VISUAL ASSESSMENT OF BLACK RHINO BROWSE AVAILABILITY Version 3

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SADC REGIONAL PROGRAMME FOR RHINO CONSERVATION

CESVI cooperazione e sviluppo

IUCN The World Conservation Union

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SPECIES SURVIVAL COMMISSION
AFRICAN RHINO SPECIALIST GROUP

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1: INTRODUCTION

This manual provides a definition and step-by step description of "browse availability scoring" - a standardised, visual method of assessing browse availability for black rhino. It also describes how to plan a comprehensive browse availability survey for an entire property or reserve.

Before undertaking a real survey of black rhino browse availability, beginners to this approach need to first do the following:

- **read and properly understand the material presented in sections 1 to 9**
- **practice and become confident with each aspect of the assessment technique, by undertaking the practice sessions given in appendix 3.**

This document is a companion to the *User Guide to the SADC RMG Black Rhino Carrying Capacity Model (Adcock 2001, to be updated 2006).* It updates the description of the approach to browse availability assessment given in earlier the first versions of this document (Visual assessment of black rhino browse availability, Adcock, October 2003, Version 2.0 of October 2004 and Version 2.1 of April 2005).

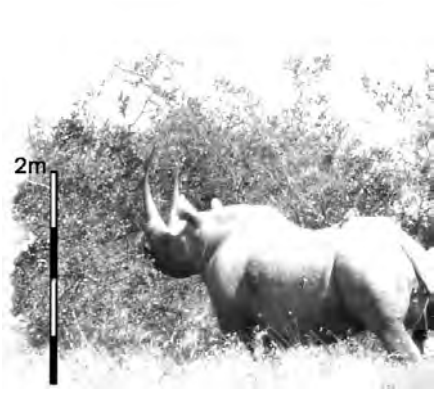
Justification for the technique described here is provided in the last section 5 of this document. Readers are also referred to an inter-observer variability test of the technique, *"Report on the field testing of inter-observer variability in the application of the standardised browse availability assessment method used in black rhino carrying capacity evaluation"* (Adcock, July 2004).

2: CHARACTERISTICS OF BLACK RHINO BROWSING: IMPORTANT POINTS

- Around 98% of black rhino food comes from the 0-2m height range, and around 85% comes from the <1.5m height range. Rhino prefer feeding between 0.50m and 1.20m in most savanna areas.

  - Generally, browse material above the 2m level is unavailable to black rhino. They can use browse from above 2m, when they can bend or push down tall plant specimens, bringing them into the <2m browse layer. This behaviour tends to be confined to certain preferred plant species or spindly growth forms. For browse availability assessment purposes, browse material over 2m off the ground is ignored, as in real terms it still only contributes a tiny proportion of rhino diet.

  - Black rhino consume leaves and significant amounts of twigs/branches, up to a maximum stem diameter of around 3cm, depending on the hardness of the wood. Generally, black rhino routinely eat twigs of up to 1.5 cm diameter.



- Patterns of woody plant eating tend to be species and growth form dependent.

  - Longer, thicker shoots or small branches are removed from spindly plant growth forms, where most of the branches easily are available to rhino (left).

  - In contrast, on a heavily hedged plant form, multiple short, thin shoots tend to be trimmed off the relatively shallow outer layer (shell) of the plant, and most of the inner branchlets are unavailable to the rhino (right).

  - Dwarf shrubs and herbs may be “trimmed” of multiple thin shoots, or pulled up and eaten entirely by black rhino.

- *Dead plant parts* (e.g. dead branches and twigs) *are not eaten by black* rhino and must be excluded during browse availability assessment.
- DORMANT PLANTS which have lost their leaves for the dry season are NOT DEAD and can be readily eaten by black rhino!

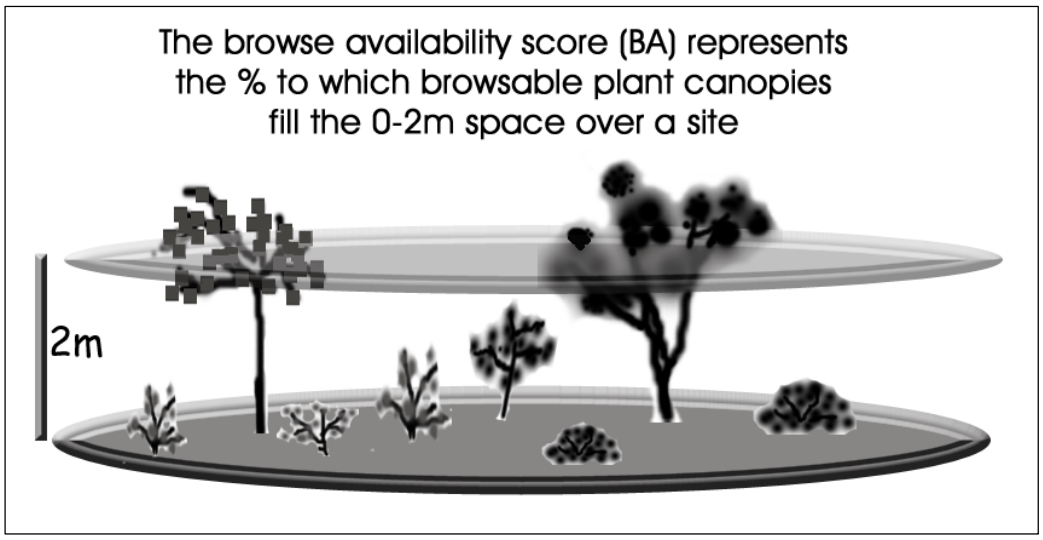
- *Burnt branches and twigs are relished and much eaten by black rhino.* Rhino eat the twigs which are not too badly burnt (i.e. not totally charcoalised right through), and which have some sap and cell content still present in them (i.e. still-alive or dying twigs). <u>They even prefer burnt twigs to unburnt twigs!</u>

3: WHAT DOES BLACK RHINO BROWSE AVAILABILITY (BA) MEASURE?

Browse availability (BA) is the single factor with the strongest influence on black rhino carrying capacity (Adcock 2001, Adcock et. al 2006). When linked with measures of browse palatability (based on species composition), BA assessments of rhino areas provide important information to understand and manage black rhino populations and their food resources in the long term.

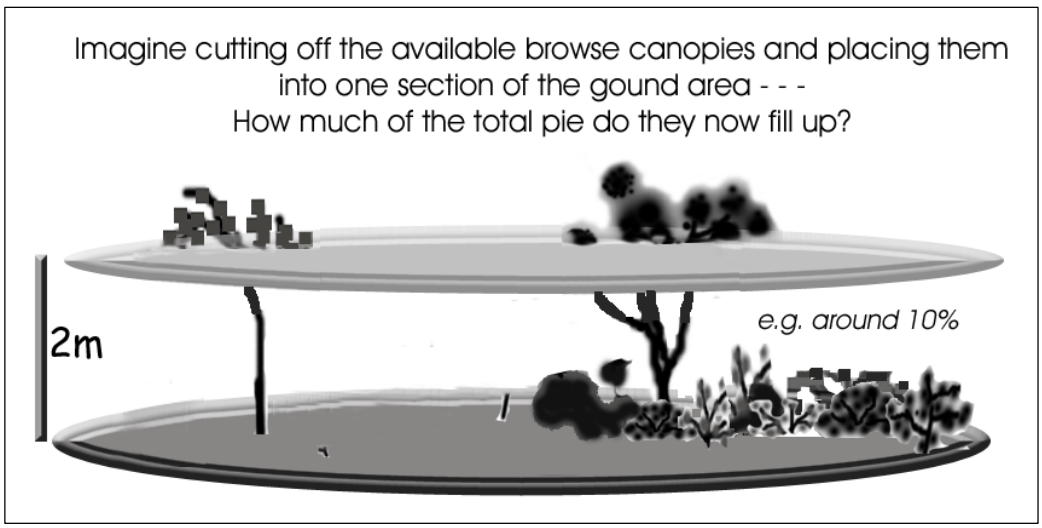
BA is an easily understandable "Index" that is *correlated* with the actual biomass of potential black rhino browse at a given site. The correlation works through the fact that the canopy dimensions of a plant are correlated with the amount (weight) of browsable material on a plant (see section 5 for a theoretical background to the technique).

- ***The 0-2m space layer over a given area (plot, vegetation type or entire reserve) defines a potential "browse space" or "pie" for black rhino.***



- The degree to which this pie is filled by browsable plant canopy material provides an index of browse availability for black rhino. ***(For example, a site filled solidly from 0m to 2m with browse (browsable plant canopies), would contain 100% "fill" of the rhino pie, or 100% browse availability.)***

- In most situations, the 0-2m browse pie is not filled entirely with browse. ***The summed volumes of the individual plant canopies in the area, expressed as proportion of the entire plot volume, gives the degree of fill of the "pie" space, providing a relative estimate of available browse.*** The BA score (as proportional or % fill) represents the amount of potential food available to black rhino.



4: HOW TO ESTIMATE BROWSE AVAILABILITY (BA)

4.1: Understand the basics of estimating or measuring BA

- Browse availability is assessed in the **<u>0 to 2</u> metre layer** over a given ground area or plot.

- **All browsable plant canopies must be accounted for** including herbs, seedlings, dwarf shrubs, shrubs and trees and overhanging branches etc.

- **BA is derived from two basic parameters: *canopy cover* and *canopy depth* within the 0-2m space.**

- For a given browse element…

  - ***<u>Total</u> Canopy Cover*** of that element is expressed as a proportion of the plot area

    e.g 0.12 (i.e. 12% canopy cover)

  - ***<u>Average</u> Canopy Depth*** is expressed as a proportion of the 0-2m layer to give ***vertical fill***,

    i.e. canopy depth (m) / 2m)

    e.g. 0.8m / 2m = 0.4 (i.e. 40% vertical fill)

    Multiplying these two together (as proportions) gives BA - the proportion to which the pie is filled by that browse element

    0.12 x 0.4 = 0.048 (covert to % -> 100 x 0.048 = 4.8%

- **BA should be assessed for all browse elements in a plot, either individual plants or in groups of browse types (see below for more detail), and then totalled for the entire plot and for browse classes**:

  - The sum of all the proportional fills (BA's) of all the browse elements is the total BA for the plot.

  - Different kinds of browse element totals of can also be defined, such as Herb BA, Dwarf Shrub BA, or Woody BA etc.

  - Once the species data are analyzed (see section 5), the BA of each species can be determined.

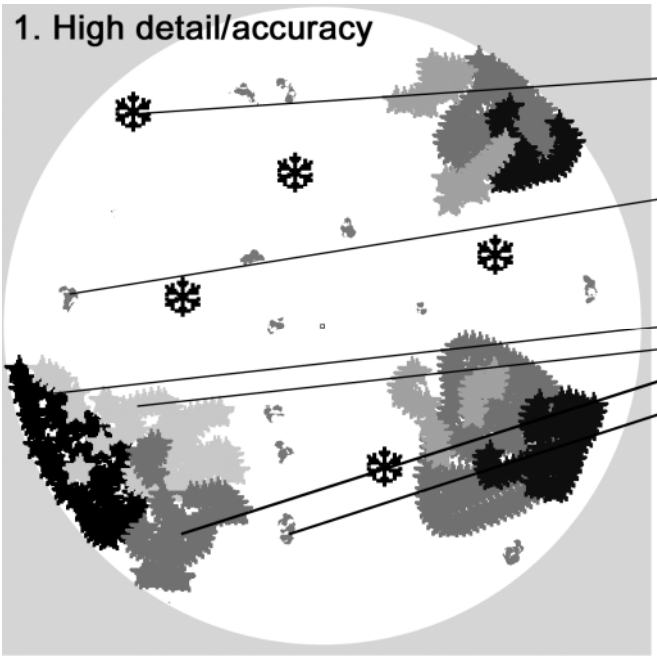
BA can be estimated to various levels of accuracy within plots depending on time available and desire for detail as described below. <u>Approach 1 to 3 below, which are illustrated on the next page, can potentially all be used in one plot to tackle different browse components</u>. In each plot, the ultimate task is to estimate the proportion of pie space that is filled with browsable material within in the 0 to 2m height range. *(Datasheets are provided in appendix 2).*

1. **High detail/accuracy**: taking measurements of individual plant canopies, i.e. average canopy diameter and avg. canopy depth. These measurements are used to calculate plant canopy cover and vertical fill to give individual plant BA.

2. **Medium detail/accuracy:** measuring or estimating the parameters *total canopy cover* and *average canopy depth* for an entire clump of canopies; or estimating/measuring average canopy parameters across a group of plants with similar canopy characteristics (e.g. by species, size class, or growth form / habit / vegetation layer).

3. **Medium to low detail/accuracy:** estimating the parameters *(total canopy cover* and *average canopy depth*) for large classes of browsable canopies in the plot all a once (eg trees, bush clumps, shrubs, herbs).

4. **Low detail/accuracy:** Estimating BA for the plot by reference to calibrated photographs of reference plots.

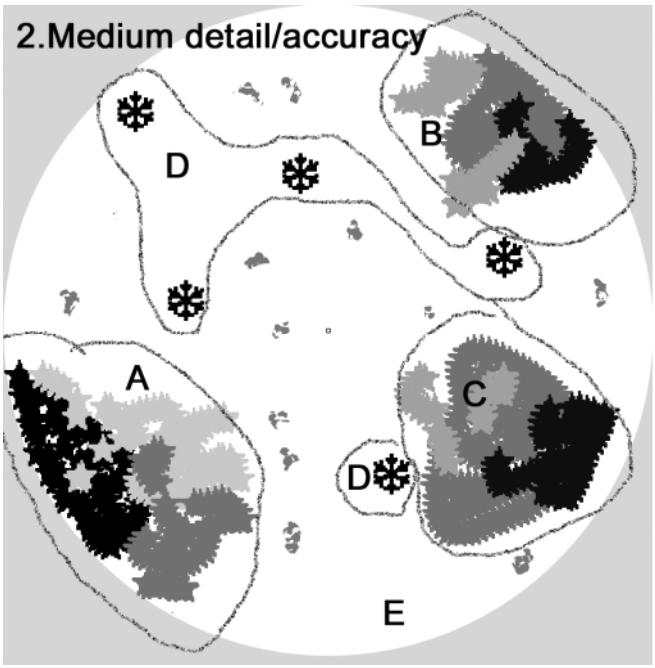


By Individual Plant

Plant 1:
* Species,
*Average canopy diameter (-convert to canopy cover later)
*Average canopy depth

Plant 2:
* Species,
*Average canopy diameter (-convert to canopy cover later)
*Average canopy depth

Plant 3....
Plant 4.....
Plant 5....
Plant 6
etc. for all plants



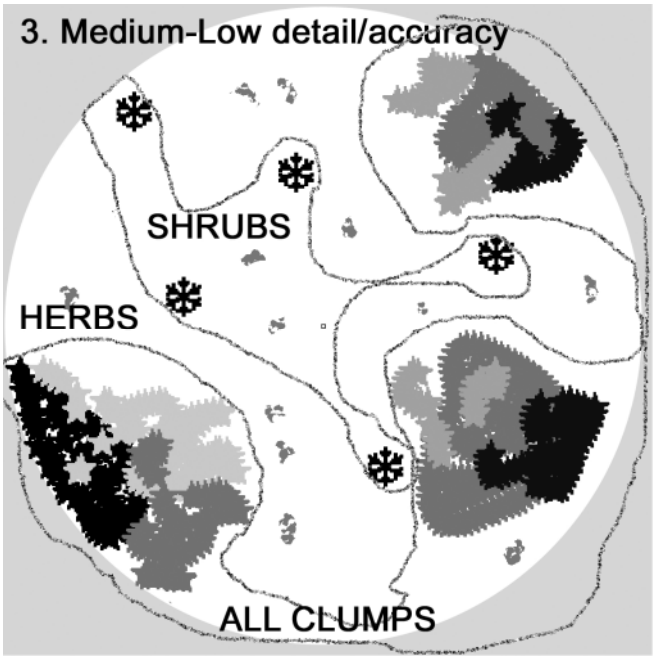
By Grouping / Type:

Clump A:
* Clump average canopy diameter (look up canopy cover); or
visually estimate canopy cover as proportion of the plot area
* Average canopy depth,
Then * Species A : proportion of clump browse biomass
* Species B: proportion of clump browse biomass
* Species C: proportion of clump browse biomass

repeat for clump B and clump C

Type D shrubs all together:
* Average canopy diameter, count number of plants; then
lookup total D canopy cover, or
visually estimate canopy cover as proportion of the plot area
* Average canopy depth over all shrubs,
then...
* proportion of D biomass by shrub species (if relevant)

Type E herbs all together:
* Average canopy diameter, count/ estimate number of plants:
lookup total canopy cover; or
estimate canopy cover as proportion of the plot area
* Average canopy depth over all herbs,
then...
* proportion of E biomass by herb species (if relevant)



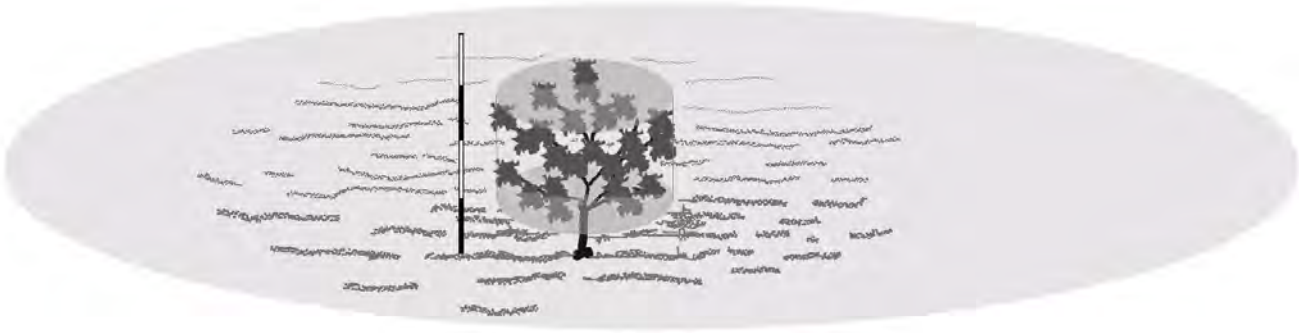
By Major Groupings

Group 1: All clumps together:
* Estimate Total clump Canopy Cover as proportion of plot
* Estimate Average Canopy Depth of clumps
* Estimate propotion of clump biomass
composition by species

Group 2: Shrubs
* Estimate Total shrub Canopy Cover as proportion of plot
* Estimate Average Canopy Depth of shrubs
* Estimate propotion of shrub biomass
composition by species

Group 3: Herbs
* Estimate Total herb Canopy Cover as proportion of plot
* Estimate Average Canopy Depth of herbs
* Estimate propotion of herb biomass
composition by species

Here is an example showing the logic of why each approach is equivalent in principle (but varying in likely practical accuracy). Take the task of estimating BA in the simple case of a single browse plant in plot.



- ***DOING IT THE LONG WAY (high accuracy)***:
- This plot has a 5m radius i.e. 10m diameter.
    - the plot area is 78.54 m^2 (*Pi x radius²*)
    - the plot volume is 78.54 m^2 x 2 m (depth) = 157.1 m^3
- The plant dimensions are:
    - average canopy diameter: 1.2 m, thus radius = 0.6 m
    - average canopy depth: 1.1 m
- The plant volume is:
    - canopy area of plant = *Pi x radius²* = 3.1415927 x 0.6^2 = 1.13 m^2
    - canopy area x canopy depth = 1.13 x 1.1 = 1.24m^3.
- The BA of this plot is thus the plant volume as a proportion of the plot volume:
    - BA = Plant volume / plot volume = 1.24 / 157.1 = <u>0.0079</u>
    - i.e. the %BA is 0.0079x100 = <u>0.79%</u>

DOING IT A QUICKER WAY (with lookup tables)…

- The **total canopy cover** for the plot can be found in a **lookup table** (***appendix 1***) for a 10m diameter plot, or by estimating the canopy cover using the canopy cover patterns of Appendix 1 (less accurately):
    - E.g. look up* the canopy cover for one 1.2 m diameter plant in a 10 m diameter plot
    - This gives 1.44% canopy cover (<u>0.0144</u> as a proportion)
- The total BA for the plot is then simply the proportional canopy cover x the proportion vertical fill
    - Proportion vertical fill = average canopy depth / 2m (i.e. half the average canopy depth) = 1.1 / 2 = <u>0.55</u>
    - ***BA = proportional canopy cover x the proportion vertical fill***
    - =0.0144 x 0.55 = <u>0.0079</u> i.e. BA = <u>0.79%</u>
- (values in the lookup table have been pre-calculated, for example for a 1.2m diameter plant……
  Canopy area of plant = *Pi x radius²*
  = 3.2415927 x 0.6^2 = 1.13 m^2
  Proportional canopy cover is Plant canopy area as proportion of plot area: 1.13 m^2 / 78.54m^2 = 0.0144)

THUS BY ESTIMATING PROPORTION TOTAL CANOPY COVER AND MULTIPLYING THIS BY PROPORTION VERTICAL FILL (average canopy depth / 2m) , ONE AUTOMATICALLY ARRIVES AT A BA ESTIMATE

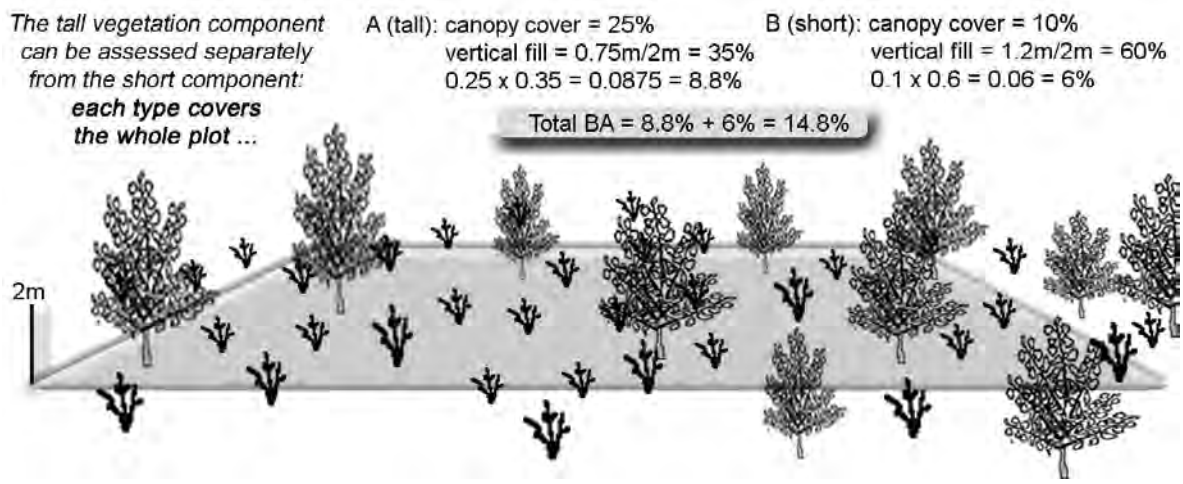
THEREFOR: You can measure the canopy dimensions of each individual plant and calculate BA the long way; but ***you can also arrive at an acceptably accurate BA estimate by estimating the proportional canopy cover and average canopy depth of plants or groups of plants***. A variety of approaches can be used to estimate canopy cover and average canopy depth: these are described in more detail in sections 4.2 and 4.3.

