EO AFRICA EXPLORERS

PRISMA 4 AFRICA

Plant LAI, ALI, FCOVOR and FAPAR measurement using Digital Hemispherical Photography (DHP) method

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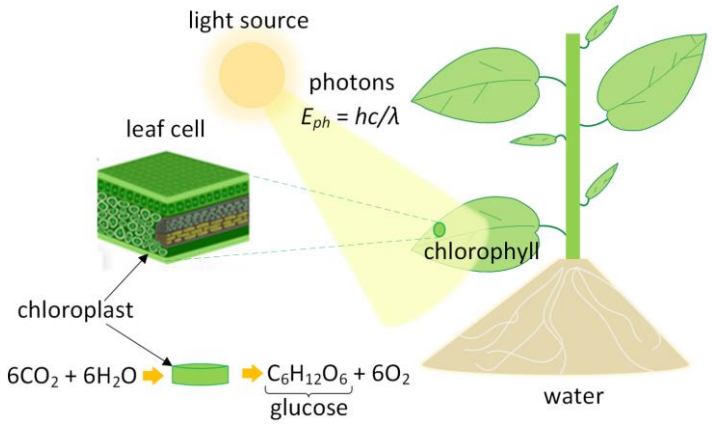
Plant LAI, ALI, FCOVOR and FAPAR

Fraction of absorbed photosynthetically active radiation (FAPAR)

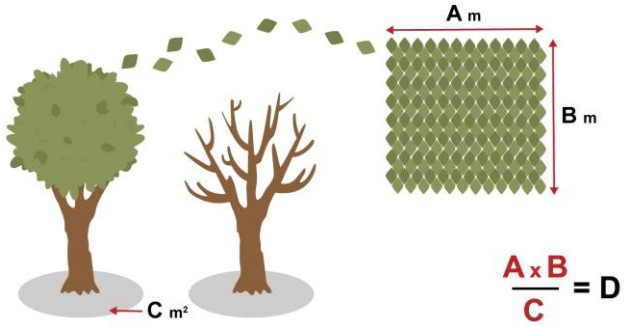
(unitless, 0-1)



The FAPAR quantifies the fraction of the solar radiation absorbed by plants for photosynthesis.

Leaf Area Index (LAI)

(0 - ~15 m^2/m^2)

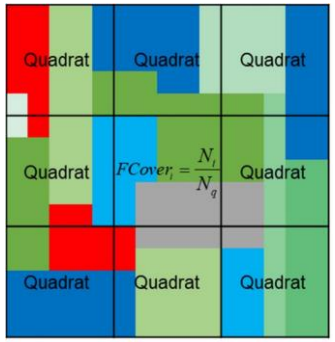


Average Leaf inclination Angle (ALA)

(0-90, degree)

Vegetation Cover Fraction (FCOVER)

(unitless, 0-1)

