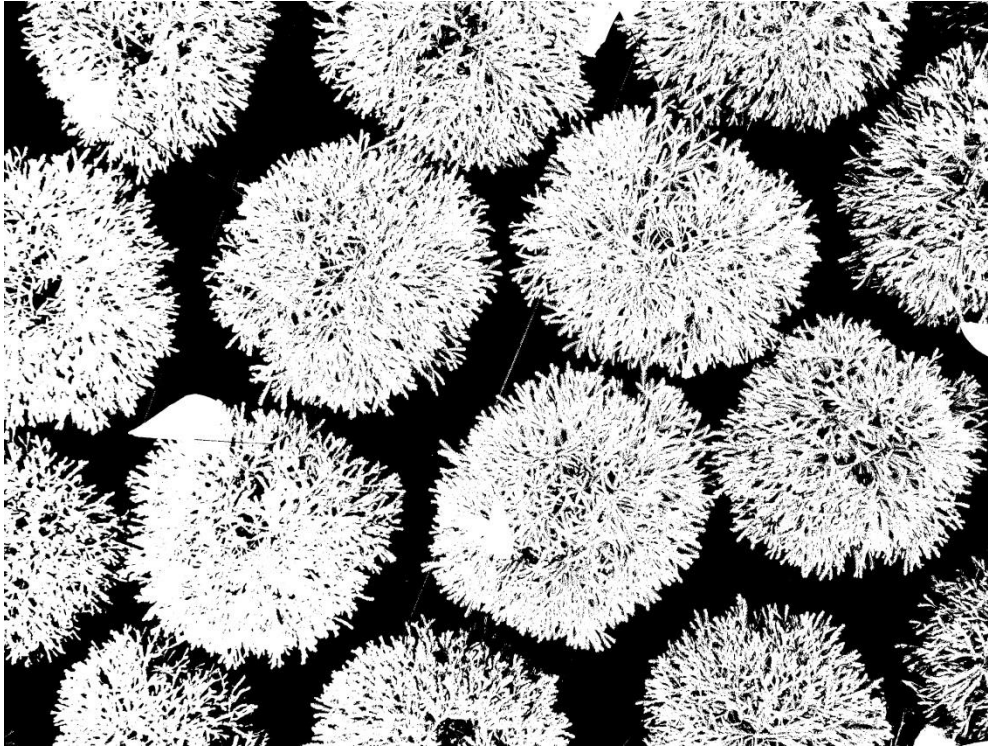

Fig 3. The Color Threshold tool (Method B) automatically reduces the image into two colors. The threshold value can be varied so that the white best matches the canopy coverage in the original photo. The PPC using this method was 60%.

Comparison Procedure for Estimating % Canopy Cover with GIMP

PCC can be estimated by comparing canopy cover to a gallery of images exhibiting a range of PCC. The images could be collected at the user's nursery and characterized with GIMP or you could print out a photo gallery available on the More Info page.