To overcome the time-consuming method of measuring every plant canopy, a "visual estimation" approach can thus be adopted. This allows more sample plots to be surveyed in a given time period, increasing the representative-ness and validity of overall survey results for rhino. In this kind of survey work, there is a trade-off between getting highly accurate results which describe a limited number of plots and plants accurately, versus doing more plots at a slightly lower level of accuracy, which together provide better average representation of each vegetation type across the whole rhino area.

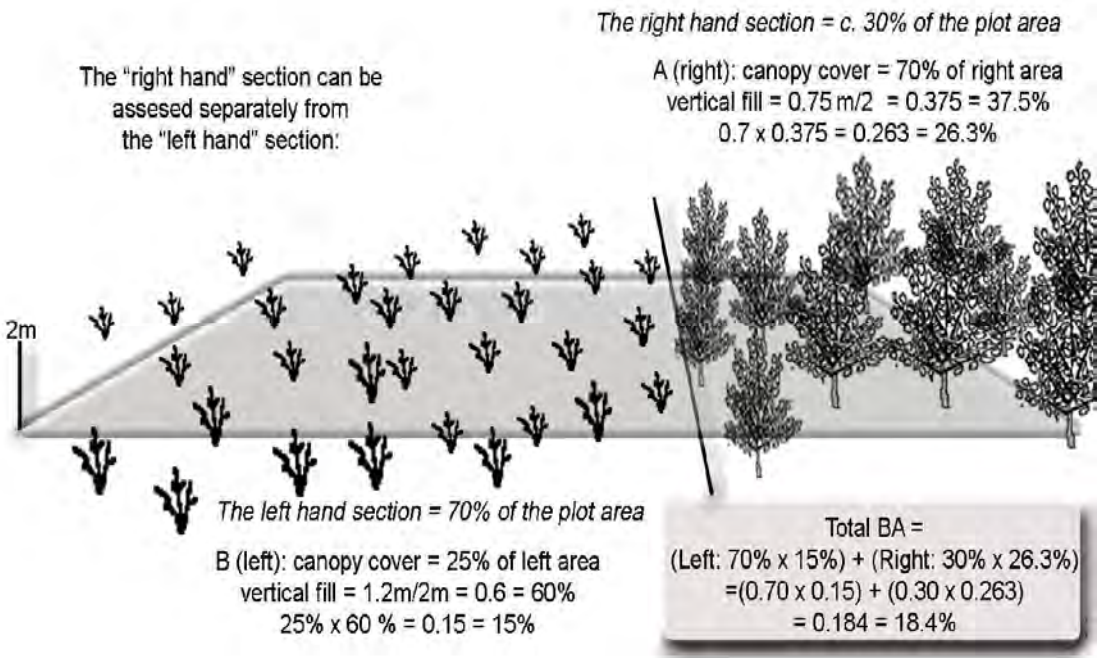
In visual assessment of black rhino browse availability, different components of vegetation at a site should be assessed separately where needed. These may for example comprise different vegetation "layers" as shown below:

Examples of vegetation components or layers:
Herbs (excluding grasses) are often best assessed separately from woody browse, but in exactly the same way, = herb layer
Dwarf shrubs = a short/low layer A
Small woody plants (seedling or sapling etc.) = a short of low layer B
Overstory canopies of larger trees or bushes = a tall or high layer

The BA score of each layer is added together to arrive at an overall BA score for the site.



Another way to define vegetation components may be by evaluating segments of the plot separately: the proportion that each segment makes of the whole plot must then be estimated to weight its browse contribution to the overall plot total BA.



Example of Field Browse Availability Assessment (my back garden):

		Plot Diameter (m)		10.00	Plot area (m^2)	78.54			
Species / Layer / Group (*Give proportion of plot areaif plot is subdivided*)	***No. of plants***	***Avg. Canopy Diameter***	**Average Canopy Depth (m):**	**(Groups) Species Proportion**	**(Groups) Species Rating**	**Prop. Canopy Cover**	**Prop. Vertical Fill**	**Group BA**	**Species BA**
Orange	1	2.8	1.4			0.08	0.7		5.5%
Orange	1	2.5	0.9			0.06	0.45		2.8%
Naartjie	1	2.1	1.3			0.04	0.65		2.9%
Limes	2	2.8	1.65			0.16	0.825		12.9%
Mackayabella	1	1.85	2			0.03	1		3.4%
Olive	1	1.1	1.1			0.01	0.55		0.7%
Hypoxis	3	0.5	0.2			0.01	0.1		0.08%
Shrub clump	1	2.75	0.75			0.08	0.375	**2.84**%	
Sage				0.59	10				1.67%
Plectranthus				0.41	7				1.17%
					17				
Bush clump			1.6			0.04	0.8	**2.89**%	
Hemizygia				0.60					1.73%
Yellow Daisy				0.40					1.16%
Herbs2	15	0.45	0.45			0.03	0.225	**0.68**%	
Rosemary				0.15	10				0.101%
Lavender				0.15	10				0.101%
Aloe				0.15	10				0.101%
Thyme				0.12	8				0.08%
Origanum				0.09	6				0.06%
Tomato				0.06	4				0.04%
Agapanthus				0.15	10				0.101%
Sprout				0.06	4				0.04%
Spring Onions				0.03	2				0.02%
Garlic Chives				0.06	4				0.04%
					68				
				Total Canopy Cover:		**53.77%**		**Total BA**	**34.7%**

<u>For this plot of 10m diameter, BA was assessed using the different methods on different components (the plot area was not subdivided):</u>

- **Large trees** and **odd plants**: (orange to Hypoxis) were measured individually to get their canopy diameter and depth. Canopy cover for each plant was read from the lookup table, and BA for each plant was calculated later.

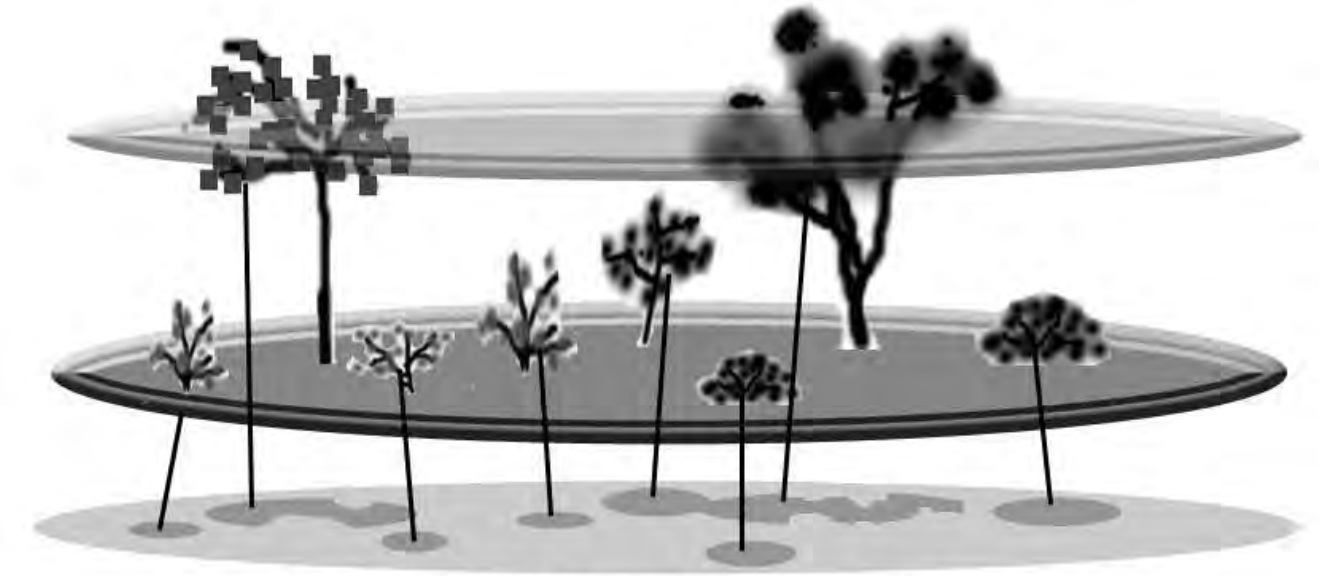
- A clump of **shrubs** was treated as one component.
  - The average diameter and depth of the whole clump was measured.
  - The clump proportional canopy cover was found from the lookup table
  - The contribution to the clump biomass of each species (Sage, Plectranthus) was rated (***see section 5***).
  - Later: The clump's BA was calculated
  - The ratings of each species were converted to proportions which summed to 1
  - Individual species BA's were calculated by multiplying their proportional biomass by the clump BA of 2.84% (for example 0.59 x 0.0289 = 0.0167 or 1.67% for Sage).

- For a clump of **bushes**, the clump canopy cover as a proportion of the plot area was estimated visually using the canopy cover pattern pictures. Species proportions of bush clump biomass were estimated and later Total BA and species BA's were calculated as for shrubs.

- For herb groups1 and 2, the average canopy diameter across all species was estimated, along with the average canopy depth. The total number of plants was counted. Species were rated for relative contribution to herb group biomass. Later, the canopy cover of such plants was looked up and multiplied by the number of plants to get total canopy cover for the herb group. BA for the group was calculated and species BA's calculated as for shrubs.

4.2. Methods of assessing proportional total Canopy Cover

The ground-projected total browse canopy cover of a group of plants can be rated visually as a proportion from of 0 to 1 (corresponding to 0 to100%) of the plot area.

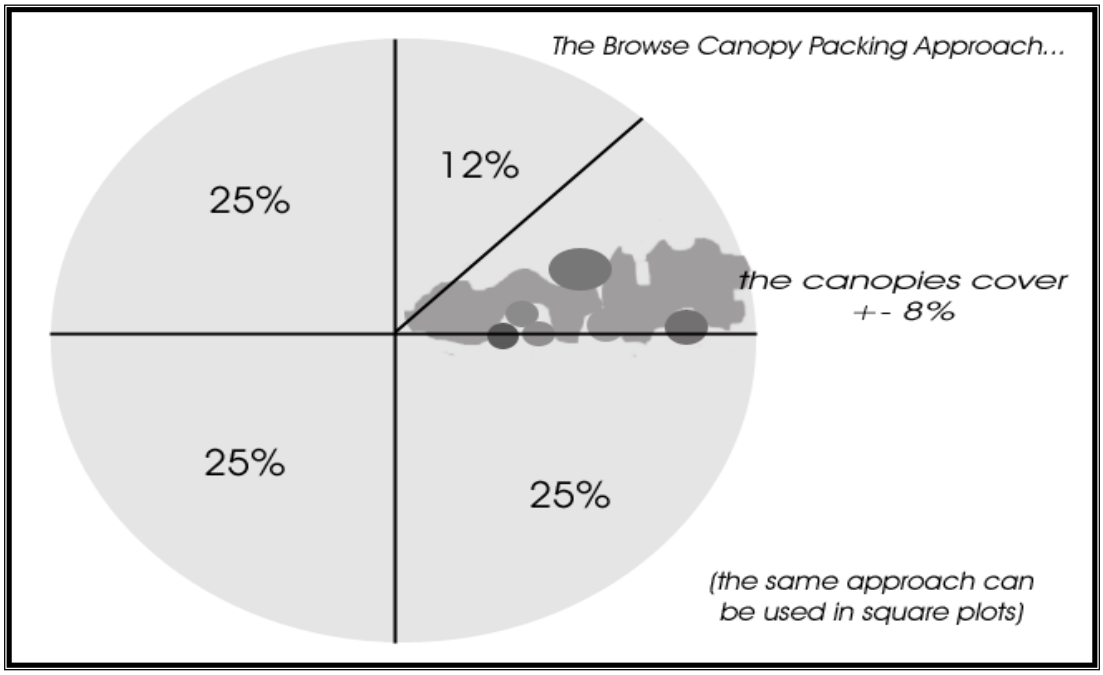


Project the browsable canopies onto the plot ground area,
and estimate:
what proportion of the plot ground area is covered?

Note: *in general, canopies of plant growing under other plants need to be visually "moved" into unoccupied ground area to estimate the correct total plot canopy "cover" (or else they should be treated as a separate layer and assessed separately, which is a better approach).*

Proportion canopy cover estimation (for all canopies, or canopy types, layers or species etc) can be done through three approaches:

A) Visually re-arrange the available browse canopies into one segment of the plot, and judge how much of the plot ground area would be covered up.



B) Match the observed canopy pattern (canopy sizes relative to inter-canopy gap sizes) observed in your plot with calibrated canopy cover percentage images: Use the visual aids provided in Appendix 1, which show a range of cover patterns for 0.5% to 90% canopy covers.

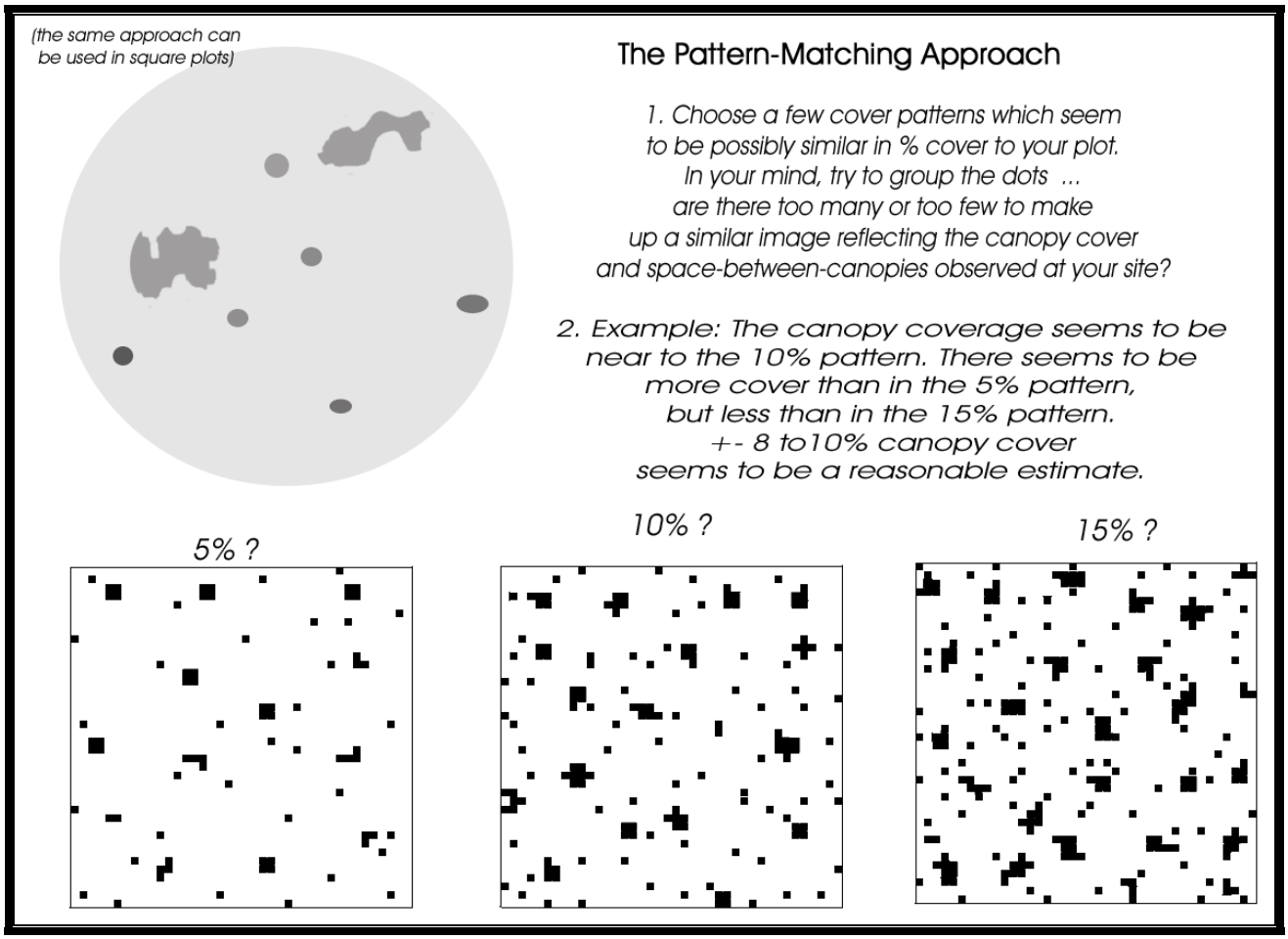


Fig 6

C) Use lookup tables, which tabulate how canopies of a certain dimension represent a certain proportion of a plot of a given size.

Lookup Tables, ***showing the % cover represented by different sized canopies in different sized plots, are provided for use in the field in appendix 1.***

- A canopy averaging 2 x 2m square equals 1% of a 20 x 20m square plot.
- A circular canopy averaging 2m diameter equals 1% of a circular plot of 20m diameter.
- A canopy of 3x3m square equals 9% of a 10 x 10m square plot.
- A circular canopy of 3m diameter equals 9% of a 10m diameter plot.
- In a 20m diameter round plot, 50 plants of 0.4m represent 2% canopy cover, while 75 plants of 0.4m represent 3% canopy cover.

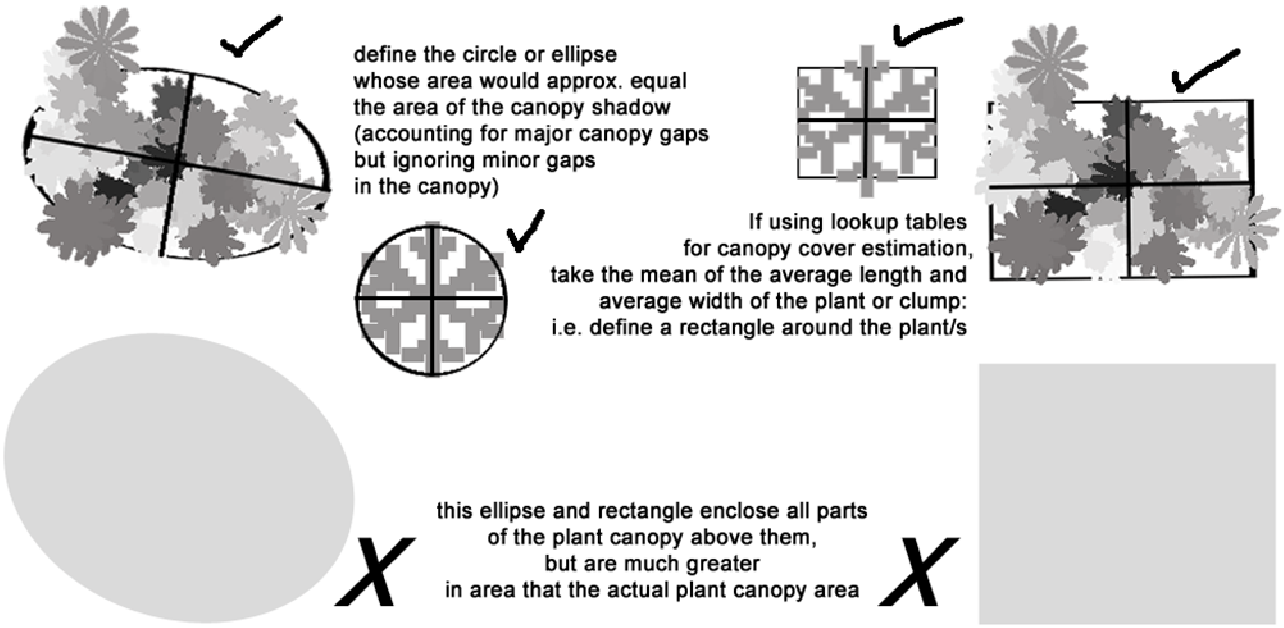
  etc etc…

Small canopies can also be visually "bundled" together to form units of 1or 2 % cover which can be counted up.