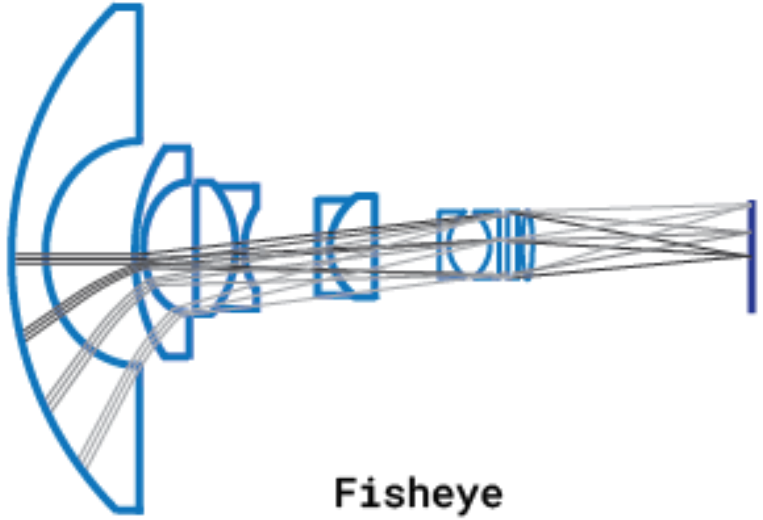


The fraction of the soil covered by the vegetation viewed in the nadir direction

$$fCover = 1 - P_o(0)$$

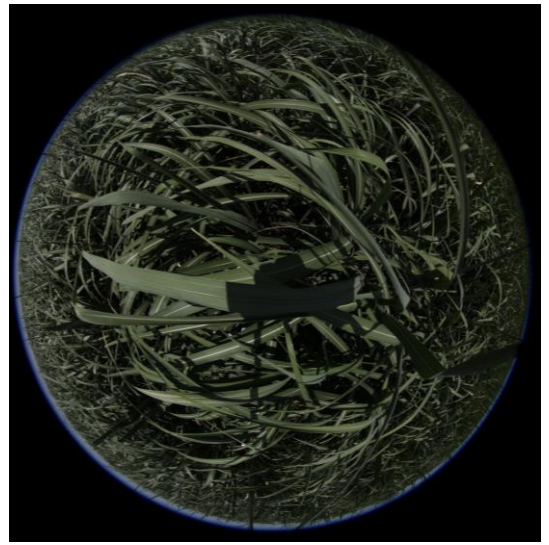
Digital Hemispherical Photography

- **DHP**: Digital hemispherical photographs (derivation of PAI, ALA, FAPAR, FCOVER and gap fraction) acquired with a fish-eye+ camera system
- **DP57**: Digital images acquired with a classic camera inclined at 57.5° from the vertical (measurement of PAI, and Gap fraction at 57.5°)
- **DP0**: Digital Images acquired at nadir (vertical camera) to estimate the vegetation cover fraction (FCOVER)



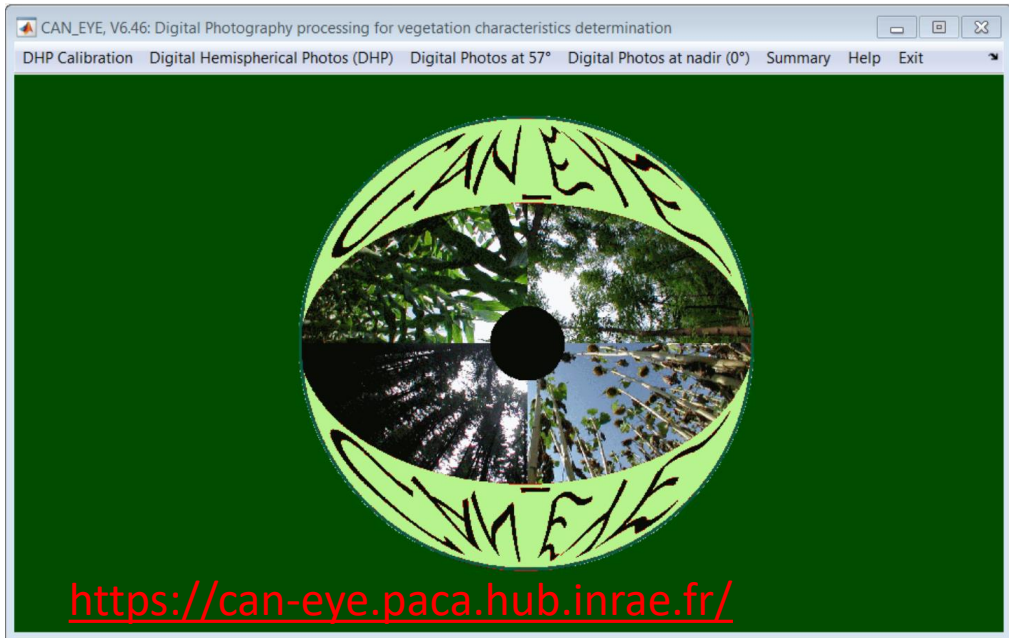
Upward (looking at the sky)