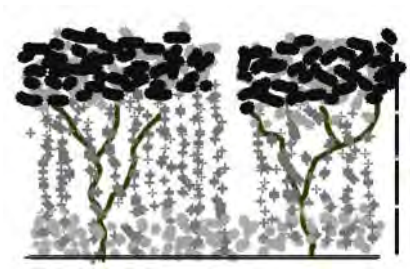
Things to remember when estimating canopy cover:

- When projecting a canopy's cover shape onto the ground, don't enclose odd twigs and bits that may stick out of the main canopy shape – i.e. don't try to project a circle/ellipse/oblong that encloses every little bit of the canopy, as this area be will be an overly large representation of the actual canopy area. Project the circular / elliptical shape that would be approximately equal in area to the area of the canopy – i.e. the canopy bits outside the shape would fill the empty areas within the shape (see below).

- If using the ***canopy cover lookup tables*** to estimate canopy cover in a circular plot, use the average of the max and min. diameters of the estimated canopy shape (see below A).
- If you use the ***canopy cover lookup tables*** for a square plot, you need to estimate and project rectangular canopy cover shapes to define the canopy areas (see below B).



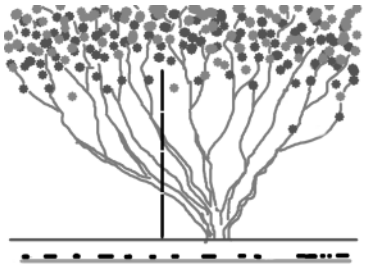
- When projecting canopy cover onto the ground area, plant canopies which occur largely underneath other ones need to be "shifted sideways" into "open space", to account for canopy overlapping (Do not worry to adjust for canopies which overlap only slightly at their tips). If many small plants occur under large ones (e.g. herbs under trees or bushes), rather assess the canopy cover and average canopy depth of these plants separately as a separate layer.



- If the canopies of the "understory" meet and intermix with the canopies of the "overstory" or upper browse layer, it can be difficult to work out where on layer begins and the other ends. In this case, treat the entire bundle as one canopy and do not separate the canopy covers of the upper and lower layer. The entire bundle's canopy depth also needs to be judged as the lower + upper layer canopy depths added together also.

- Canopies of tall trees often have a "doughnut" shaped projected available canopy, i.e. the central part of the canopy in many trees often contains only thick branches and stems. Only the outer ring of smaller branches and twigs+leaves comprises available browse. Do not include the centre of such tree "canopies" in your projected canopy cover estimation. (Subtract a proportion of canopy cover from the total).

- Very large, tall bushes also usually have a central region which has no available browse. You should estimate what proportion of such bush canopy area is “empty”, and this area must also be deducted from the bush canopy cover estimate.



- Sometimes a site has large shrubs with very sparse canopies within the 0-2m level, i.e. the browsable canopy consists of small, widely spaced bunches of leaves/twigs of 10-50cm diameter, scattered around a bush canopy which may be 5m + in diameter. Here, you need to do the following (treating such bushes as a separate layer:

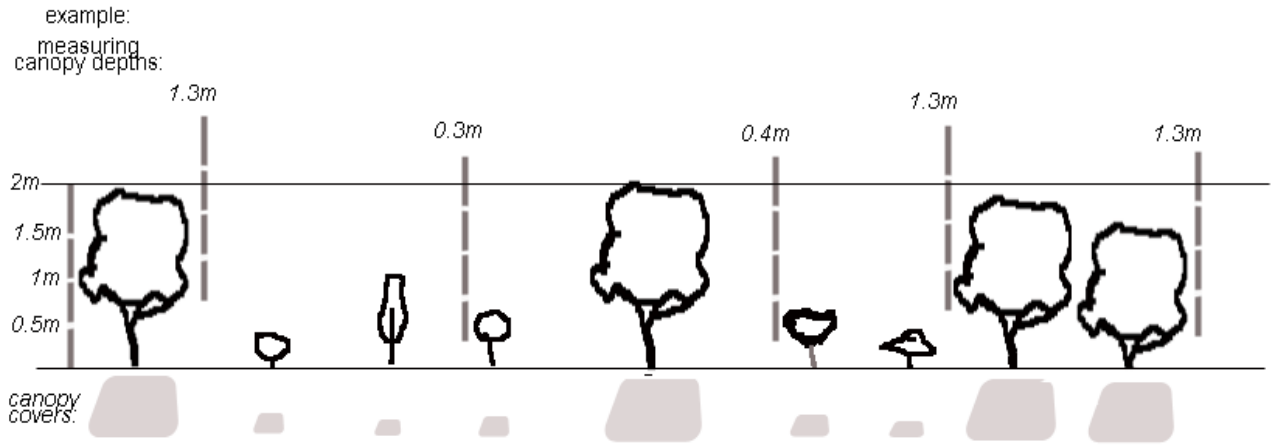
  - Estimate the proportion of canopy cover of the entire reachable bush canopy
    [e.g. 20% of the plot, or 0.2]
  - Then estimate the proportion of this canopy cover that actually has bits of browsable material
    [e.g. 30% or 0.3]
  - Multiply these proportions together to get a more realistic estimate of browsable canopy cover for this bush:
    [i.e. 0.2 x 0.3 = 0.06 (6%)]

4.3. Assessing Vertical Fill

If assessing a group of plants together, the *weighted* average vertical "depth" or "thickness" of the browsable plant canopies needs to be estimated in metres, and converted to a proportion of 2 metres (i.e. the avg. canopy depth is halved).

Proportion of vertical fill = wt'd avg. canopy depth(m) / 2m
e.g. wt'd avg. depth = 0.5m 0.5/2 = 0.25 (or 25%).

Average canopy depth can be roughly estimated for a variety of canopies all together, but because wide or large canopies contributes more to total canopy cover than narrow/small plants, the average depth needs to be weighted more towards wider plant canopies residing in the 0-2m layer. ***However if canopies are ranging greatly in depth and width, use it is better to split them into size classes / layers***. See the figure below for an explanation of how to get a weighted average canopy depth, even among a complex variety of canopies.

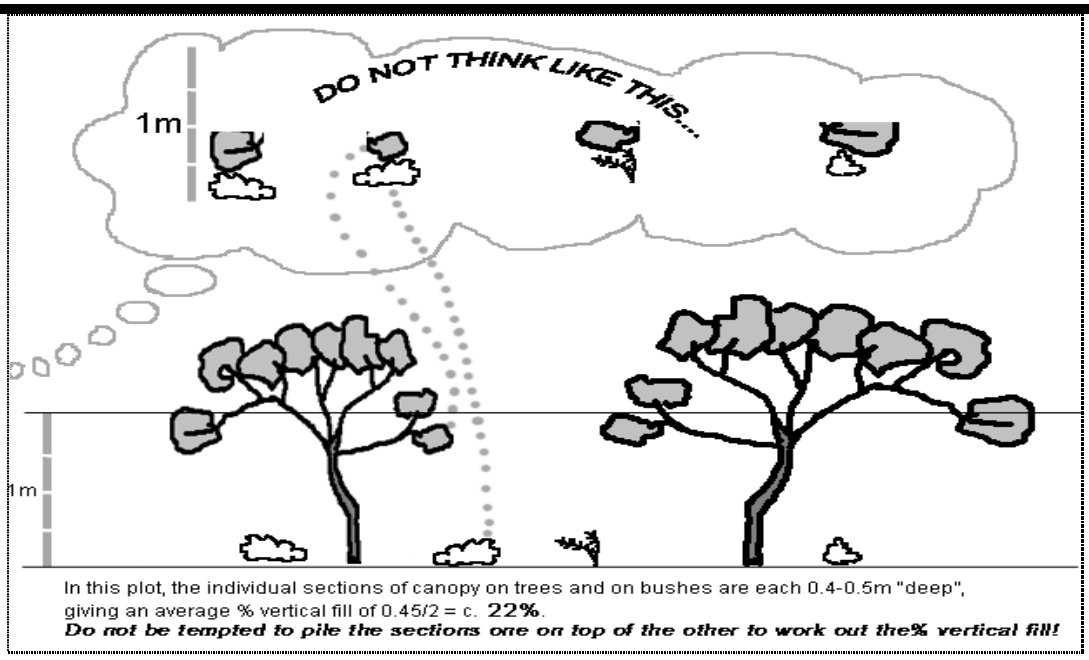


Large canopy covers make up +-80% of total canopy cover, and small canopies make up +-20% of the total canopy cover

thus canopy depths from large shrubs must contribute about 80% to the weighted average canopy depth, and small shrubs must contribute 20% to the average canopy depth.

average canopy depth of large shrubs (making 80% of the canopy cover) = +- 1.3m 0.8 * 1.3 = 1.04m
+ average canopy depth of small shrubs (making 20% of the canopy cover) = +- 0.4m 0.2 * 0.4 = 0.08m
overall average canopy depth = 1.12m

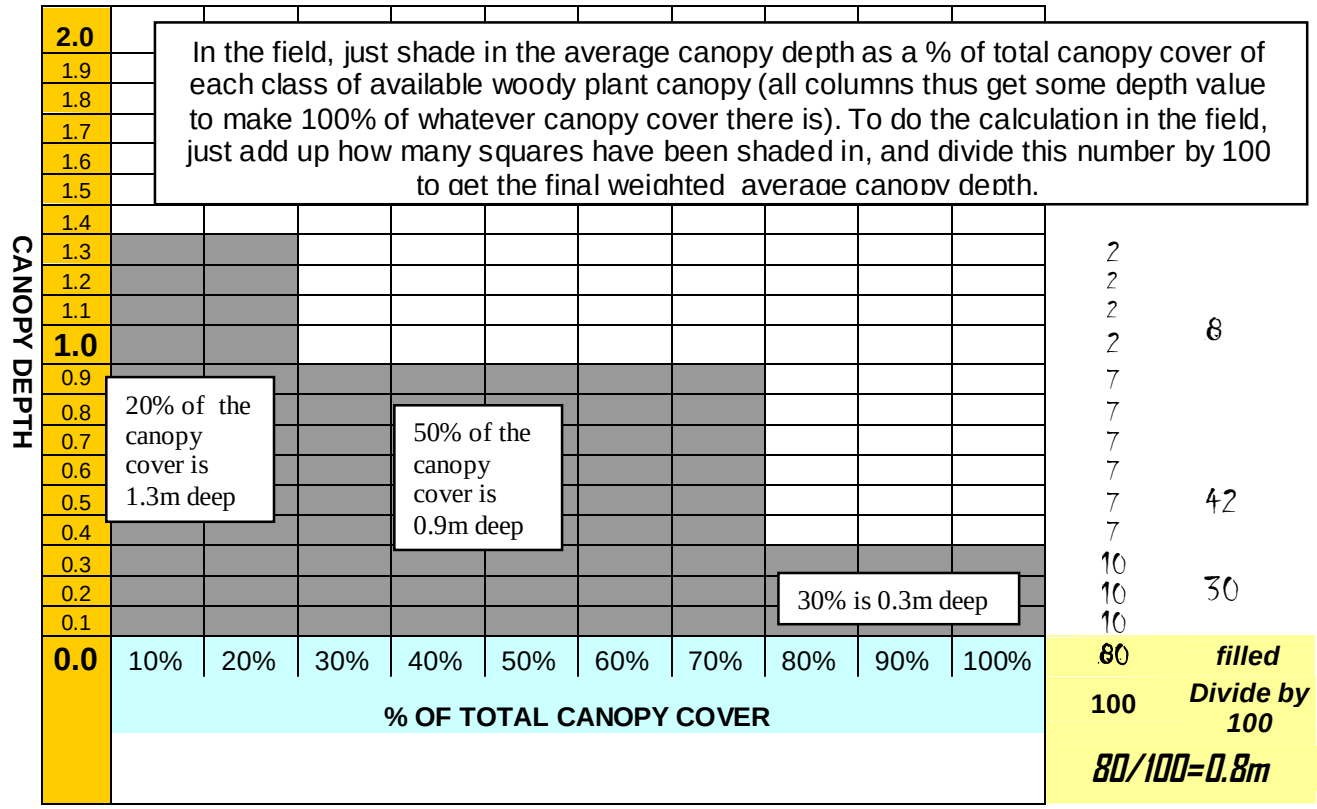
Proportion Vertical Fill = 1.12m / 2m = 0.56 (or 56%fill)



In this plot, the individual sections of canopy on trees and on bushes are each 0.4-0.5m "deep", giving an average % vertical fill of 0.45/2 = c. **22%**.
Do not be tempted to pile the sections one on top of the other to work out the% vertical fill!

- **Table for estimating weighted average canopy depth of a group of plants:**

When the available woody plant canopy structure is fairly varied at a site, this table can be shaded in while in the field. *Decide on 2 or 3 "classes" of canopy depth, and estimate their % contribution to total canopy cover and their average depth separately*. The answer can be calculated out in the field, or the table shading can be entered later onto a computer spreadsheet, to automatically calculate the proportion of vertical fill.



To calculate the answer later, in a spreadsheet, fill in a 1 in each shaded block. Then calculate side totals and sum the number of filled squares. The sum divided by 100 gives the weighted average canopy depth in meters.

Example: approximately 20% of the canopy cover was c.1.3m deep, 50% was 90cm deep, and about 30% was 30cm deep, giving a weighted depth of 0.8 meters. The proportion of vertical fill is then 0.8m / 2m =0.4 (or 40% vertical fill).

CANOPY DEPTH	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
2.0											0
1.9											0
1.8											0
1.7											0
1.6											0
1.5											0
1.4											0
1.3	1	1									2
1.2	1	1									2
1.1	1	1									2
1.0	1	1									2
0.9	1	1	1	1	1	1	1				7
0.8	1	1	1	1	1	1	1				7
0.7	1	1	1	1	1	1	1				7
0.6	1	1	1	1	1	1	1				7
0.5	1	1	1	1	1	1	1				7
0.4	1	1	1	1	1	1	1				7
0.3	1	1	1	1	1	1	1	1	1	1	10
0.2	1	1	1	1	1	1	1	1	1	1	10
0.1	1	1	1	1	1	1	1	1	1	1	10
0.0	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	80
	% OF TOTAL CANOPY COVER										100

The sum = 80 cm or 0.8m = Wt'd Avg. depth

Filled

Divide by 100

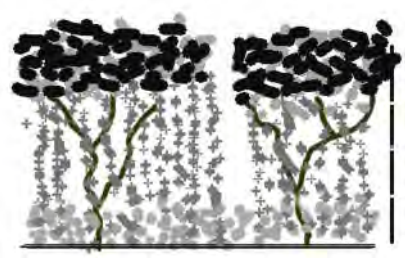
(filled /100)

Wt'd AVERAGE CANOPY DEPTH (meters)= **0.8**

Things to remember: *(some points are repeats from section D 1)*

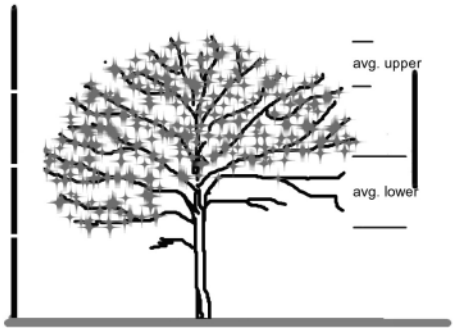
- In general, if one plant occurs under another, do not add their canopy depths together – find the average of individual plant canopy depths (or treat each level as a separate class of browse and assess separately).

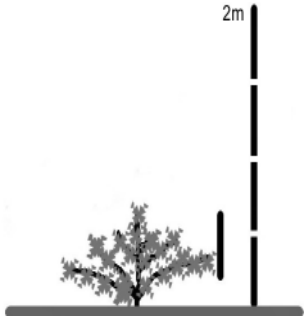
- If many small plants occur under large ones (e.g. herbs under trees), assess the average canopy depth and canopy cover and average of these plants separately, as a separate layer. Assessing different kinds of plants as separate layers often makes the assessment easier.



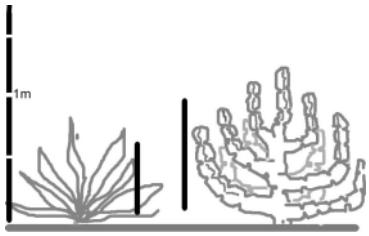
- If the canopies of the "understory" meet and intermix with the canopies of the "overstory" or upper browse layer such as in a dense bush clump, it can be difficult to work out where on layer begins and the other ends. In this case, treat the entire bundle as one canopy. The entire bundle's canopy depth needs to be judged as one unit, combining the depths of the upper and underneath plant canopies. Do account for definite unfilled spaces e.g. near the ground (don't just assume a full of 2m fill!)

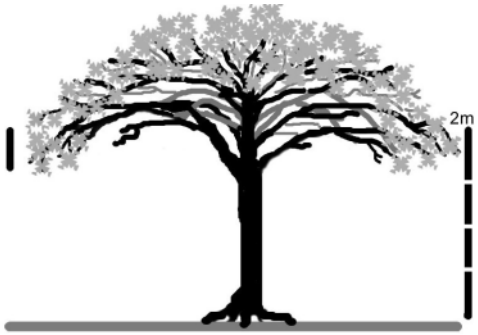
- Sometimes bushes may have a domed shape where the outer layer contains all the available leaves and twigs, while the inner section contains inedible thick branches, dead twigs and no leaves. In these cases, try to estimate the average thickness of the browsable layer itself (which curves over the bush) and not the apparent height of the whole bush. Some climbers / creepers can also form a thick layered tangle over vegetation, where the underneath sections contain no available browse while a surface layer of browsable material covers the tangle. Take the depth of this surface layer only.

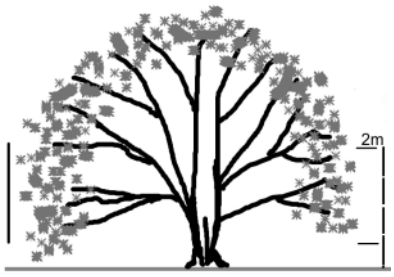




Other examples of how to measure canopy depths







4.4 Calculating BA from canopy cover and vertical fill

To get the BA of a vegetation component, the canopy cover, expressed as a proportion from 0 to 1, is multiplied by the proportion of vertical fill:

Proportion BA = Proportion Canopy Cover x Proportion Vertical Fill

Proportion BA x 100 = % BA

E.g. canopy cover x vertical fill = 0.1 x 0.25 = 0.025 (=2.5%)

IMPORTANT: Remember to get the decimal places in the right place when converting from %'s to proportions (or visa versa)

e.g. 0.5% = 0.005, 0.05 = 5%, 50% = 0.5

Practice converting back and forth between proportions and percentages (fill in the missing values):

PROPORTION	PERCENTAGE
0.75	
	62%
0.003	
	2.7%
0.135	
	0.46%
0.0029	
	8%
0.81	
	0.01%
0.09	

5. ASSESSING PLANT SPECIES CONTRIBUTION TO AVAILABLE BROWSE

(datasheet in appendix 2)

Once parameters of canopy cover and depth for have been estimated for a vegetation component in a plot (or site), one should proceed to assess the relative contributions of the different plant species making up that vegetation component to this available browse.

The desired outcome is an estimate of what proportion (or %) of the available browse biomass if the given component is made up by each species present.

Later, this data is combined with ratings of each species' value to potential black rhino diet on a scale of 1 to 3. This allows a more objective assessment of the overall suitability of the available browse for black rhino in each vegetation type. Browse suitability is also a determinant of black rhino carrying capacity.

The issues of facilitating the assessment of species contribution to available browse, and of determining objective ratings of species value to black rhino, are still under ongoing investigation. Improved information on the diet profiles and species preferences of black rhino population from a large range of habitats is still accumulating.

The basic field approach is similar in concept to the dry-weight-rank method of t'Mannetje and Haydock (1963), but adapted for browse, and adapted for easy rescaling of ratings to sum to 1 (i.e. to 100% of the browse component being assessed).

1. Make a list of each species in the vegetation component being assessed. Inconsequential plants (for black rhino) or a mixed bag of unknown small plants can be assigned to a species called "Other". Where necessary, hard-to separate species can be lumped to genus or family or type, such as Barlaria's, herbaceous legumes, Vigna's/Rhyncosia's; Amaranth's etc.

2. Decide which species contributes the most to browsable biomass in that vegetation component: give this a rating of either 10 or 100.

3. Decide on the next weightiest species, and estimate its rating relative to the top-rated) species. Eg. If the next species provides about ½ as much browse as the first species, give it a rating of 5 or 50.

4. Continue to rate each species relative to the already-rated species. Also give ratings for "Other" and any species groups listed. If needed, fractions (0.5; 0.25 etc) can be used to rate low-biomass species (as shown in example below).

    - ***The idea is that the ratings assigned to each species reflect the relative weight or biomass contribution of the species to the vegetation layer/component concerned.***

5. Later in the office, the rating data can be entered into a spreadsheet or database which calculates the actual proportion of each species in the given component, and the absolute browse availability (BA) of each species.

(in Field:) Species in Tall layer, plot 65)	Field Rating		(later) Rescaled to sum to 1		(Later: Tall layer Plot 65: BA = 0.163 or 16.3%) Individual Species BA :
Acacia tortilis	10		10/29.5 = 0.34		0.34 X 0.163 = 0.055 = 5.5% BA
Ozoroa engleri	7		7/29.5 = 0.24		0.24 x 0.163 = 0.039 = 3.9% BA
Acacia nilotica	4		0.14		0.022 = 2.2% BA
Combretum molle	2		0.07		0.011 = 1.1% BA
Croton dichogomas	3		0.1		0.017 = 1.7% BA
Maytenus senegalensis	2		0.07		0.011 = 1.1% BA
Ziziohus mucronata	1		0.03		0.006 = 0.6% BA
Other	0.5		0.02		0.0027 = 0.3% BA
(later) SUM:	29.5		1		SUM: 16.3%

6. ADDING BA'S OF VEGETATION COMPONENTS ASSESSED SEPARATELY

For example, add the BA scores for the woody and herb components, or any other subdivisions of vegetation in a plot.

BA(woody) + BA(herb) = Total BA

or

BA(component A) + BA(component B)…etc = Total BA

- If the components were assessed by dividing the plot area into sections, you need to calculate an *area-weighted sum* of the component BAs – i.e. weighted by the proportion of the plot they comprised.
  - o [proportion BA of component A) x proportion of .plot area of component A]
    + [proportion BA(component B) x proportion of plot area(component B)]+…etc = Total weighted prop. BA. (multiply by 100 to get % BA)

7. CALCULATING AN OVERALL BROWSE AVAILABILITY SCORE FOR A PROPERTY

The overall browse availability score for a vegetation type (or sub-type*) is the average of the BA scores given to plots assessed within that type.

The overall Browse Availability Score for the protected area is calculated as the sum each vegetation type's BA score (expressed as a proportion from 0-1) x by the proportional area of each vegetation type.

Example of calculating the total BA score for an area:

Vegetation Type	**%BA score**	**% of Reserve**	**BA as proportion**	**Area as proportion**	***BA x Area***
Riverine Woodland	25%	8%	0.25	0.08	0.02
Mixed sp. Grassland	3.5%	64%	0.035	0.64	0.022
Acacia mellifera Thicket	45%	28%	0.45	0.28	0.126
TOTAL RESERVE BA Score:					***0.17***

This 0.17 or 17% represents the average degree to which the 0-2m space across the entire reserve / property is filled with browse.

Estimates from some real examples in Kenya:

Masai Mara has an overall average BA in the range of 2 to 5%,
Solio and Nakuru average between 15-20% BA
Sweetwater and Ol Jogi have BA's of around 10%
Lewa and Nairobi (including their forest sections) average 12-13% BA
Ngulia Sanctuary has about 32% BA on average
The Salient (incl. lower bamboo zone) averages 42% BA

BA scores for vegetation components such as "Highly Suitable browse species", "Unpalatable browse species", "Woody browse", or "Herbs" can also be calculated for entire reserves. The average BA of each component in each vegetation type is calculated, and multiplied by the vegetation type's area as shown above. Such breakdowns of browse resources *give strong indications of the potential of different areas to carry black rhino*.

8. SURVEY DESIGNS

8.1 Time of year for field assessments

The visual browse availability assessment technique is reasonably robust in dealing with seasonal variations in standing available browse for the woody browse component. This is because the main structural parts of woody plants, which provide the skeletons for assessing browse volume, remain similar irrespective of the amount of leaf material present on them. A measurement variation of around 10 to 20cm on average per plant for each canopy spatial dimension will probably result from dry-season leaf drop.

The herb component however does exhibit large seasonal fluctuations in available volume. The assessment of herb BA will need to represent an average state between wet and dry season conditions.

For this reason if only one survey in a year can take place, and for practical reasons of minimising rain interference, early dry season (approximately April-**May-June)** is the best time to survey black rhino browse availability. Assessments at this time of year provide a reasonable average between wet season and dry season browse conditions.
If two surveys can be done, one should be done in the peak of the main rainy season (April/May in East Africa; Jan/Feb in Southern Africa), and one in the late dry period (August to October) after leaf drop but before the main leaf flush. Assessment in the full rainy period only is not advised, as it would be difficult to account for the decline in browse availability of the dry seasons.

8.2 Survey layout

Stratification

A stratified survey of an area is usually the only practical means of sampling all the vegetation available to rhino. Stratification is by vegetation type – i.e. species composition and density / size structure. *A vegetation map of the property to be assessed is essential*, because it is important to visit and assess all the main different kinds of vegetations available to rhino. Aerial photographs are also highly recommended to assist with stratification within broad vegetation types. If no vegetation map is available, the assessor needs to obtain a 1:50 000 topocadastral map or something similar, and needs to work closely with someone who knows the area well. With this person's help, before (and perhaps during) the survey, a rough vegetation map needs to be drawn up. Features such as different orders of drainage line, hill sides etc can easily be delineated to form the first "vegetation types".

For variance-reduction purposes, it is especially important to identify and estimate proportions of thickets or bush clumps within vegetation types – these will need to assessed as "vegetation strata" on their own. Such clumps are usually "outliers" in generally lower-density vegetation strata, and hugely inflate the variance and sample-size requirements for such strata. They are best dealt with separately. Similarly, in otherwise dense thicket vegetation types, open pan sites need to be treated separately. Vegetation types can be also be subdivided on the map if some parts are in very different size-structure states to other parts. If this is done, then such subdivisions get treated as separate vegetation "types". They will need to be rated for average BA score, and their proportional area must be calculated or estimated.

Example: you may estimate that bush clumps themselves make up 20% of the area within a vegetation type called "*Rhus / Carissa* Woodland", and this type comprises 46% of the entire property. Thus bush clumps make up 20% x 46% or 0.2 x 0.46 = 0.092, or 9.2% of the entire property, and the "*Rhus / Carissa* Woodland" without clumps makes up 46% - 9.2% = 36.8% of the property.

The degree to which one tries to stratify for thickets etc will have to be based on what can be practically recognised and surveyed in the field.

8.3 Conducting a proper scientific survey

Ideally (if time/ resources permit), a properly designed survey with stratified systematic or preferably random samples within each vegetation type should be conducted. By recording the GPS position and taking photographs from 2 different sides of each sample plot, *this survey can act as a valuable baseline of browse conditions in an area, against which subsequent browse availability changes can be monitored in a rhino area*. ***Date sheets*** *for browse availability surveying are provided in appendix 2.*

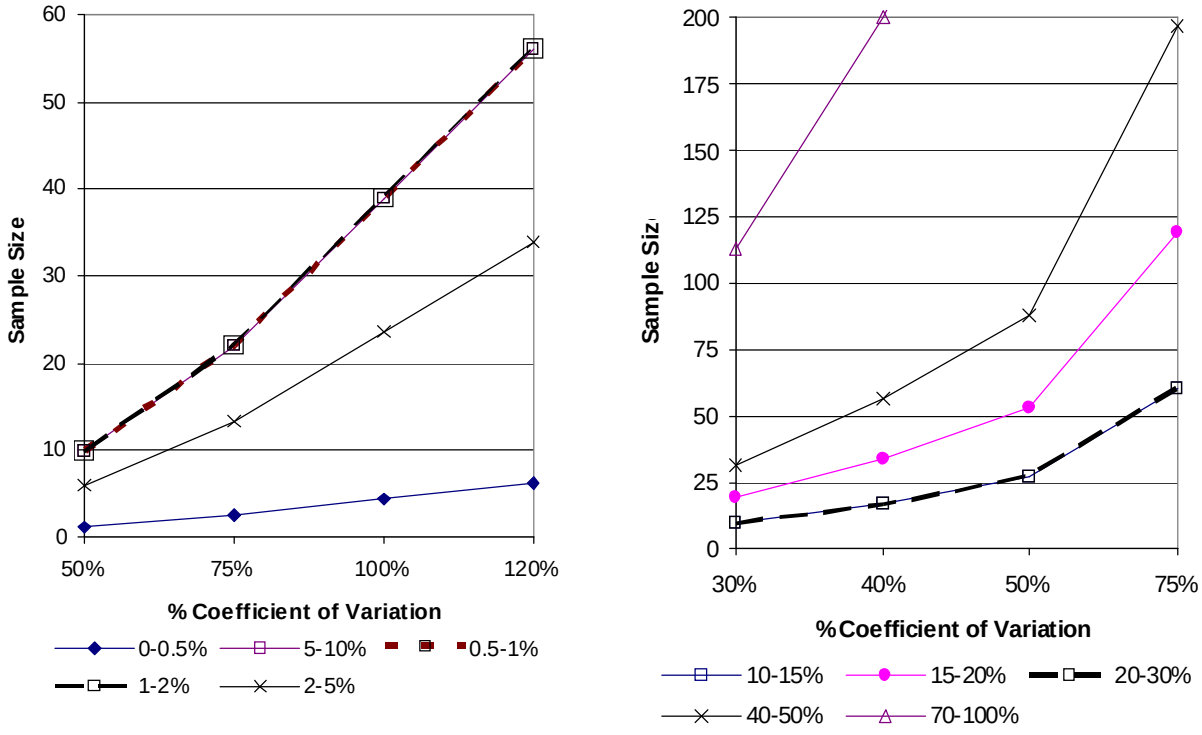
Sample size – number of plots

The number of plots to assess in each vegetation type depends on the degree of variation in browse availability within a type. More variable types need a greater number of samples. Very dense vegetation types tend to need more sampling than others, partly because the desired confidence intervals are closer to the score mid-class, as a % of that mid-class (i.e. you are attempting to be proportionately more accurate in thicker vegetation types). If you can perform a pilot survey to obtain estimates of vegetation type average BA scores and sample standard deviations, you can determine the sample % coefficients of variation (Std.Dev./Mean x 100), and then your sample size requirements for each vegetation type using the graphs below.

Some rules of thumb provided by previous surveys are given in the table below. For homogeneously very open vegetation (<1% BA), generally <20 samples may be needed. For most other types in the range 1 to 30% BA, around 25 samples are generally needed. For large areas of thicket (BA > 30% on average), 50 samples may be needed, but fewer will be needed for thicket patches and bush clumps which occur as a small% area within generally more open vegetation types.

Example % coefficients of variation obtained in 5 vegetation types.

	Open *Grassland*	Bushland	Riverine	Thornveld	Closed Thicket
Avg. BA Score, Mid-Class	0-0.5% 0.25%	5-10% 7.5%	20-25% 25%	5-10% 7.5%	40-50% 45%
%CV without thicket patches	110%	80%	48%	80%	Excl. open pan spots: 35%
Sample size needed	c.5	c.25	c.25	c.25	c.40



Choose the line with the roughly estimated average % BA of your vegetation type

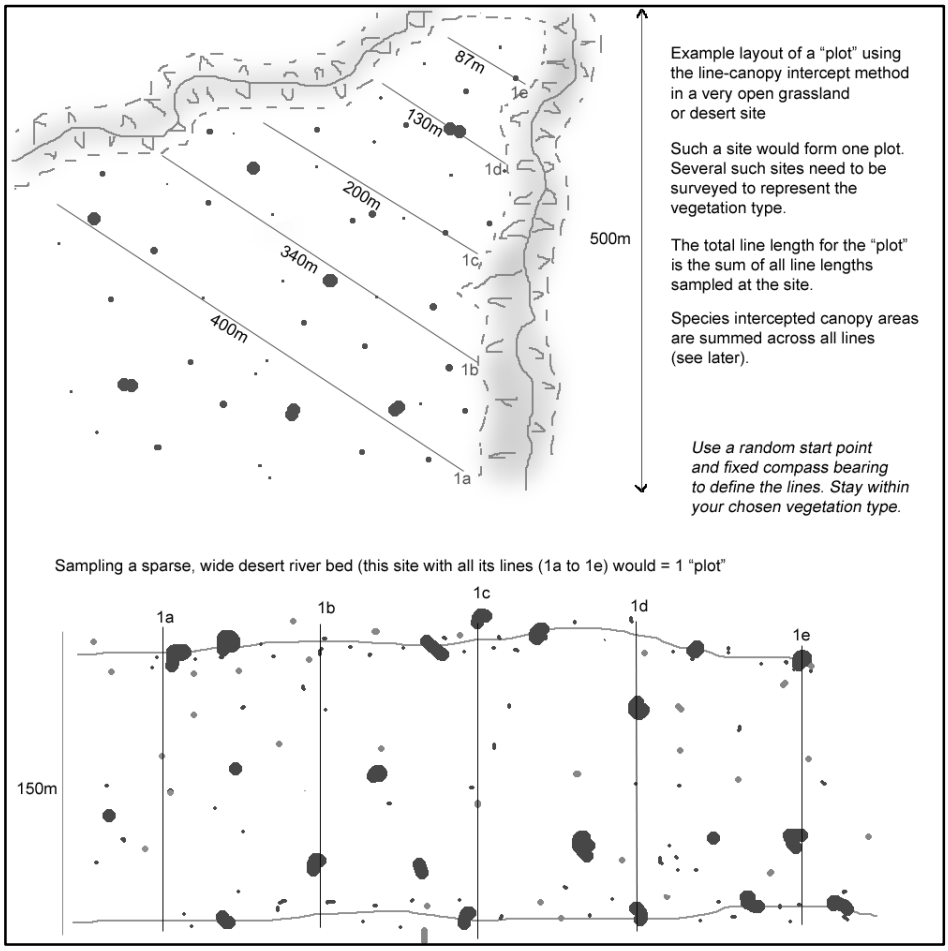
Figure 9: Sample sizes requirements for a range of average %BA's (see key) and % CV's (e.g. if you estimated CV is 100% and your estimates average BA score is 2-5%, you will need c. 24 sample plots in that vegetation type for proper statistical inference).

Deciding plot sizes and shapes:

- Square or circular plot can be used, but circular plots are preferable (circular plots of a given diameter ***d*** are equal to 78.5% of the area of a square plot with sides = length ***d).***
- Maintain the same plot size within the same vegetation type/stratum.
- The "pie" volume being assessed is the plot ground area x 2m height, e.g. for a 20m diameter circular plot, the volume is 314.16m^2 x 2m = 628.32m^3.

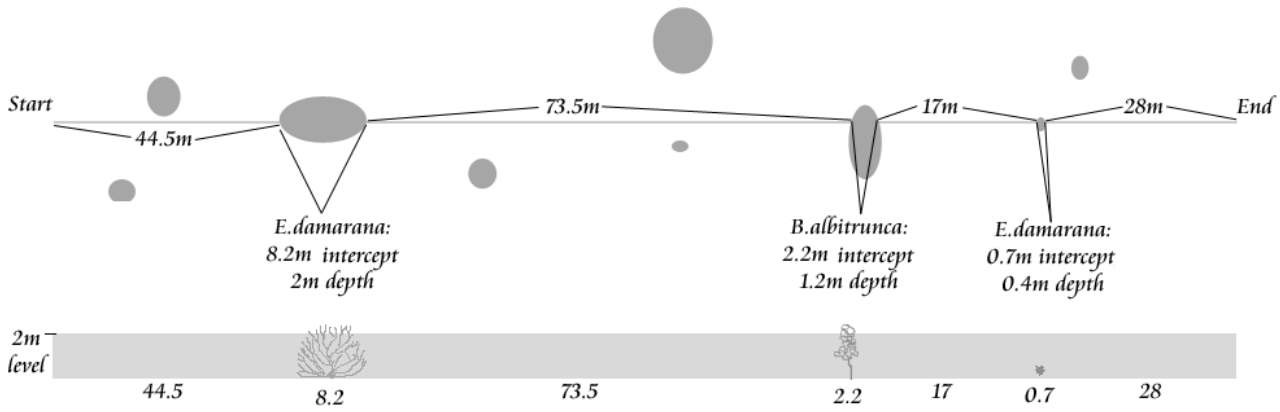
Square Plots (Ground area)	Type of Bush Density	Circular Plots (Ground area)
10x10 m = 100 m^2	✓thick bush, inside bush clumps, thickets	10 m diameter = 78.5 m^2
16x16 m = 256 m^2	✓moderately thick bush density	16m diameter = 201.1 m^2
20x20 m = 400 m^2	✓ moderate bush density	20 m diameter = 314.2 m^2
30x30 m = 900 m^2	✓ open bush density	30 m diameter = 706.9 m^2
40x40 m = 1600 m^2	✓very open desert, grasslands and very open bush	40 m diameter = 1256.6 m^2

8.4. Alternative method for very open areas and open deserts: Line/Canopy Intercept method:



In areas where the vegetation in really sparse, and where browse does not occur in overlapping layers (e.g. smaller bush or herbs under trees), the line/canopy intercept method is recommended**.**

Distance is measured along a straight bearing. When a plant is encountered on the line, the length of the actual <u>canopy intercepted by the line</u> is measured (i.e. canopy intercept length is any canopy element at <2m transected by the line along the bearing); plus the <u>average depth</u> of the intercepted part of the canopy.



Total line length =1 74.1m
Total canopy intercepted = 11.1m

Field data recording: (Calculate later)

Distance	Species	Intercept	Depth	Intercepted Canopy area
44m				
	E.damarana	8.2m	2m	8.2 x 2 = 16.4 m squared
73.5m				
	B.albitrunca	2.2m	1.2m	2.2 x 1.2 = 2.64 m squared
17m				
	E.damarana	0.7m	0.4m	0.7 x 0.4 = 0.28m squared
28m				

163m + 11.1m = 174.1m = total line length

174.1m (length) x 2m (height) = 348.2m squared = Total area sampled

Thus: Sum the intercepted canopy areas by species, and divide by the total line area sampled, to derive Browse Availability Scores for each species

BA for E.damarana = (16.4 + 0.28) / 348.2 = 0.0479 = 4.78%
BA for B.albitrunca = 2.64 / 348.2 = 0.0076 = 0.76%

8.5 Conducting a rapid survey

Where time and funds do not permit a proper scientific survey, a more rapid eye-balling approach will have to be adopted. During such a survey, the assessor must plan a walked+ driven route to visit as many patches or sections of each vegetation type as possible during the time available, using a vegetation map. It is important to get good evaluations of riverine or drainage line areas.

Instead of doing proper plots, treat each visited patch or section of a given vegetation type as a sample "site", and use datasheets in appendix 2C, and 2B (which rates proportional species composition of the available browse).

Estimate the average browse availability (as per this technique) more widely across a field of view within a given vegetation type at the site.

If you have difficulty assigning a single average %BA score, you can deal with vegetation variability or your uncertainty about the exact average %BA score, by assigning probabilities between 0 and 1 of different %BA classes being relevant to the site, and use the appendix 2. 2C datasheet (you can use appendix 2C and 2B datasheets for the same site – just number the sites correctly on each).

See the table and examples below for an explanation.

For example, in ***case A*** (see table below) when unsure of correct score: you may estimate that a site probably has an average score of 2-5% - you feel you are about 75% sure of this, however, you feel there is about a 25% chance that it is 1-2% on average.

- Enter 0.75 into the prop.? column in the 2-5% BA row
- Enter 0.25 into the prop.? column in the 1-2% BA row
- Multiply 0.75 by the mid-class proportion 0.035 for that BA class, place answer 0.2625 in the next column Wt'd Avg.
- Multiply 0.25 by the mid-class proportion 0.015 for that BA class, place answer 0.00375 in the next column Wt'd Avg.
- Sum these proportions in the bottom block: weighted average answer **0.03 or 3%.**

Site / Plot No.: **Vegetation Type:**		Case A Hilltop grassland		Case B Xerocline Slope	
BA Score	**Mid-class proportion**	**Prop? (Un certain)**	**Wt'd Avg. BA**	**Prop? (variable Veg)**	**Wt'd Avg. BA**
0-0.5%	x 0.0025				
0.5-1%	x 0.0075				
1-2%	x 0.015	0.25	0.00375		
2-5%	x 0.035	0.75	0.02625	0.25	0.00875
5-10%	x 0.075			0.3	0.0225
10-15%	x 0.125			0.3	0.0375
15-20%	x 0.175				
20-30%	x 0.25			0.15	0.0375
30-40%	x 0.35				
40-50%	x 0.45				
50-60%	x 0.55				
60-70%	x 0.65				
70-100%	x 0.85				
	Sum->		0.03 3%		0.106 10.6%

For example ***case B*** (see table above) when the vegetation site is fairly patchy and variable in amount of browse: you may proceed to estimate scores for separate subtypes and estimate what proportion each subtype comprises in that site: i.e. 25% of the site scores 2-5%, 30% scores 5-10%, 30% scores 10-15%, and about 15% scores 20-40%.

- Enter 0.25 into the prop.? column in the 2-5% BA row
- Enter 0.3 into the prop.? column in the 5-10% BA row
- Enter 0.3 into the prop.? column in the 10-15% BA row
- Enter 0.15 into the prop.? column in the 20-30% BA row
- Multiply each of your entered proportions by the corresponding mid-class proportion, placing the answer in the next column Wt'd Avg.
- Sum these proportions in the bottom block: answer **0.106 or weighted average 10.6%**

Calibrated browse availability photographs can be used to assist with rating – this will also speed up assessments. *Calibrated browse availability photographs from 6 southern African reserves are supplied on disk. A set showing comparable forms of vegetation to the area to be assessed, covering a range of browse availabilities, can be printed out in good quality colour, and laminated for use in the field.*

Important Note: Observers tend to overestimate browse availability using only photographs, *thus when allocating final %BA's for each vegetation type using photographs alone, use the lower boundary of the BA score class that the relevant photo fell into.* For example, if you estimated that vegetation type A matched photos showing 28% browse- i.e. from the BA score class 20-30% browse, use 20% as you final allocation, not the BA score mid class of 25%.

Using your final recorded scores for each site visited within a vegetation type, try to gain an integrated impression of the average BA of each vegetation type as the survey progresses. In the end, enough of the diversity of states or conditions within each vegetation type must be visited and evaluated to give a valid overall average browse availability score for each type. You can use your site assessments within sections of a vegetation type to get an average estimate for the entire vegetation type.

To calculate the overall park browse availability, see section C6, but use your actual final scores for each vegetation type – *do not now use the relevant %BA score mid-classes*.