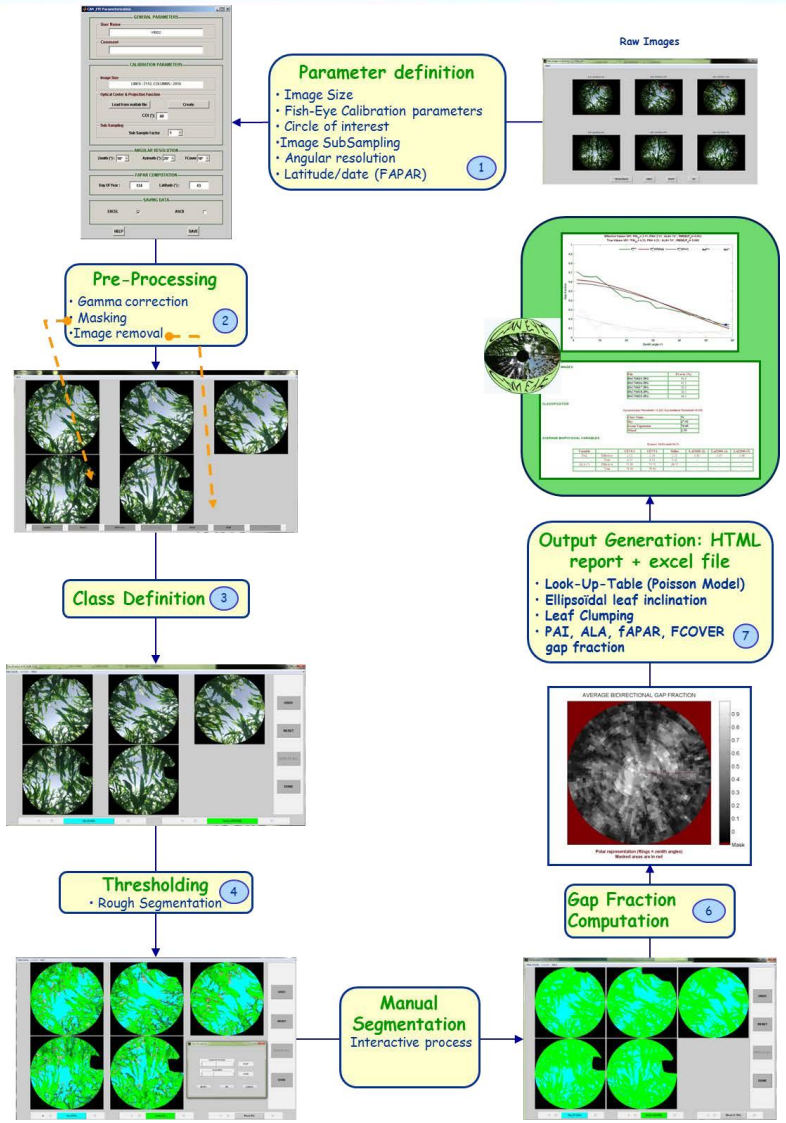
Downward (looking at the soil)



CAN_EYE Processing Steps

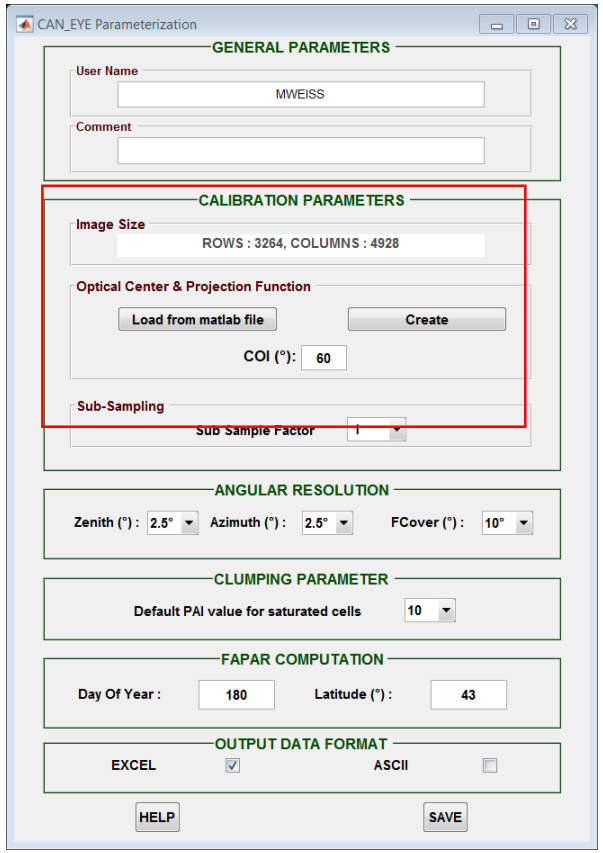
1. Set up of the processing
2. Pre-processing the images
3. Segmentation
4. LAI, ALI, FCOVOR and FAPAR Parameters calculation