While this is not a rigorous scientific approach, it can still provide ballpark BA estimates to assist carrying capacity estimation. It is valuable to conduct the survey with someone who knows the area well. This allows such a person to bring their knowledge of the overall vegetation conditions to bear when deciding jointly on average BA scores for vegetation types.

9: BACKGROUND AND JUSTIFICATION FOR THE BLACKRHINO BROWSE AVAILABILITY SCORE METHOD

The need for an easily implemented, standardised black rhino-specific browse availability assessment procedure arises from the black rhino conservation plans of several African countries. These specify the need to create new rhino populations in new habitats with acceptable carrying capacities for this species. The plans also require that existing rhino areas are managed for maximum productivity, by maintaining rhino densities below the maximum level supported by the vegetation resources.

Assessments of available rhino browse are integral to carrying capacity assessments that assist in deciding potential rhino densities and rhino introduction numbers for new areas. They can also aid in the describing or ongoing monitoring of habitat conditions in existing rhino areas, under conditions of changing climate, vegetation and competing browser densities. Standardising browse availability assessment across all southern African black rhino areas also assists in developing our understanding of contrasting black rhino habitat conditions and related population performances across the sub-continent.

The need for a quick, but acceptably accurate method to estimate the amounts of available forage (e.g. browse) across large areas of land and in different habitats, is widely recognised in the endeavour of assessing animal carrying capacities. Direct methods involving destructive sampling and weighing of browsable plant parts are expensive and impossible to use routinely in most situations. Indeed, Blair (1958) stated that browse biomass is recognised as one of the most difficult of all vegetation components to measure.

Allometric regression methods: **evidence for the strong relationships between browse availability and plant dimensions**

Efficient ways of estimating available browse and other attributes such as plant biomass, leaf area and fuel wood, have been extensively investigated (e.g. Netshiluvi and Scholes 2000). These approaches involve determining the mathematical (allometric or morphometric) relationship between more easily measured aspects of plant size and the target attribute. The basis for this is the necessary physical relationships between a plant's size and its aboveground biomass; and between the leaf or shoot mass or leaf area that can be supported and the cross-sectional area the stem which supplies them with water.

Regression equations for predicting woody plant biomass from plant height and/or basal stem circumference for 23 different southern African trees showed highly significant r-squared's of near or > 0.95 (Netshiluvi and Scholes 2000). Equations for predicting leaf or shoot mass (browsable material) from plant height and/or basal diameter or circumference for 23 different southern African trees or tree classes* also showed highly significant r-squared's of much greater than or >= 0.85 (Netshiluvi and Scholes 2000). Allometric regressions of canopy diameter on seasonal production of leaves and twigs by Kelly and Walker (1976) also showed highly significant r-squared's in 8 lowveld species in Zimbabwe.

*e.g. combined *Acacias,* broadleaves, *Brachystegia* species, mixed-species scrublands and woodlands in Botswana.

Although the above highly significant regressions bring validity to indirect measures as a surrogate or index of available browse, in many field situations, plant height, canopy structures and available browse may be altered by continuous browse pressure (e.g. impala browsing in riverine areas of Kruger National Park, Dayton 1978), animal damage, or fire. This means that browse canopies do not always closely conform to the general patterns for a given species. Also, parts of a canopy may be out of reach of certain browsers. Use of simple canopy area, basal stem measurements and even plant height cannot provide realistic reflections of this diversity in browsable plant canopy.

Methods focussing in greater detail on the plant canopies within browsable height are more appropriate. Such methods aim at closely measuring plant canopy shape, for example in the BECVOL method of Smit (1996). Smit (1989), demonstrated highly significant correlations between the volumes of the canopy sections being measured and the leaf mass contained within the volumes, corrected for apparent leaf density visually assigned on a scale of 1 (sparse) to 3 (dense) (e.g. r^2s from linear regression of 0.93 to 0.98 were found for the microphyllous *A.karroo*, and *D.cinerea* and the non-microphyllous *Grewia flava.* R^2's of 0.88, still highly significant, were obtained without the visual correction for apparent leaf density).

Others have also shown highly significant log-log or quadratic relationships between more crudely measured available canopy volumes and browse forage production for a range of shrub species. (e.g. Bryant and

Kothmann (1979), Hughes et. al. (1987). These authors' and Smit's regressions were species specific, nevertheless, common multi-species equations also show that significant relationships exist.

A problem with these methods is that they still require detailed and time-consuming measurement of individual plant canopy dimensions. This leads to problems in the ability to sample many vegetation sites, as too much time is spent in relatively few sites. Given the naturally great variability in vegetation physiognomy within any single protected area, sampling available browse via relatively fewer accurately measured plots is inferior to assessing many sites at an acceptably lower precision (e.g. as highlighted by Haydock and Shaw, 1975).

Visual estimation methods

In seeking a viable approach allowing for more rapid, widespread sampling, visual assessment techniques have been proposed. In grasslands, herbage availability (yield) can efficiently be estimated in random sites (quadrats) by visually rating these sites with respect to a set of reference sites, which provide a scale over a range of availabilities (yields) Haydock and Shaw, 1975.

In a study of the browser carrying capacity of eastern Cape succulent valley bushveld, Stuart-Hill (1991), Stuart-Hill and Aucamp (1993) developed a visual browse vegetation "condition" index using reference "visual calibration" sites, which represented to a large extent the range in available browse from very dense thicket to sparse woody vegetation. This index however also accounted for differences in dominant plant species palatabilities, so that the condition index required the simultaneous assessment of two parameters, availability and suitability. Their experimental trials with goat browsers demonstrated the positive (but possibly curvilinear) relationship between the condition index and browse capacity, with a c.27-fold increase in carrying capacity from the least to the most dense vegetation conditions.

Given the evidence above for strong relationships between various plant canopy dimensions (volumes) and leaf/shoot material available to browsers, a visual approach that focuses on plant canopy attributes seems highly appropriate in browse availability assessment for black rhino.

DEVELOPMENT OF THE BLACK RHINO BROWSE AVAILABILITY SCORE METHOD

Browse availability had previously been separated from browse palatability or suitability as a separate variable with its own strong influence on black rhino carrying capacity. For example in the RMG Black Rhino Carrying Capacity Model Version 1 (Adcock 2001), highly significant correlations were found between expert estimates of rhino carrying capacity and the square root of the first visually-based browse availability index developed for the model. Similarly, strong correlations were found between the index and the log of average male home range size across 15 rhino areas (correlation coefficients were 0.77 and -0.81 respectively). Assessing a single parameter at a time in a visual assessment also improves the repeatability of the technique over multi-parameter visual estimation.

Defining available rhino browse: black rhino feeding heights

Possibly 98% of black rhino food comes from the 0-2m height range, and in general browse material above this level is unavailable to black rhino. Several studies have shown how most black rhino feeding is done in the 0-2m height range, and how lower feeding heights are preferred.

Percentage of black rhino feeding that occurred at different height levels in the available vegetation:

Study:		**<50cm**	**50cm-1m**	**1-2m**	**cumulative <=2m**	**>2m**
Breebart (2000)	Weenen	c.38%	c.47%	c. 14.4	99.4%	0.6%
Rossouw (1998)	E.Shores	35.59%	54.45%	8.79%	98.82%	1.17%
(Joubert and Eloff 1971)	Etosha West	Optimum feeding ht. 60-120cm; with a c. 152cm (5ft) browse line (i.e. most feeding offtake was below this height level.)				

Emslie and Adcock (1993) also documented the significant decline in preference of black rhino feeding with plant height in Umfolozi. Plants of 0-1m were most preferred and taller height classes were rejected.

Black rhino can use browse from above 2m, when they can bend or push down tall plant specimens, bringing them into the <2m browse layer. This behaviour tends to be generally confined to certain preferred plant species or spindly growth forms, and does not contribute a significant proportion of total rhino food intake. Young rhino are also not readily able to access browse over 2m.

Measuring available browse volumes in defined areas, and developing calibrated browse availability photographs as an aid to visual assessment

To develop a set of *calibrated browse availability photographs* to assist visual BA assessment, canopy volumes of all plants within circular plots of known area were determined for 14 to 16 sites in 7 rhino areas covering a sub-continental range of vegetation structures and plant growth forms. There were:

Pilanesberg National Park (April 03)
Mkhuze Game Reserve (May 03)
Great Fish River Reserve (February 03)
Vaalbos National Park (July 03)
Waterberg Plateau Park (June 03)
Western Kunene (June 03)
Weenen Nature Reserve (May 04)

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Mike Hearn
Caiphus Khumalo

The sites in Weenen Game Reserve were also used for an inter-observer variability test of visual browse availability assessment. Results are given in *"Report on the field testing of inter-observer variability in the application of the standardised browse availability assessment method used in black rhino carrying capacity evaluation"* (Adcock, July 2004).

Plot measurements for BA assessment or photo calibration:

Canopy volumes were approximated by measuring to the nearest 10 cm the following on each woody plant:

1. lowest browsable canopy level (or average lowest level for tilted plant canopies).

2. Canopy height - up to 2m in the case of an unbendable tree, or up to 4m in the case of species / growth forms frequently broken down by black rhino.

3. Average horizontal diameter of canopy – being the mean of the average long-axis horizontal diameter and average horizontal short-axis diameter on the canopy section within reach of a black rhino. The aim here was to try to describe average canopy dimensions – i.e. not to measure the largest possible cylinder but best-fit cylinder around the canopy.

Distinct parcels of a plant's canopy could also be measured as units in their own right in the same way, e.g. where two separate sections of canopy from a tall tree protrude down below the 2m level, or where canopy sections fall in the plot from trees rooted outside the plot.

The following were calculated from these measurements:

1. Canopy area= (average canopy diameter/2) squared x Pi

2. Canopy depth = upper canopy height or canopy height to 2m - lowest browsable canopy level

3. Canopy volume is calculated as canopy area x canopy depth = volume of a cylinder.

Volumes of all plant canopy material within the plot were summed and expressed as a % of the plot volume (2m x plot area).

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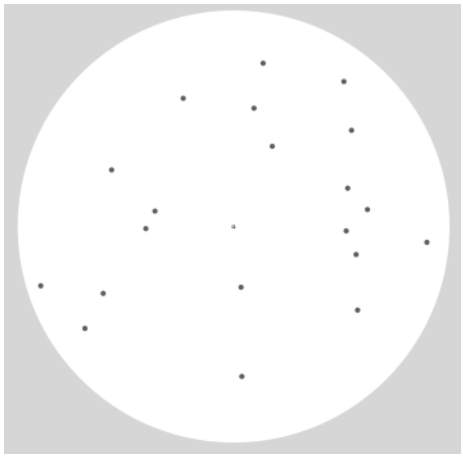

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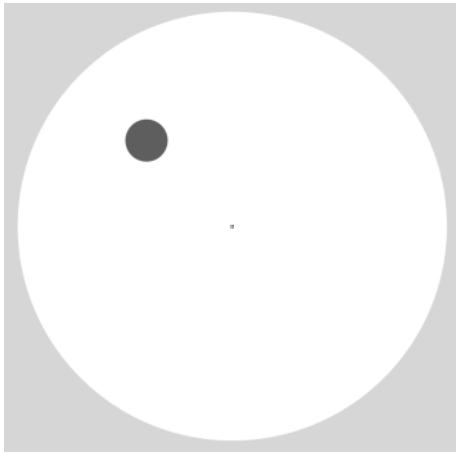
Reference length – each size is 1m in length,

Plot is 20m diameter



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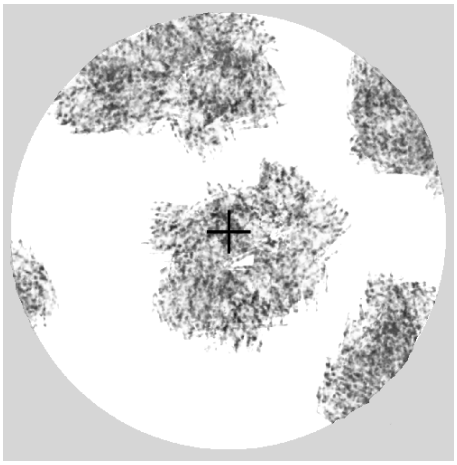

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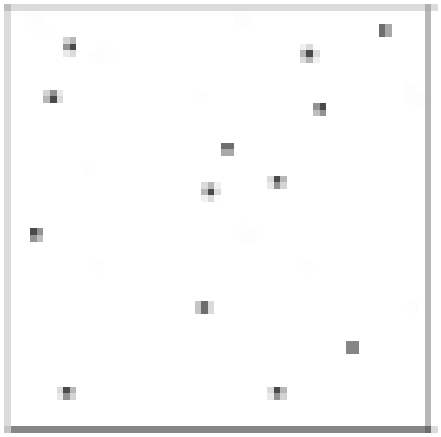
(cross is 2m from arm tip to arm tip)



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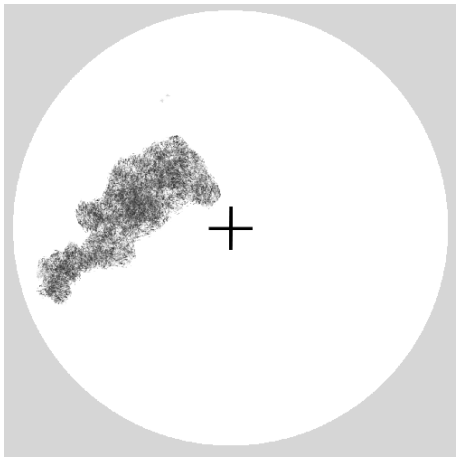

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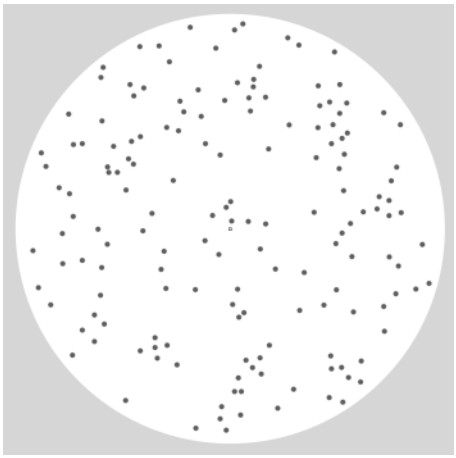

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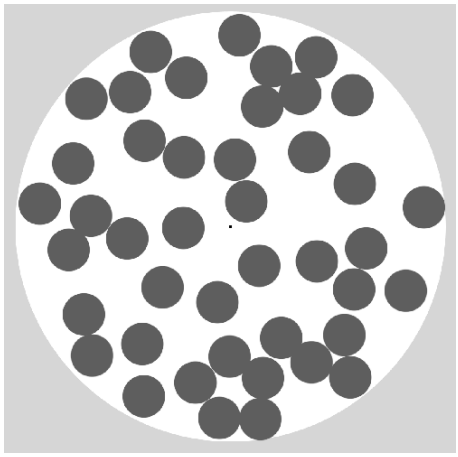

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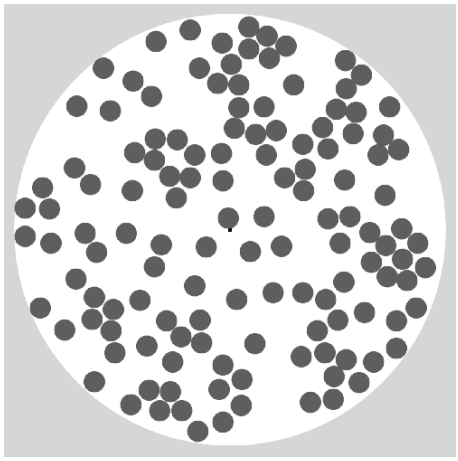

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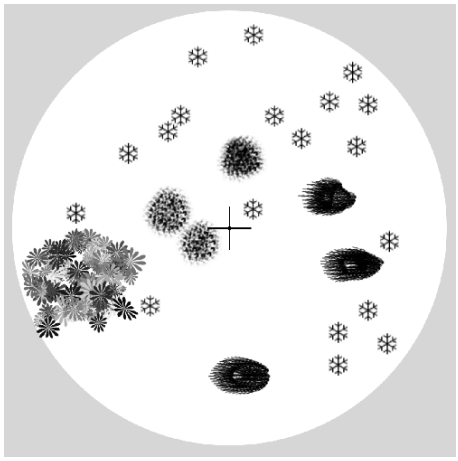

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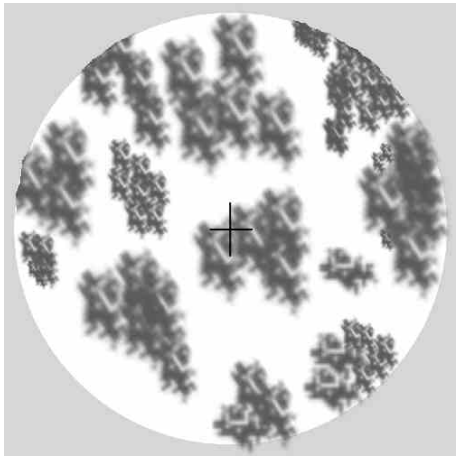

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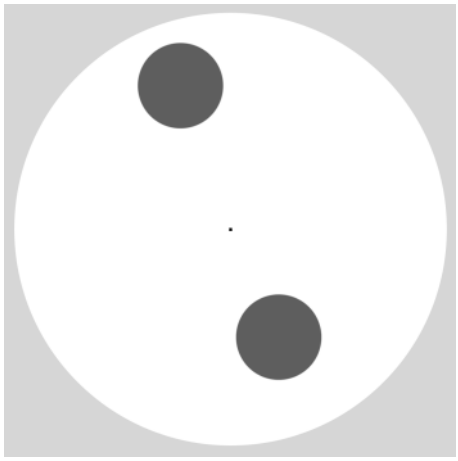

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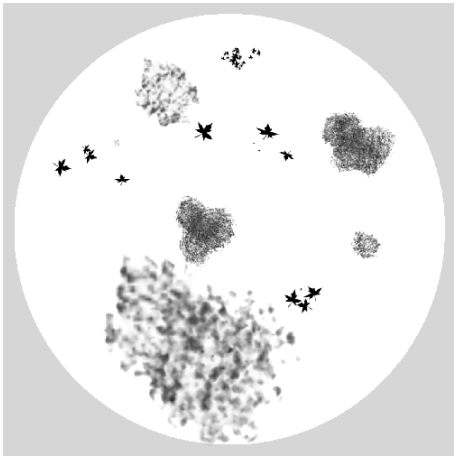

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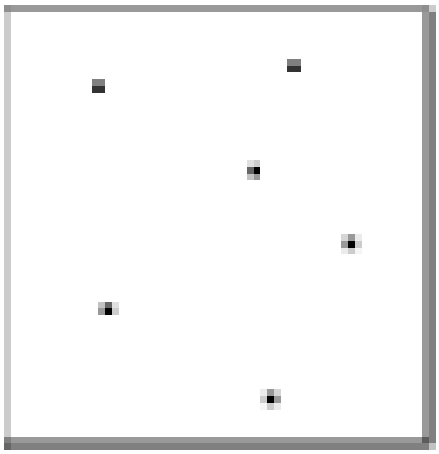

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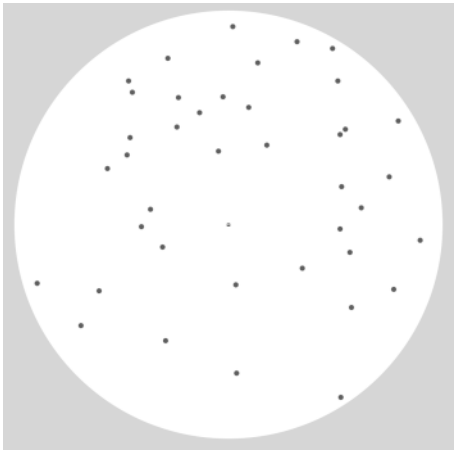

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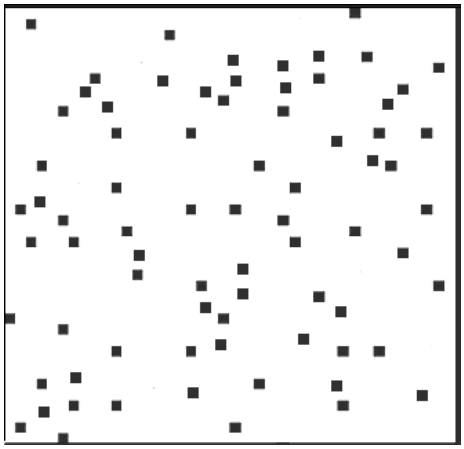

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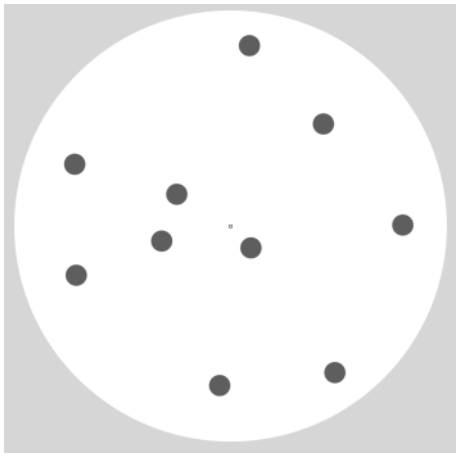

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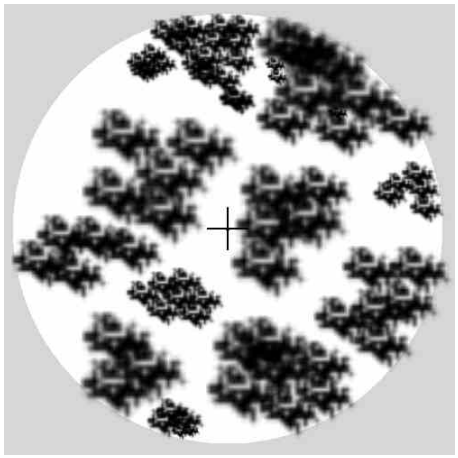