1. Set-up of the Processing

CAN_EYE Parametrization



Projection Function Parameters

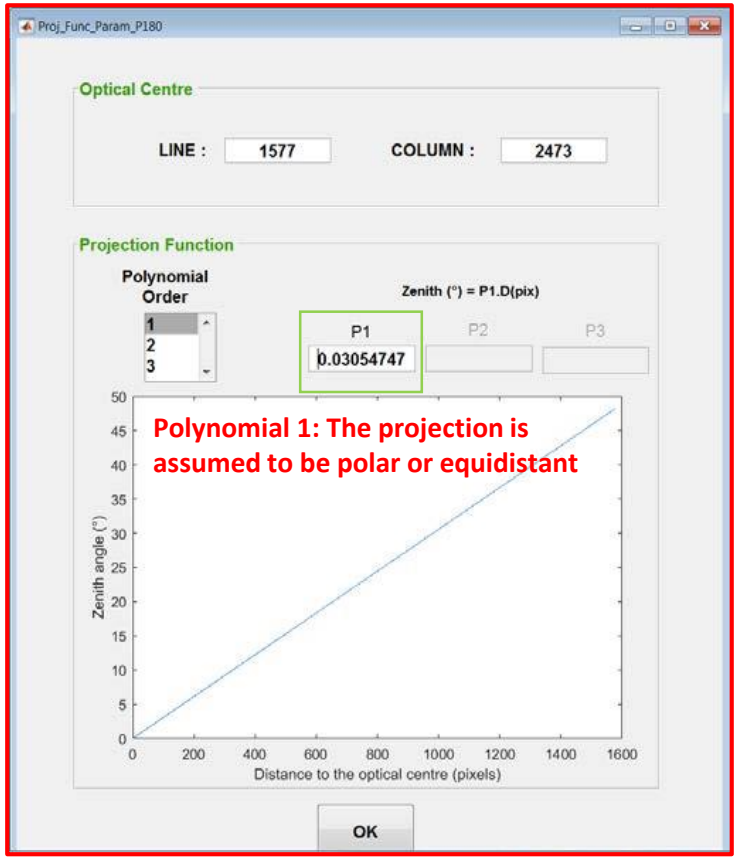
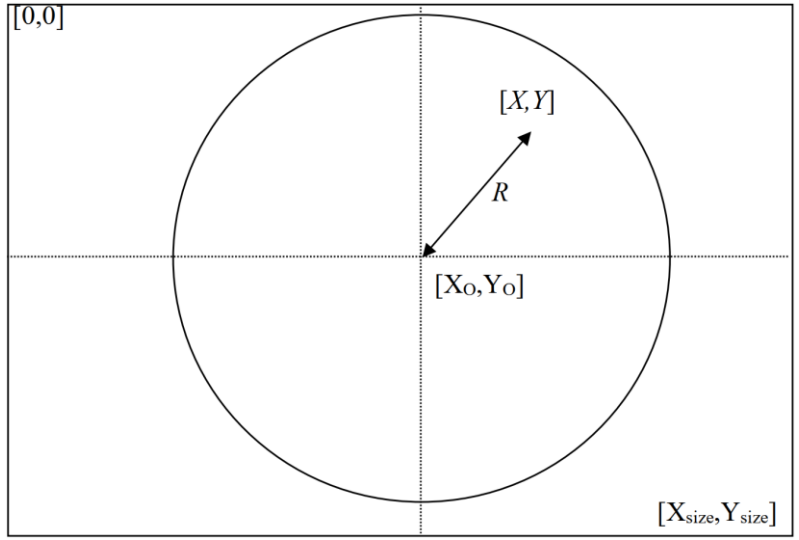


Image coordinate system



$$P_1 = \frac{FOV_{max}}{L_D}$$

$$L_D = \sqrt{Length^2 + Width^2}$$

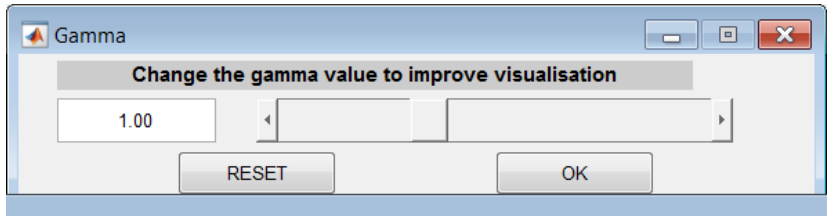
*** This setup configuration can be saved and used to process another series of photos.**

2. Pre-processing the images

- CAN_EYE accepts only **TIF** and **JPEG** images with any size (resolution).
- The image naming convention requires no **special characters** (such as ‘.’ ‘&’ and etc.).
- All the images to be processed concurrently and stored in a single directory should have the same **format**, **size**, **camera setup** (zoom, …), and the same **direction** (upward or downward).
- No more than **25** images can be processed by CAN_EYE at once.
- Based on CAN_EYE assumption, it is not correct to estimate the LAI from the gap fraction using a single image. A minimum of **8** to **12** images is required (Weiss et al., 2003).