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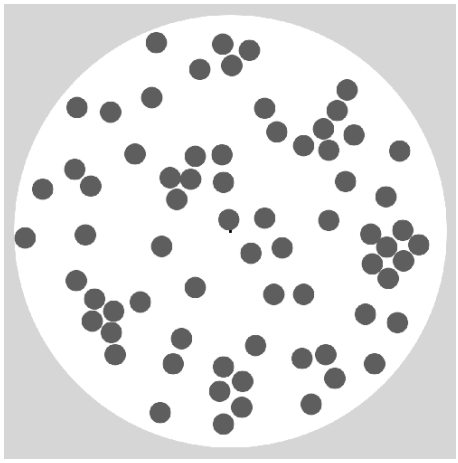

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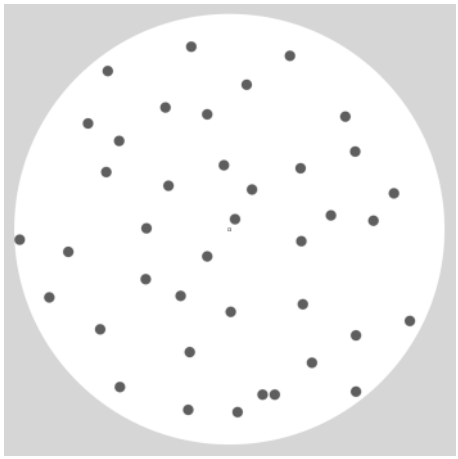

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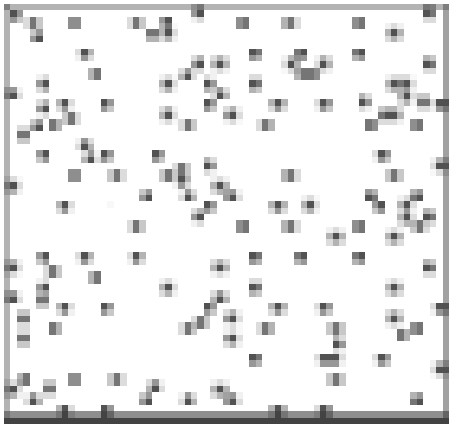

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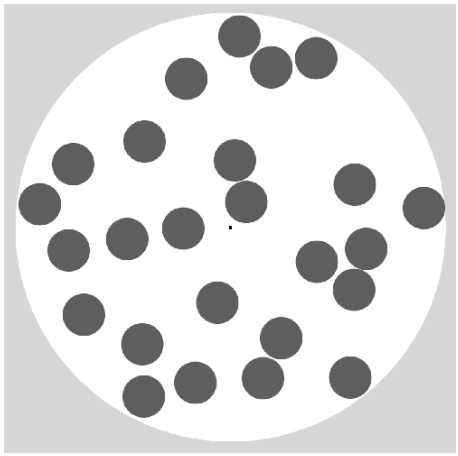

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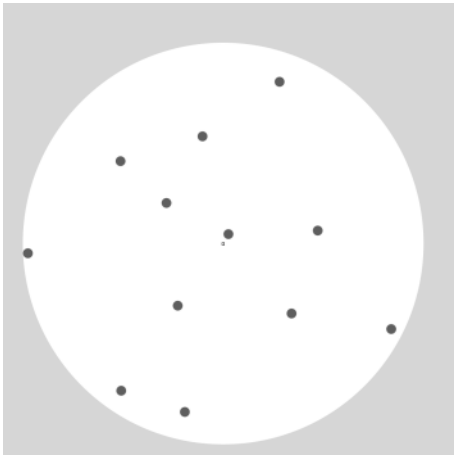

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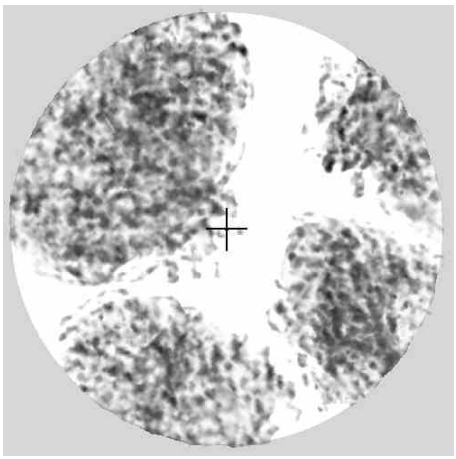

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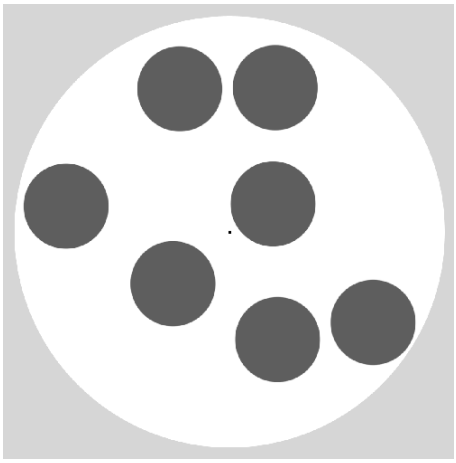

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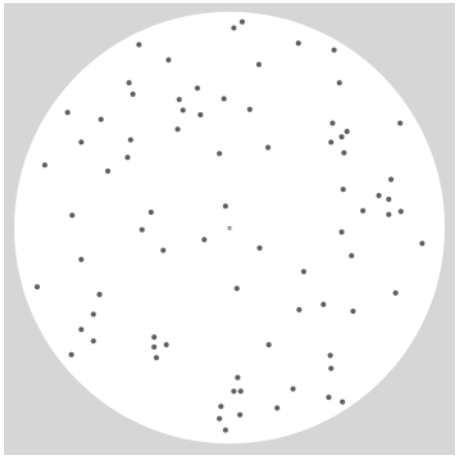

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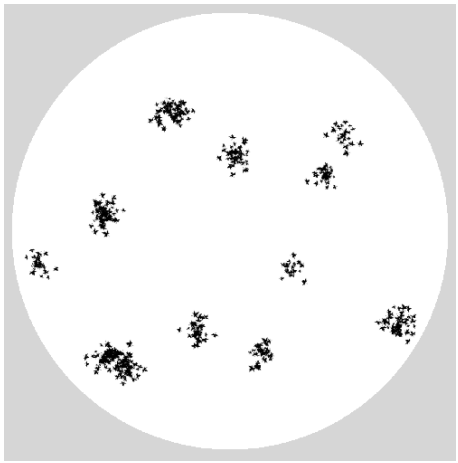
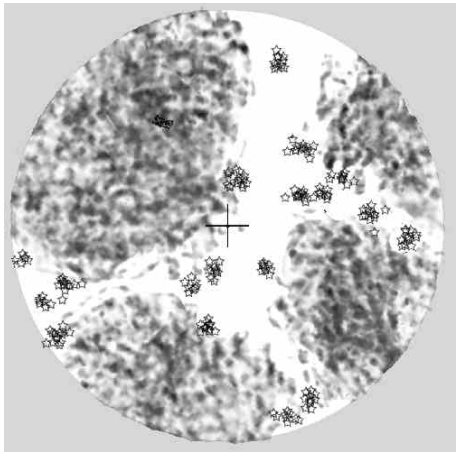
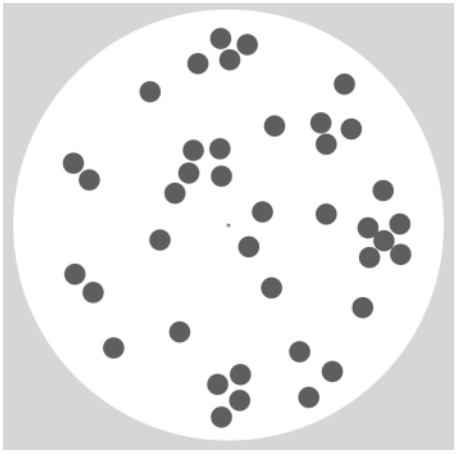


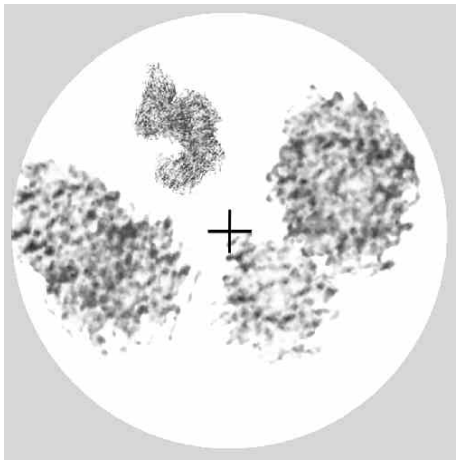
26



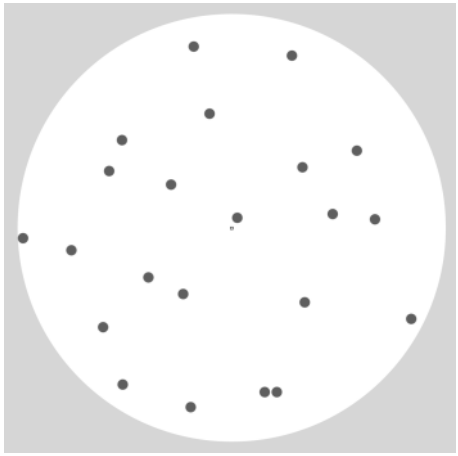
237



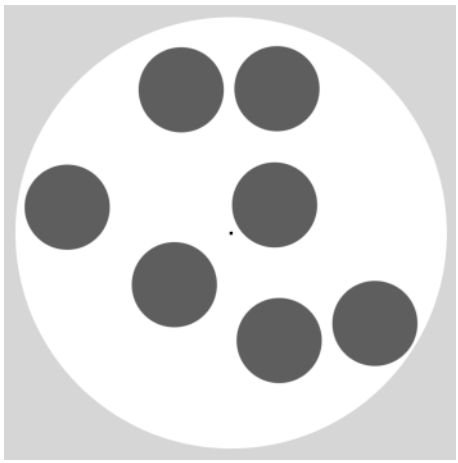
28



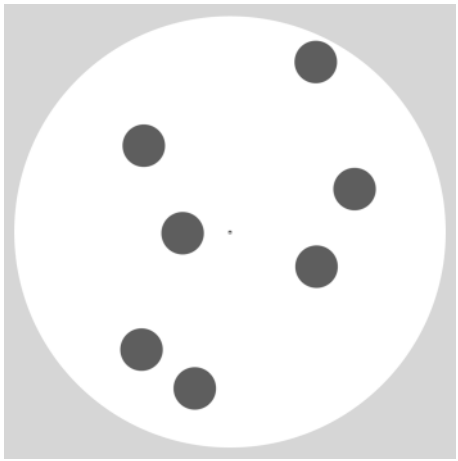
29



30



31



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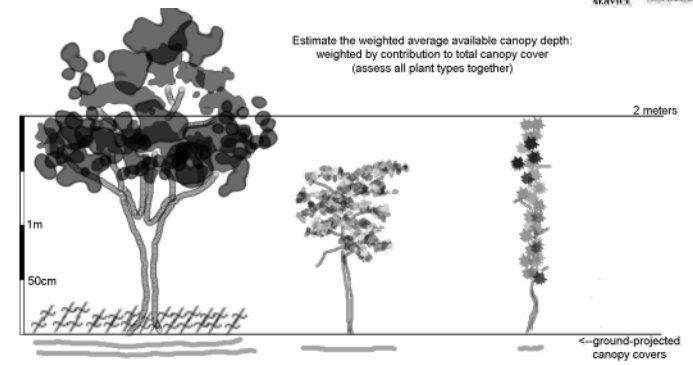
END OF CANOPY COVER PRACTICE PICTURES

PRACTICE PICTURES FOR ESTIMATING AVERAGE VERTICAL HEIGHT ARE BELOW…..

EXAMPLE 1

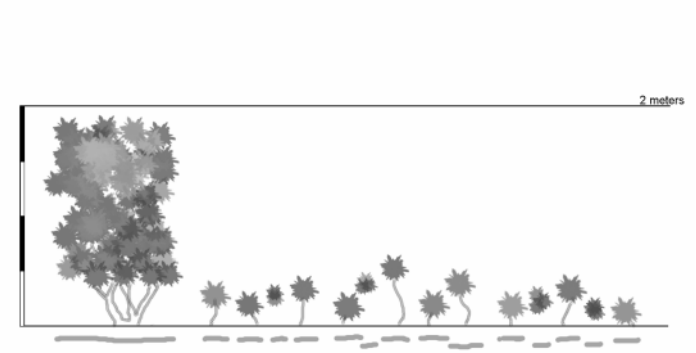


WEIGHTED AVERAGE CANOPY DEPTH CALCULATOR

CANOPY DEPTH (meters)	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
2											
1.9											
1.8											
1.7											
1.6											
1.5											
1.4											
1.3											
1.2											
1.1											
1											
0.9											
0.8											
0.7											
0.6											
0.5											
0.4											
0.3											
0.2											
0.1											
0											(Total filled segments)
	% OF TOTAL CANOPY COVER										100 (divide filled by 100)
											=Avg. depth in meters

Avg. Canopy Depth:

EXAMPLE 2

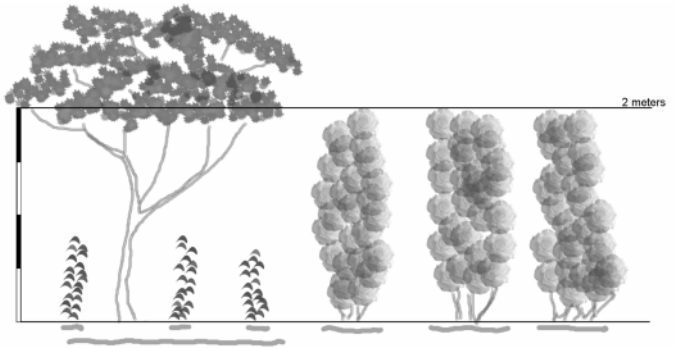


WEIGHTED AVERAGE CANOPY DEPTH CALCULATOR

CANOPY DEPTH (meters)	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
2											
1.9											
1.8											
1.7											
1.6											
1.5											
1.4											
1.3											
1.2											
1.1											
1											
0.9											
0.8											
0.7											
0.6											
0.5											
0.4											
0.3											
0.2											
0.1											
0											(Total filled segments)
	% OF TOTAL CANOPY COVER										***100*** (divide filled by 100)
											=Avg. depth in meters

Avg. Canopy Depth:

EXAMPLE 3



WEIGHTED AVERAGE CANOPY DEPTH CALCULATOR

CANOPY DEPTH (meters)	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
2											
1.9											
1.8											
1.7											
1.6											
1.5											
1.4											
1.3											
1.2											
1.1											
1											
0.9											
0.8											
0.7											
0.6											
0.5											
0.4											
0.3											
0.2											
0.1											
0											(Total filled segments)
	% OF TOTAL CANOPY COVER										100 (divide filled by 100)
											=Avg. depth in meters

Avg. Canopy Depth:

EXAMPLE 4

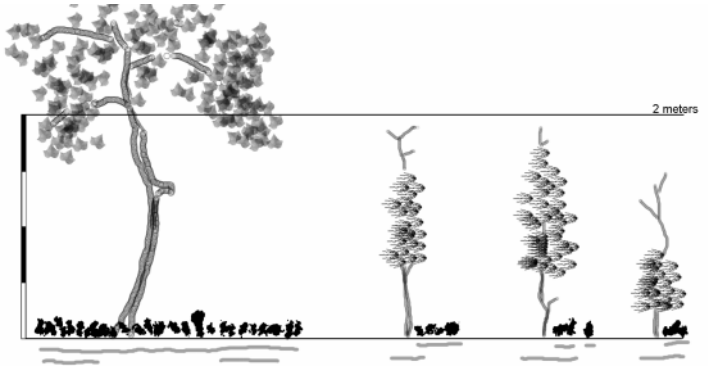
WEIGHTED AVERAGE CANOPY DEPTH CALCULATOR

CANOPY DEPTH (meters)

	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
2											
1.9											
1.8											
1.7											
1.6											
1.5											
1.4											
1.3											
1.2											
1.1											
1											
0.9											
0.8											
0.7											
0.6											
0.5											
0.4											
0.3											
0.2											
0.1											
0											(Total filled segments)
	% OF TOTAL CANOPY COVER										100 (divide filled by 100)
											=Avg. depth in meters

Avg. Canopy Depth:

EXAMPLE 5



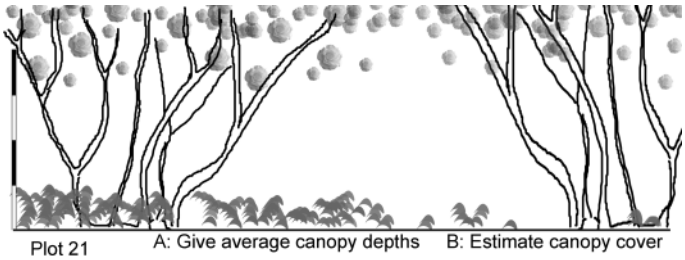
WEIGHTED AVERAGE CANOPY DEPTH CALCULATOR

CANOPY DEPTH (meters)

2											
1.9											
1.8											
1.7											
1.6											
1.5											
1.4											
1.3											
1.2											
1.1											
1											
0.9											
0.8											
0.7											
0.6											
0.5											
0.4											
0.3											
0.2											
0.1											
0	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	(Total filled segments)
	% OF TOTAL CANOPY COVER										100 (divide filled by 100)
										Avg. Canopy Depth:	=Avg. depth in meters

WORKING WITH TYPES/LAYERS: Give canopy depths and Canopy cover for each element (layer / species), and estimate overall BA

Plot 20



Plot 21 A: Give average canopy depths B: Estimate canopy cover

Plot 22 Average canopy depth

Overall BA = (Depth in m/2 *cover as a proportion) per layer or type

Plot 20

Layer/type 1: (name)
Avg. Canopy Depth:
Avg. Canopy Cover: Overall BA 1

Layer/type 2: (name)
Avg. Canopy Depth:
Avg. Canopy Cover: Overall BA 2

Layer/type 3: (name)
Avg. Canopy Depth:
Avg. Canopy Cover: Overall BA 3

Final Sum BA:

Plot 21

Layer/type 1: (name)
Avg. Canopy Depth:
Avg. Canopy Cover: Overall BA 1

Layer/type 2: (name)
Avg. Canopy Depth:
Avg. Canopy Cover: Overall BA 2

Layer/type 3: (name)
Avg. Canopy Depth:
Avg. Canopy Cover: Overall BA 3

Final Sum BA:

Plot 23

Layer/type 1: (name)
Avg. Canopy Depth:
Avg. Canopy Cover: Overall BA 1

Layer/type 2: (name)
Avg. Canopy Depth:
Avg. Canopy Cover: Overall BA 2

Layer/type 3: (name)
Avg. Canopy Depth:
Avg. Canopy Cover: Overall BA 3

Final Sum BA:

Appendix 1. For 10m plot: Proportional canopy cover (table body) of a given number of plants (read from top of table) of a given average canopy diameter / dimension (read from left column). E.g. 3 plants of 0.8m diam. have prop. canopy cover 0.019 (1.9%).

Area of a circle 10m Diameter=						*78.54*	*m2*	*Square 10x10=*	*100*	*m2*
Circular Plot of 10m Diameter (5m radius), or Square plot of 10 x 10m										
Plant Avg. Diam.or Side Length	**Number of plants**									
(meters)	**1**	**2**	**3**	**5**	**10**	**15**	**20**	**50**	**75**	**100**	**300**
0.1	0.0001	0.0002	0.0003	0.0005	0.0010	0.0015	0.0020	0.0050	0.0075	0.010	0.030
0.2	0.0004	0.0008	0.0012	0.0020	0.0040	0.0060	0.0080	0.020	0.030	0.040	0.120
0.3	0.0009	0.0018	0.0027	0.0045	0.0090	0.014	0.018	0.045	0.068	0.090	0.270
0.4	0.0016	0.0032	0.0048	0.0080	0.0160	0.024	0.032	0.080	0.120	0.160	0.480
0.5	0.0025	0.0050	0.0075	0.0125	0.0250	0.038	0.050	0.125	0.188	0.250	0.750
0.6	0.0036	0.0072	0.0108	0.0180	0.0360	0.054	0.072	0.180	0.270	0.360	1.080
0.7	0.005	0.010	0.015	0.025	0.049	0.074	0.098	0.245	0.368	0.490	
0.8	0.006	0.013	0.019	0.032	0.064	0.096	0.128	0.320	0.480	0.640	
0.9	0.008	0.016	0.024	0.041	0.081	0.122	0.162	0.405	0.608	0.810	
1	0.010	0.020	0.030	0.050	0.100	0.150	0.200	0.500	0.750	1.000	
1.1	0.012	0.024	0.036	0.061	0.121	0.182	0.242	0.605	0.908		
1.2	0.014	0.029	0.043	0.072	0.144	0.216	0.288	0.720	1.080		
1.3	0.017	0.034	0.051	0.085	0.169	0.254	0.338	0.845			
1.4	0.020	0.039	0.059	0.098	0.196	0.294	0.392	0.980			
1.5	0.023	0.045	0.068	0.113	0.225	0.338	0.450	1.125			
1.6	0.026	0.051	0.077	0.128	0.256	0.384	0.512				
1.7	0.029	0.058	0.087	0.145	0.289	0.434	0.578				
1.8	0.032	0.065	0.097	0.162	0.324	0.486	0.648				
1.9	0.036	0.072	0.108	0.181	0.361	0.542	0.722				
2	0.040	0.080	0.120	0.200	0.400	0.600	0.800				
2.1	0.044	0.088	0.132	0.221	0.441	0.662	0.882				
2.2	0.048	0.097	0.145	0.242	0.484	0.726	0.968				
2.3	0.053	0.106	0.159	0.265	0.529	0.794	1.058				
2.4	0.058	0.115	0.173	0.288	0.576	0.864					
2.5	0.063	0.125	0.188	0.313	0.625	0.938					
2.6	0.068	0.135	0.203	0.338	0.676	1.014					
2.7	0.073	0.146	0.219	0.365	0.729						
2.8	0.078	0.157	0.235	0.392	0.784						
2.9	0.084	0.168	0.252	0.421	0.841						
3	0.090	0.180	0.270	0.450	0.900						
3.1	0.096	0.192	0.288	0.481	0.961						
3.2	0.102	0.205	0.307	0.512	1.024						
3.3	0.109	0.218	0.327	0.545							
3.4	0.116	0.231	0.347	0.578							
3.5	0.123	0.245	0.368	0.613							
3.6	0.130	0.259	0.389	0.648							
3.7	0.137	0.274	0.411	0.685							
3.8	0.144	0.289	0.433	0.722							
3.9	0.152	0.304	0.456	0.761							
4	0.160	0.320	0.480	0.800							
4.1	0.168	0.336	0.504	0.841							
4.2	0.176	0.353	0.529	0.882							
4.3	0.185	0.370	0.555	0.925							
4.4	0.194	0.387	0.581	0.968							
4.5	0.203	0.405	0.608	1.013							
4.6	0.212	0.423	0.635								
4.7	0.221	0.442	0.663								
4.8	0.230	0.461	0.691								
4.9	0.240	0.480	0.720								
5	0.250	0.500	0.750								
5.2	0.270	0.541	0.811								
5.4	0.292	0.583	0.875								
5.6	0.314	0.627	0.941								
5.8	0.336	0.673	1.009								
6	0.360	0.720									

Cont.....