2. Pre-processing the images

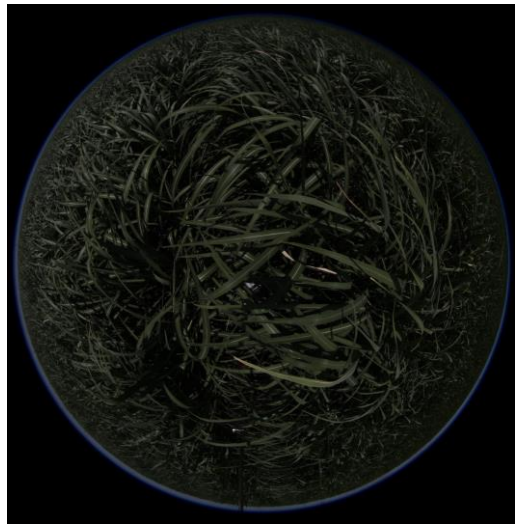
- The **illumination** conditions should be about the same within a series of images. If there are large differences in illumination conditions (such as strong direct light or strong diffuse conditions), it is recommended to split into homogeneous sub-series.



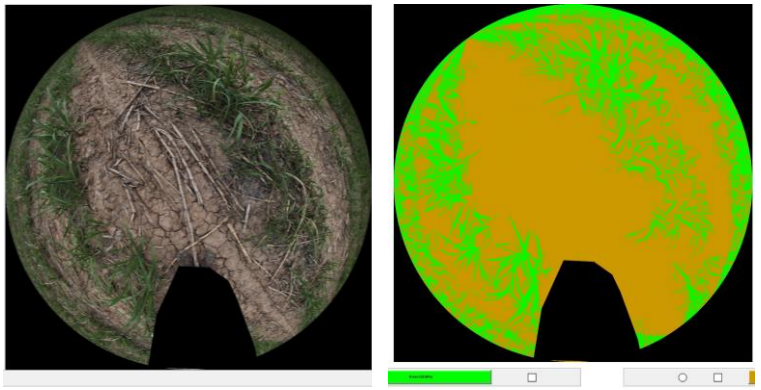
High brightness

Moderate brightness

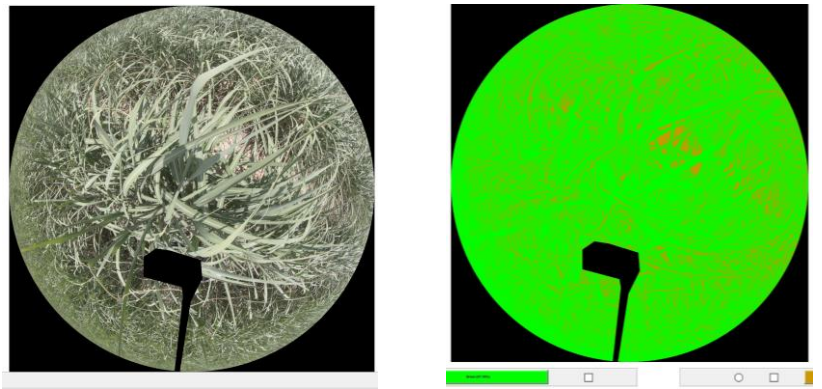
Low brightness



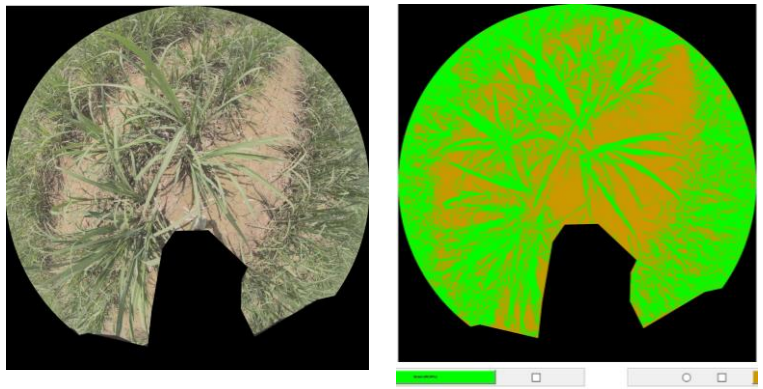
3. Image Segmentation, by Threshold



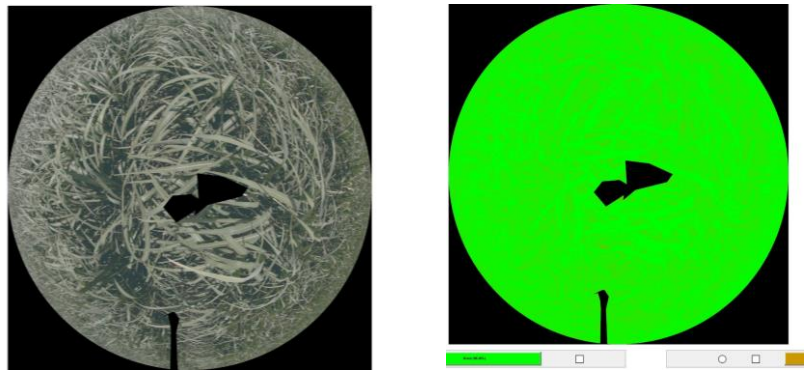
LAI = 0.42



LAI = 2.56

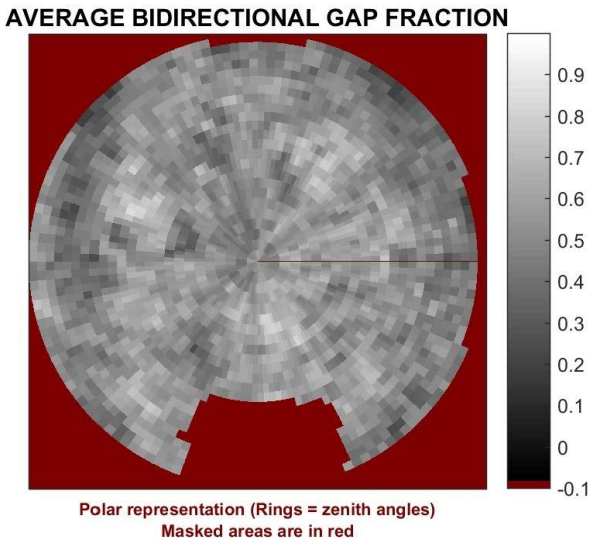


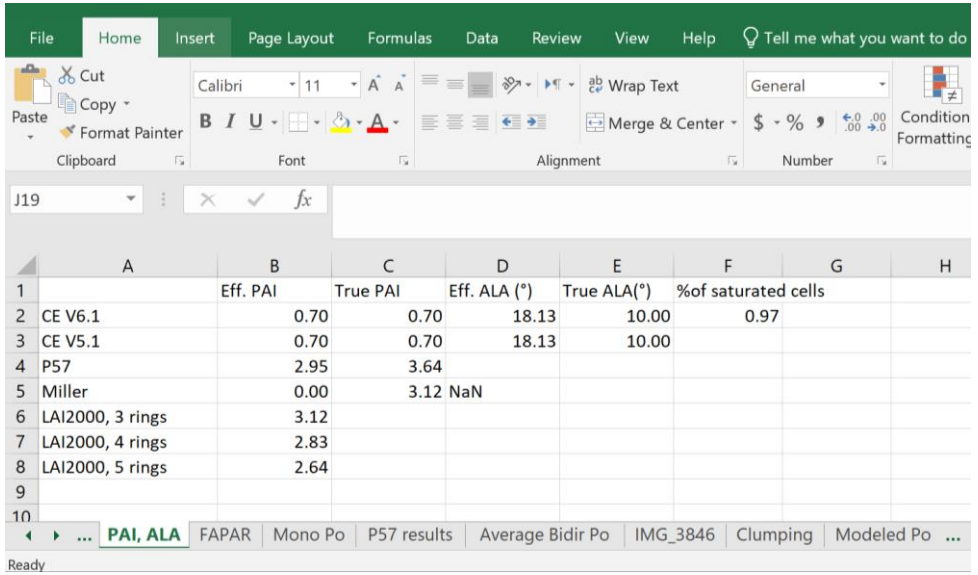
LAI = 1.02



LAI = 3.45

4. LAI, ALI, FCOVOR and FAPAR Calculation





	A	B	C	D	E	F	G	H
1		Eff. PAI	True PAI	Eff. ALA (°)	True ALA(°)	%of saturated cells		
2	CE V6.1	0.70	0.70	18.13	10.00	0.97		
3	CE V5.1	0.70	0.70	18.13	10.00			
4	P57	2.95	3.64					
5	Miller	0.00	3.12	NaN				
6	LAI2000, 3 rings	3.12						
7	LAI2000, 4 rings	2.83						
8	LAI2000, 5 rings	2.64						
9								
10