Circular Plot of 10m Diameter (5m radius), or Square plot of 10 x 10m

Plant Avg. Diam. or Side Length (meters)	Number of plants										
	1	2	3	5	10	15	20	50	75	100	300
6	0.360	0.720	1.080								
6.2	0.384	0.769									
6.4	0.410	0.819									
6.6	0.436	0.871									
6.8	0.462	0.925									
7	0.490	0.980									
7.2	0.518	1.037									
7.4	0.548										
7.6	0.578										
7.8	0.608										
8	0.640										
8.2	0.672										
8.4	0.706										
8.6	0.740										
8.8	0.774										
9	0.810										
9.2	0.846										
9.4	0.884										
9.6	0.922										
9.8	0.960										
10	1.000										

Appendix 1: Proportional canopy covers for plants in a 16m plot.

	Area of a circle 16m Diameter =				*201.1*	*m2*	*Square 16x16=*		*256*		*m2*
Circular Plot of 16m Diameter (8m radius), or Square plot of 16 x 16m											
Plant Avg. Diam.or Side Length	**Number of plants**										
(meters)	**1**	**2**	**3**	**5**	**10**	**15**	**20**	**50**	**75**	**100**	**300**
0.1	0.0000	0.0001	0.0001	0.0002	0.0004	0.0006	0.0008	0.0020	0.0029	0.0039	0.0117
0.2	0.0002	0.0003	0.0005	0.0008	0.0016	0.0023	0.0031	0.0078	0.0117	0.0156	0.0469
0.3	0.0004	0.0007	0.0011	0.0018	0.0035	0.0053	0.0070	0.0176	0.0264	0.0352	0.1055
0.4	0.0006	0.0013	0.0019	0.0031	0.0063	0.0094	0.0125	0.0313	0.047	0.063	0.188
0.5	0.0010	0.0020	0.0029	0.0049	0.0098	0.0146	0.0195	0.0488	0.073	0.098	0.293
0.6	0.0014	0.0028	0.0042	0.0070	0.0141	0.0211	0.0281	0.0703	0.105	0.141	0.422
0.7	0.0019	0.0038	0.0057	0.0096	0.0191	0.0287	0.0383	0.0957	0.144	0.191	0.574
0.8	0.0025	0.0050	0.008	0.013	0.025	0.038	0.050	0.125	0.188	0.250	0.750
0.9	0.0032	0.0063	0.009	0.016	0.032	0.047	0.063	0.158	0.237	0.316	0.949
1	0.0039	0.0078	0.012	0.020	0.039	0.059	0.078	0.195	0.293	0.391	1.172
1.1	0.0047	0.0095	0.014	0.024	0.047	0.071	0.095	0.236	0.354	0.473	
1.2	0.0056	0.0113	0.017	0.028	0.056	0.084	0.113	0.281	0.422	0.563	
1.3	0.0066	0.0132	0.020	0.033	0.066	0.099	0.132	0.330	0.495	0.660	
1.4	0.0077	0.0153	0.023	0.038	0.077	0.115	0.153	0.383	0.574	0.766	
1.5	0.0088	0.0176	0.026	0.044	0.088	0.132	0.176	0.439	0.659	0.879	
1.6	0.010	0.020	0.030	0.050	0.100	0.150	0.200	0.500	0.750	1.000	
1.7	0.011	0.023	0.034	0.056	0.113	0.169	0.226	0.564	0.847		
1.8	0.013	0.025	0.038	0.063	0.127	0.190	0.253	0.633	0.949		
1.9	0.014	0.028	0.042	0.071	0.141	0.212	0.282	0.705	1.058		
2	0.016	0.031	0.047	0.078	0.156	0.234	0.313	0.781			
2.1	0.017	0.034	0.052	0.086	0.172	0.258	0.345	0.861			
2.2	0.019	0.038	0.057	0.095	0.189	0.284	0.378	0.945			
2.3	0.021	0.041	0.062	0.103	0.207	0.310	0.413	1.033			
2.4	0.023	0.045	0.068	0.113	0.225	0.338	0.450				
2.5	0.024	0.049	0.073	0.122	0.244	0.366	0.488				
2.6	0.026	0.053	0.079	0.132	0.264	0.396	0.528				
2.7	0.028	0.057	0.085	0.142	0.285	0.427	0.570				
2.8	0.031	0.061	0.092	0.153	0.306	0.459	0.613				
2.9	0.033	0.066	0.099	0.164	0.329	0.493	0.657				
3	0.035	0.070	0.105	0.176	0.352	0.527	0.703				
3.1	0.038	0.075	0.113	0.188	0.375	0.563	0.751				
3.2	0.040	0.080	0.120	0.200	0.400	0.600	0.800				
3.3	0.043	0.085	0.128	0.213	0.425	0.638	0.851				
3.4	0.045	0.090	0.135	0.226	0.452	0.677	0.903				
3.5	0.048	0.096	0.144	0.239	0.479	0.718	0.957				
3.6	0.051	0.101	0.152	0.253	0.506	0.759	1.013				
3.7	0.053	0.107	0.160	0.267	0.535	0.802					
3.8	0.056	0.113	0.169	0.282	0.564	0.846					
3.9	0.059	0.119	0.178	0.297	0.594	0.891					
4	0.063	0.125	0.188	0.313	0.625	0.938					
4.1	0.066	0.131	0.197	0.328	0.657	0.985					
4.2	0.069	0.138	0.207	0.345	0.689	1.034					
4.3	0.072	0.144	0.217	0.361	0.722						
4.4	0.076	0.151	0.227	0.378	0.756						
4.5	0.079	0.158	0.237	0.396	0.791						
4.6	0.083	0.165	0.248	0.413	0.827						
4.7	0.086	0.173	0.259	0.431	0.863						
4.8	0.090	0.180	0.270	0.450	0.900						
4.9	0.094	0.188	0.281	0.469	0.938						
5	0.098	0.195	0.293	0.488	0.977						
5.2	0.106	0.211	0.317	0.528	1.056						
5.4	0.114	0.228	0.342	0.570							
5.6	0.123	0.245	0.368	0.613							
5.8	0.131	0.263	0.394	0.657							
6	0.141	0.281	0.422	0.703							

cont.....

Circular Plot of 16m Diameter (8m radius), or Square plot of 16 x 16m

Plant Avg. Diam.or Side Length	Number of plants										
(meters)	1	2	3	5	10	15	20	50	75	100	300
6	0.141	0.281	0.422	0.703							
6.2	0.150	0.300	0.450	0.751							
6.4	0.160	0.320	0.480	0.800							
6.6	0.170	0.340	0.510	0.851							
6.8	0.181	0.361	0.542	0.903							
7	0.191	0.383	0.574	0.957							
7.2	0.203	0.405	0.608	1.013							
7.4	0.214	0.428	0.642								
7.6	0.226	0.451	0.677								
7.8	0.238	0.475	0.713								
8	0.250	0.500	0.750								
8.2	0.263	0.525	0.788								
8.4	0.276	0.551	0.827								
8.6	0.289	0.578	0.867								
8.8	0.303	0.605	0.908								
9	0.316	0.633	0.949								
9.2	0.331	0.661	0.992								
9.4	0.345	0.690	1.035								
9.6	0.360	0.720	1.080								
9.8	0.375	0.750	1.125								
10	0.391	0.781									
10.5	0.431	0.861									
11	0.473	0.945									
11.5	0.517	1.033									
12	0.563										
12.5	0.610										
13	0.660										
13.5	0.712										
14	0.766										
14.5	0.821										
15	0.879										
15.5	0.938										
16	1.000										

Appendix 1. Proportional canopy covers in a 20m plot.

Area of a circle 20m Diameter 314.2 m2 Square 20x20= 400 m2

Circular Plot of 20m Diameter (10m radius), or Square plot of 20 x 20m

Plant Avg. Diam.or Side Length	Number of plants										
(meters)	1	2	3	5	10	15	20	50	75	100	300
0.1	0.0000	0.0001	0.0001	0.0001	0.0003	0.0004	0.0005	0.0013	0.0019	0.0025	0.0075
0.2	0.0001	0.0002	0.0003	0.0005	0.0010	0.0015	0.0020	0.0050	0.0075	0.0100	0.0300
0.3	0.0002	0.0005	0.0007	0.0011	0.0023	0.0034	0.0045	0.0113	0.0169	0.0225	0.0675
0.4	0.0004	0.0008	0.0012	0.0020	0.0040	0.006	0.008	0.020	0.030	0.040	0.120
0.5	0.0006	0.0013	0.0019	0.0031	0.0063	0.009	0.013	0.031	0.047	0.063	0.188
0.6	0.0009	0.0018	0.0027	0.0045	0.0090	0.014	0.018	0.045	0.068	0.090	0.270
0.7	0.0012	0.0025	0.0037	0.0061	0.0123	0.018	0.025	0.061	0.092	0.123	0.368
0.8	0.0016	0.0032	0.0048	0.0080	0.0160	0.024	0.032	0.080	0.120	0.160	0.480
0.9	0.0020	0.0041	0.0061	0.0101	0.0203	0.030	0.041	0.101	0.152	0.203	0.608
1	0.0025	0.0050	0.0075	0.0125	0.0250	0.038	0.050	0.125	0.188	0.250	0.750
1.1	0.0030	0.0061	0.0091	0.0151	0.0303	0.045	0.061	0.151	0.227	0.303	0.908
1.2	0.0036	0.0072	0.0108	0.0180	0.0360	0.054	0.072	0.180	0.270	0.360	1.080
1.3	0.0042	0.0085	0.0127	0.0211	0.0423	0.063	0.085	0.211	0.317	0.423	
1.4	0.0049	0.0098	0.0147	0.0245	0.0490	0.074	0.098	0.245	0.368	0.490	
1.5	0.0056	0.0113	0.0169	0.0281	0.0563	0.084	0.113	0.281	0.422	0.563	
1.6	0.0064	0.0128	0.0192	0.0320	0.0640	0.096	0.128	0.320	0.480	0.640	
1.7	0.0072	0.0145	0.022	0.036	0.072	0.108	0.145	0.361	0.542	0.723	
1.8	0.0081	0.0162	0.024	0.041	0.081	0.122	0.162	0.405	0.608	0.810	
1.9	0.0090	0.0181	0.027	0.045	0.090	0.135	0.181	0.451	0.677	0.903	
2	0.0100	0.0200	0.030	0.050	0.100	0.150	0.200	0.500	0.750	1.000	
2.1	0.0110	0.0221	0.033	0.055	0.110	0.165	0.221	0.551	0.827		
2.2	0.0121	0.0242	0.036	0.061	0.121	0.182	0.242	0.605	0.908		
2.3	0.0132	0.0265	0.040	0.066	0.132	0.198	0.265	0.661	0.992		
2.4	0.0144	0.0288	0.043	0.072	0.144	0.216	0.288	0.720	1.080		
2.5	0.0156	0.031	0.047	0.078	0.156	0.234	0.313	0.781			
2.6	0.0169	0.034	0.051	0.085	0.169	0.254	0.338	0.845			
2.7	0.0182	0.036	0.055	0.091	0.182	0.273	0.365	0.911			
2.8	0.0196	0.039	0.059	0.098	0.196	0.294	0.392	0.980			
2.9	0.0210	0.042	0.063	0.105	0.210	0.315	0.421	1.051			
3	0.0225	0.045	0.068	0.113	0.225	0.338	0.450				
3.1	0.024	0.048	0.072	0.120	0.240	0.360	0.481				
3.2	0.026	0.051	0.077	0.128	0.256	0.384	0.512				
3.3	0.027	0.054	0.082	0.136	0.272	0.408	0.545				
3.4	0.029	0.058	0.087	0.145	0.289	0.434	0.578				
3.5	0.031	0.061	0.092	0.153	0.306	0.459	0.613				
3.6	0.032	0.065	0.097	0.162	0.324	0.486	0.648				
3.7	0.034	0.068	0.103	0.171	0.342	0.513	0.685				
3.8	0.036	0.072	0.108	0.181	0.361	0.542	0.722				
3.9	0.038	0.076	0.114	0.190	0.380	0.570	0.761				
4	0.040	0.080	0.120	0.200	0.400	0.600	0.800				
4.1	0.042	0.084	0.126	0.210	0.420	0.630	0.841				
4.2	0.044	0.088	0.132	0.221	0.441	0.662	0.882				
4.3	0.046	0.092	0.139	0.231	0.462	0.693	0.925				
4.4	0.048	0.097	0.145	0.242	0.484	0.726	0.968				
4.5	0.051	0.101	0.152	0.253	0.506	0.759	1.013				
4.6	0.053	0.106	0.159	0.265	0.529	0.794					
4.7	0.055	0.110	0.166	0.276	0.552	0.828					
4.8	0.058	0.115	0.173	0.288	0.576	0.864					
4.9	0.060	0.120	0.180	0.300	0.600	0.900					
5	0.063	0.125	0.188	0.313	0.625	0.938					
5.2	0.068	0.135	0.203	0.338	0.676	1.014					
5.4	0.073	0.146	0.219	0.365	0.729						
5.6	0.078	0.157	0.235	0.392	0.784						
5.8	0.084	0.168	0.252	0.421	0.841						
6	0.090	0.180	0.270	0.450	0.900						

cont.....

Circular Plot of 20m Diameter (10m radius), or Square plot of 20 x 20m

Plant Avg. Diam.or Side Length	Number of plants										
(meters)	1	2	3	5	10	15	20	50	75	100	300
6	0.090	0.180	0.270	0.450	0.900						
6.2	0.096	0.192	0.288	0.481	0.961						
6.4	0.102	0.205	0.307	0.512	1.024						
6.6	0.109	0.218	0.327	0.545							
6.8	0.116	0.231	0.347	0.578							
7	0.123	0.245	0.368	0.613							
7.2	0.130	0.259	0.389	0.648							
7.4	0.137	0.274	0.411	0.685							
7.6	0.144	0.289	0.433	0.722							
7.8	0.152	0.304	0.456	0.761							
8	0.160	0.320	0.480	0.800							
8.2	0.168	0.336	0.504	0.841							
8.4	0.176	0.353	0.529	0.882							
8.6	0.185	0.370	0.555	0.925							
8.8	0.194	0.387	0.581	0.968							
9	0.203	0.405	0.608	1.013							
9.2	0.212	0.423	0.635								
9.4	0.221	0.442	0.663								
9.6	0.230	0.461	0.691								
9.8	0.240	0.480	0.720								
10	0.250	0.500	0.750								
10.5	0.276	0.551	0.827								
11	0.303	0.605	0.908								
11.5	0.331	0.661	0.992								
12	0.360	0.720	1.080								
12.5	0.391	0.781	1.172								
13	0.423	0.845	1.268								
13.5	0.456	0.911	1.367								
14	0.490	0.980	1.470								
14.5	0.526	1.051									
15	0.563										
15.5	0.601										
16	0.640										
16.5	0.681										
17	0.723										
17.5	0.766										
18	0.810										
18.5	0.856										
19	0.903										
19.5	0.951										
20	1.000										

Appendix 1. Proportional canopy covers for a 30m plot.

	Area of a circle30m Diameter				*706.9*	*m2*	*Square 30x30=*		*900*	*m2*	

Circular Plot of 30m Diameter (15m radius), or Square plot of 30 x 30m

Plant Avg. Diam.or Side Length	Number of plants										
(meters)	1	2	3	5	10	15	20	50	75	100	300
0.1	0.0000	0.0000	0.0000	0.0001	0.0001	0.0002	0.0002	0.0006	0.0008	0.0011	0.0033
0.2	0.0000	0.0001	0.0001	0.0002	0.0004	0.0007	0.0009	0.0022	0.0033	0.0044	0.0133
0.3	0.0001	0.0002	0.0003	0.0005	0.0010	0.0015	0.0020	0.0050	0.0075	0.0100	0.0300
0.4	0.0002	0.0004	0.0005	0.0009	0.0018	0.0027	0.0036	0.0089	0.0133	0.0178	0.0533
0.5	0.0003	0.0006	0.0008	0.0014	0.0028	0.0042	0.0056	0.0139	0.0208	0.0278	0.0833
0.6	0.0004	0.0008	0.0012	0.0020	0.0040	0.0060	0.0080	0.0200	0.0300	0.0400	0.1200
0.7	0.0005	0.0011	0.0016	0.0027	0.0054	0.0082	0.0109	0.0272	0.0408	0.0544	0.1633
0.8	0.0007	0.0014	0.0021	0.0036	0.0071	0.0107	0.0142	0.0356	0.0533	0.0711	0.2133
0.9	0.0009	0.0018	0.0027	0.0045	0.0090	0.0135	0.0180	0.0450	0.068	0.090	0.270
1	0.0011	0.0022	0.0033	0.0056	0.0111	0.0167	0.0222	0.0556	0.083	0.111	0.333
1.1	0.0013	0.0027	0.0040	0.0067	0.0134	0.0202	0.0269	0.0672	0.101	0.134	0.403
1.2	0.0016	0.0032	0.0048	0.0080	0.0160	0.0240	0.0320	0.0800	0.120	0.160	0.480
1.3	0.0019	0.0038	0.0056	0.0094	0.0188	0.0282	0.0376	0.0939	0.141	0.188	0.563
1.4	0.0022	0.0044	0.0065	0.0109	0.0218	0.0327	0.0436	0.1089	0.163	0.218	0.653
1.5	0.0025	0.0050	0.0075	0.0125	0.0250	0.0375	0.0500	0.1250	0.188	0.250	0.750
1.6	0.0028	0.0057	0.0085	0.0142	0.0284	0.0427	0.0569	0.1422	0.213	0.284	0.853
1.7	0.0032	0.0064	0.0096	0.0161	0.0321	0.0482	0.0642	0.1606	0.241	0.321	0.963
1.8	0.0036	0.0072	0.0108	0.0180	0.0360	0.0540	0.0720	0.1800	0.270	0.360	1.080
1.9	0.0040	0.0080	0.0120	0.0201	0.0401	0.0602	0.0802	0.2006	0.301	0.401	1.203
2	0.0044	0.0089	0.0133	0.022	0.044	0.067	0.089	0.222	0.333	0.444	
2.1	0.0049	0.0098	0.0147	0.025	0.049	0.074	0.098	0.245	0.368	0.490	
2.2	0.0054	0.0108	0.0161	0.027	0.054	0.081	0.108	0.269	0.403	0.538	
2.3	0.0059	0.0118	0.0176	0.029	0.059	0.088	0.118	0.294	0.441	0.588	
2.4	0.0064	0.0128	0.0192	0.032	0.064	0.096	0.128	0.320	0.480	0.640	
2.5	0.0069	0.0139	0.0208	0.035	0.069	0.104	0.139	0.347	0.521	0.694	
2.6	0.0075	0.0150	0.0225	0.038	0.075	0.113	0.150	0.376	0.563	0.751	
2.7	0.0081	0.0162	0.0243	0.041	0.081	0.122	0.162	0.405	0.608	0.810	
2.8	0.0087	0.0174	0.0261	0.044	0.087	0.131	0.174	0.436	0.653	0.871	
2.9	0.0093	0.0187	0.0280	0.047	0.093	0.140	0.187	0.467	0.701	0.934	
3	0.0100	0.0200	0.0300	0.050	0.100	0.150	0.200	0.500	0.750	1.000	
3.1	0.0107	0.0214	0.0320	0.053	0.107	0.160	0.214	0.534	0.801		
3.2	0.0114	0.0228	0.0341	0.057	0.114	0.171	0.228	0.569	0.853		
3.3	0.0121	0.0242	0.0363	0.061	0.121	0.182	0.242	0.605	0.908		
3.4	0.0128	0.0257	0.0385	0.064	0.128	0.193	0.257	0.642	0.963		
3.5	0.014	0.027	0.041	0.068	0.136	0.204	0.272	0.681	1.021		
3.6	0.0144	0.029	0.043	0.072	0.144	0.216	0.288	0.720			
3.7	0.0152	0.030	0.046	0.076	0.152	0.228	0.304	0.761			
3.8	0.0160	0.032	0.048	0.080	0.160	0.241	0.321	0.802			
3.9	0.0169	0.034	0.051	0.085	0.169	0.254	0.338	0.845			
4	0.0178	0.036	0.053	0.089	0.178	0.267	0.356	0.889			
4.1	0.0187	0.037	0.056	0.093	0.187	0.280	0.374	0.934			
4.2	0.0196	0.039	0.059	0.098	0.196	0.294	0.392	0.980			
4.3	0.0205	0.041	0.062	0.103	0.205	0.308	0.411	1.027			
4.4	0.0215	0.043	0.065	0.108	0.215	0.323	0.430				
4.5	0.0225	0.045	0.068	0.113	0.225	0.338	0.450				
4.6	0.024	0.047	0.071	0.118	0.235	0.353	0.470				
4.7	0.025	0.049	0.074	0.123	0.245	0.368	0.491				
4.8	0.026	0.051	0.077	0.128	0.256	0.384	0.512				
4.9	0.027	0.053	0.080	0.133	0.267	0.400	0.534				
5	0.028	0.056	0.083	0.139	0.278	0.417	0.556				
5.2	0.030	0.060	0.090	0.150	0.300	0.451	0.601				
5.4	0.032	0.065	0.097	0.162	0.324	0.486	0.648				
5.6	0.035	0.070	0.105	0.174	0.348	0.523	0.697				
5.8	0.037	0.075	0.112	0.187	0.374	0.561	0.748				
6	0.040	0.080	0.120	0.200	0.400						

cont....

Circular Plot of 30m Diameter (15m radius), or Square plot of 30 x 30m

Plant Avg. Diam.or Side Length (meters)	Number of plants										
	1	2	3	5	10	15	20	50	75	100	300
6.0	0.040	0.080	0.120	0.200	0.400	0.600	0.800				
6.2	0.043	0.085	0.128	0.214	0.427	0.641	0.854				
6.4	0.046	0.091	0.137	0.228	0.455	0.683	0.910				
6.6	0.048	0.097	0.145	0.242	0.484	0.726	0.968				
6.8	0.051	0.103	0.154	0.257	0.514	0.771	1.028				
7.0	0.054	0.109	0.163	0.272	0.544	0.817					
7.2	0.058	0.115	0.173	0.288	0.576	0.864					
7.4	0.061	0.122	0.183	0.304	0.608	0.913					
7.6	0.064	0.128	0.193	0.321	0.642	0.963					
7.8	0.068	0.135	0.203	0.338	0.676	1.014					
8.0	0.071	0.142	0.213	0.356	0.711						
8.2	0.075	0.149	0.224	0.374	0.747						
8.4	0.078	0.157	0.235	0.392	0.784						
8.6	0.082	0.164	0.247	0.411	0.822						
8.8	0.086	0.172	0.258	0.430	0.860						
9.0	0.090	0.180	0.270	0.450	0.900						
9.2	0.094	0.188	0.282	0.470	0.940						
9.4	0.098	0.196	0.295	0.491	0.982						
9.6	0.102	0.205	0.307	0.512	1.024						
9.8	0.107	0.213	0.320	0.534							
10.0	0.111	0.222	0.333	0.556							
10.5	0.123	0.245	0.368	0.613							
11.0	0.134	0.269	0.403	0.672							
11.5	0.147	0.294	0.441	0.735							
12.0	0.160	0.320	0.480	0.800							
12.5	0.174	0.347	0.521	0.868							
13.0	0.188	0.376	0.563	0.939							
13.5	0.203	0.405	0.608	1.013							
14.0	0.218	0.436	0.653								
14.5	0.234	0.467	0.701								
15.0	0.250	0.500	0.750								
15.5	0.267	0.534	0.801								
16.0	0.284	0.569	0.853								
16.5	0.303	0.605	0.908								
17.0	0.321	0.642	0.963								
17.5	0.340	0.681	1.021								
18.0	0.360	0.720	1.080								
18.5	0.380	0.761									
19.0	0.401	0.802									
19.5	0.423	0.845									
20.0	0.444	0.889									
25.0	0.694										
30.0	1.000										

Appendix 1: Proportional canopy covers for a 40m plot.

Area of a circle 40m Diameter = 1256.6 m2 Square 40x40= 1600 m2

Circular Plot of 40m Diameter (20m radius), or Square plot of 40 x 40m

Plant Avg. Diam.or Side Length	Number of plants										
(meters)	1	2	3	5	10	15	20	50	75	100	300
0.1	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0003	0.0005	0.0006	0.0019
0.2	0.0000	0.0001	0.0001	0.0001	0.0003	0.0004	0.0005	0.0013	0.0019	0.0025	0.0075
0.3	0.0001	0.0001	0.0002	0.0003	0.0006	0.0008	0.0011	0.0028	0.0042	0.0056	0.0169
0.4	0.0001	0.0002	0.0003	0.0005	0.0010	0.0015	0.0020	0.0050	0.0075	0.0100	0.0300
0.5	0.0002	0.0003	0.0005	0.0008	0.0016	0.0023	0.0031	0.0078	0.0117	0.0156	0.0469
0.6	0.0002	0.0005	0.0007	0.0011	0.0023	0.0034	0.0045	0.011	0.017	0.023	0.068
0.7	0.0003	0.0006	0.0009	0.0015	0.0031	0.0046	0.0061	0.015	0.023	0.031	0.092
0.8	0.0004	0.0008	0.0012	0.0020	0.0040	0.0060	0.0080	0.020	0.030	0.040	0.120
0.9	0.0005	0.0010	0.0015	0.0025	0.0051	0.0076	0.0101	0.025	0.038	0.051	0.152
1	0.0006	0.0013	0.0019	0.0031	0.0063	0.009	0.013	0.031	0.047	0.063	0.188
1.1	0.0008	0.0015	0.0023	0.0038	0.0076	0.011	0.015	0.038	0.057	0.076	0.227
1.2	0.0009	0.0018	0.0027	0.0045	0.0090	0.014	0.018	0.045	0.068	0.090	0.270
1.3	0.0011	0.0021	0.0032	0.0053	0.0106	0.016	0.021	0.053	0.079	0.106	0.317
1.4	0.0012	0.0025	0.0037	0.0061	0.0123	0.018	0.025	0.061	0.092	0.123	0.368
1.5	0.0014	0.0028	0.0042	0.0070	0.0141	0.021	0.028	0.070	0.105	0.141	0.422
1.6	0.0016	0.003	0.005	0.008	0.016	0.024	0.032	0.080	0.120	0.160	0.480
1.7	0.0018	0.004	0.005	0.009	0.018	0.027	0.036	0.090	0.135	0.181	0.542
1.8	0.0020	0.004	0.006	0.010	0.020	0.030	0.041	0.101	0.152	0.203	0.608
1.9	0.0023	0.005	0.007	0.011	0.023	0.034	0.045	0.113	0.169	0.226	0.677
2	0.0025	0.005	0.008	0.013	0.025	0.038	0.050	0.125	0.188	0.250	0.750
2.1	0.003	0.006	0.008	0.014	0.028	0.041	0.055	0.138	0.207	0.276	0.827
2.2	0.003	0.006	0.009	0.015	0.030	0.045	0.061	0.151	0.227	0.303	0.908
2.3	0.003	0.007	0.010	0.017	0.033	0.050	0.066	0.165	0.248	0.331	0.992
2.4	0.004	0.007	0.011	0.018	0.036	0.054	0.072	0.180	0.270	0.360	1.080
2.5	0.004	0.008	0.012	0.020	0.039	0.059	0.078	0.195	0.293	0.391	
2.6	0.004	0.008	0.013	0.021	0.042	0.063	0.085	0.211	0.317	0.423	
2.7	0.005	0.009	0.014	0.023	0.046	0.068	0.091	0.228	0.342	0.456	
2.8	0.005	0.010	0.015	0.025	0.049	0.074	0.098	0.245	0.368	0.490	
2.9	0.005	0.011	0.016	0.026	0.053	0.079	0.105	0.263	0.394	0.526	
3	0.006	0.011	0.017	0.028	0.056	0.084	0.113	0.281	0.422	0.563	
3.1	0.006	0.012	0.018	0.030	0.060	0.090	0.120	0.300	0.450	0.601	
3.2	0.006	0.013	0.019	0.032	0.064	0.096	0.128	0.320	0.480	0.640	
3.3	0.007	0.014	0.020	0.034	0.068	0.102	0.136	0.340	0.510	0.681	
3.4	0.007	0.014	0.022	0.036	0.072	0.108	0.145	0.361	0.542	0.723	
3.5	0.008	0.015	0.023	0.038	0.077	0.115	0.153	0.383	0.574	0.766	
3.6	0.008	0.016	0.024	0.041	0.081	0.122	0.162	0.405	0.608	0.810	
3.7	0.009	0.017	0.026	0.043	0.086	0.128	0.171	0.428	0.642	0.856	
3.8	0.009	0.018	0.027	0.045	0.090	0.135	0.181	0.451	0.677	0.903	
3.9	0.010	0.019	0.029	0.048	0.095	0.143	0.190	0.475	0.713	0.951	
4	0.010	0.020	0.030	0.050	0.100	0.150	0.200	0.500	0.750	1.000	
4.1	0.011	0.021	0.032	0.053	0.105	0.158	0.210	0.525	0.788		
4.2	0.011	0.022	0.033	0.055	0.110	0.165	0.221	0.551	0.827		
4.3	0.012	0.023	0.035	0.058	0.116	0.173	0.231	0.578	0.867		
4.4	0.012	0.024	0.036	0.061	0.121	0.182	0.242	0.605	0.908		
4.5	0.013	0.025	0.038	0.063	0.127	0.190	0.253	0.633	0.949		
4.6	0.013	0.026	0.040	0.066	0.132	0.198	0.265	0.661	0.992		
4.7	0.014	0.028	0.041	0.069	0.138	0.207	0.276	0.690	1.035		
4.8	0.014	0.029	0.043	0.072	0.144	0.216	0.288	0.720			
4.9	0.015	0.030	0.045	0.075	0.150	0.225	0.300	0.750			
5	0.016	0.031	0.047	0.078	0.156	0.234	0.313	0.781			
5.2	0.017	0.034	0.051	0.085	0.169	0.254	0.338	0.845			
5.4	0.018	0.036	0.055	0.091	0.182	0.273	0.365	0.911			
5.6	0.020	0.039	0.059	0.098	0.196	0.294	0.392	0.980			
5.8	0.021	0.042	0.063	0.105	0.210	0.315	0.421	1.051			
6	0.023	0.045	0.068	0.113	0.225	0.338	0.450				

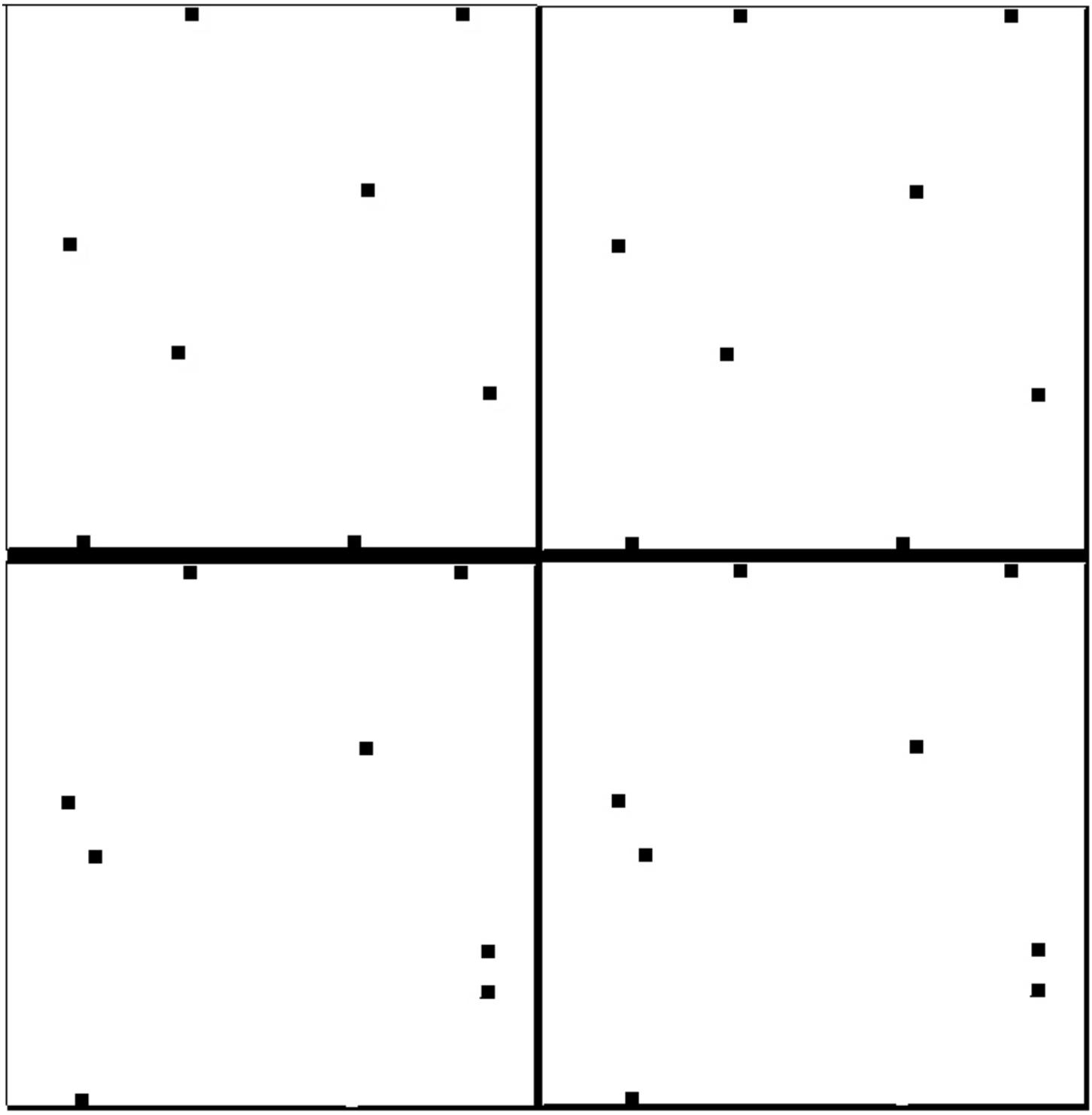
cont....

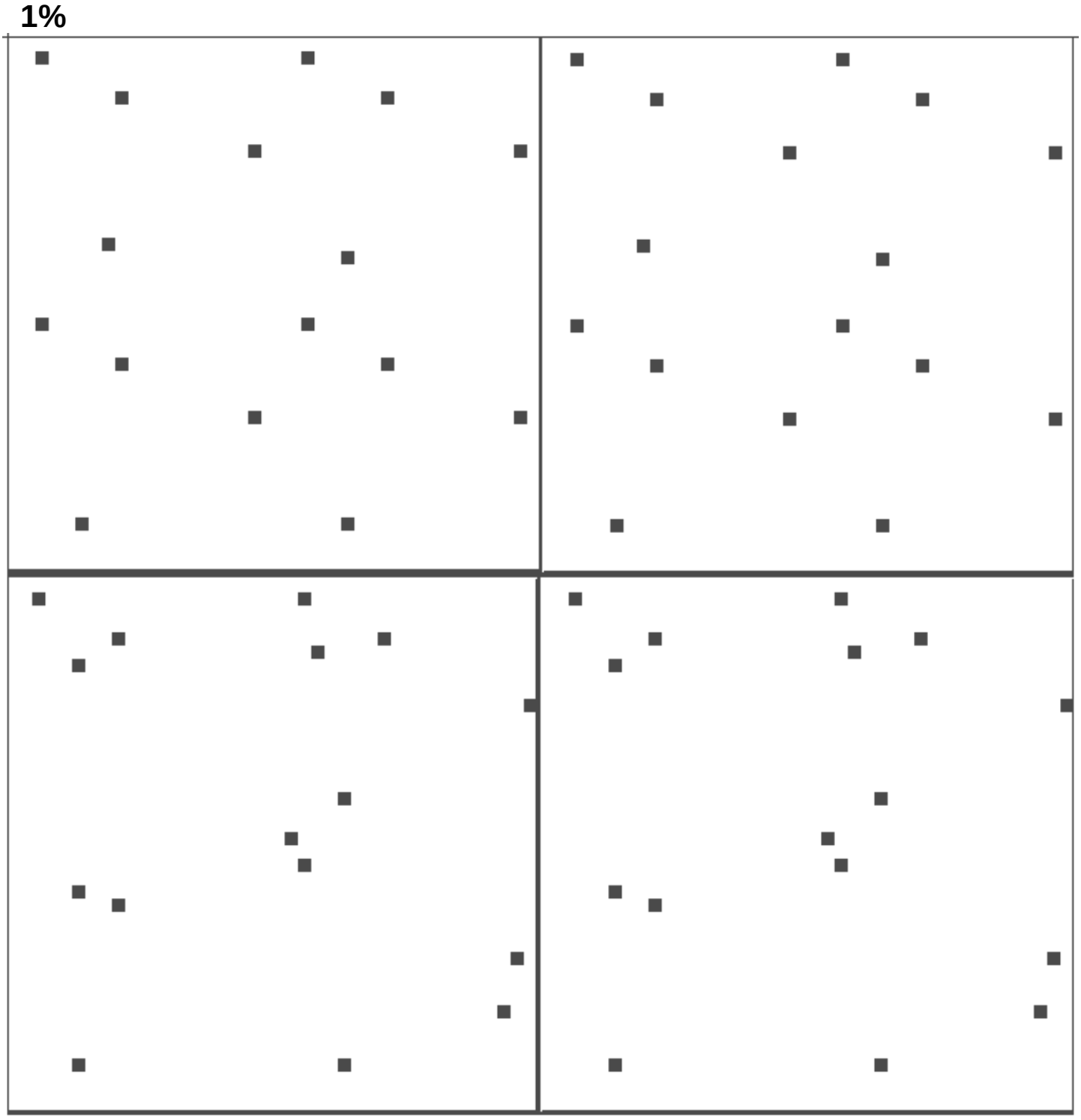
Circular Plot of 40m Diameter (20m radius), or Square plot of 40 x 40m

Plant Avg. Diam.or Side Length (meters)	Number of plants										
	1	2	3	5	10	15	20	50	75	100	300
6	0.023	0.045	0.068	0.113	0.225	0.338	0.450	1.125			
6.2	0.024	0.048	0.072	0.120	0.240	0.360	0.481				
6.4	0.026	0.051	0.077	0.128	0.256	0.384	0.512				
6.6	0.027	0.054	0.082	0.136	0.272	0.408	0.545				
6.8	0.029	0.058	0.087	0.145	0.289	0.434	0.578				
7	0.031	0.061	0.092	0.153	0.306	0.459	0.613				
7.2	0.032	0.065	0.097	0.162	0.324	0.486	0.648				
7.4	0.034	0.068	0.103	0.171	0.342	0.513	0.685				
7.6	0.036	0.072	0.108	0.181	0.361	0.542	0.722				
7.8	0.038	0.076	0.114	0.190	0.380	0.570	0.761				
8	0.040	0.080	0.120	0.200	0.400	0.600	0.800				
8.2	0.042	0.084	0.126	0.210	0.420	0.630	0.841				
8.4	0.044	0.088	0.132	0.221	0.441	0.662	0.882				
8.6	0.046	0.092	0.139	0.231	0.462	0.693	0.925				
8.8	0.048	0.097	0.145	0.242	0.484	0.726	0.968				
9	0.051	0.101	0.152	0.253	0.506	0.759	1.013				
9.2	0.053	0.106	0.159	0.265	0.529	0.794	1.058				
9.4	0.055	0.110	0.166	0.276	0.552	0.828					
9.6	0.058	0.115	0.173	0.288	0.576	0.864					
9.8	0.060	0.120	0.180	0.300	0.600	0.900					
10	0.063	0.125	0.188	0.313	0.625	0.938					
10.5	0.069	0.138	0.207	0.345	0.689	1.034					
11	0.076	0.151	0.227	0.378	0.756						
11.5	0.083	0.165	0.248	0.413	0.827						
12	0.090	0.180	0.270	0.450	0.900						
12.5	0.098	0.195	0.293	0.488	0.977						
13	0.106	0.211	0.317	0.528	1.056						
13.5	0.114	0.228	0.342	0.570							
14	0.123	0.245	0.368	0.613							
14.5	0.131	0.263	0.394	0.657							
15	0.141	0.281	0.422	0.703							
15.5	0.150	0.300	0.450	0.751							
16	0.160	0.320	0.480	0.800							
16.5	0.170	0.340	0.510	0.851							
17	0.181	0.361	0.542	0.903							
17.5	0.191	0.383	0.574	0.957							
18	0.203	0.405	0.608	1.013							
18.5	0.214	0.428	0.642	1.070							
19	0.226	0.451	0.677								
19.5	0.238	0.475	0.713								
20	0.250	0.500	0.750								
25	0.391	0.781	1.172								
30	0.563	1.125									
35	0.766										
40	1.000										

Appendix 1. % Canopy Cover Patterns, 0.5% to 90%.

0.5%

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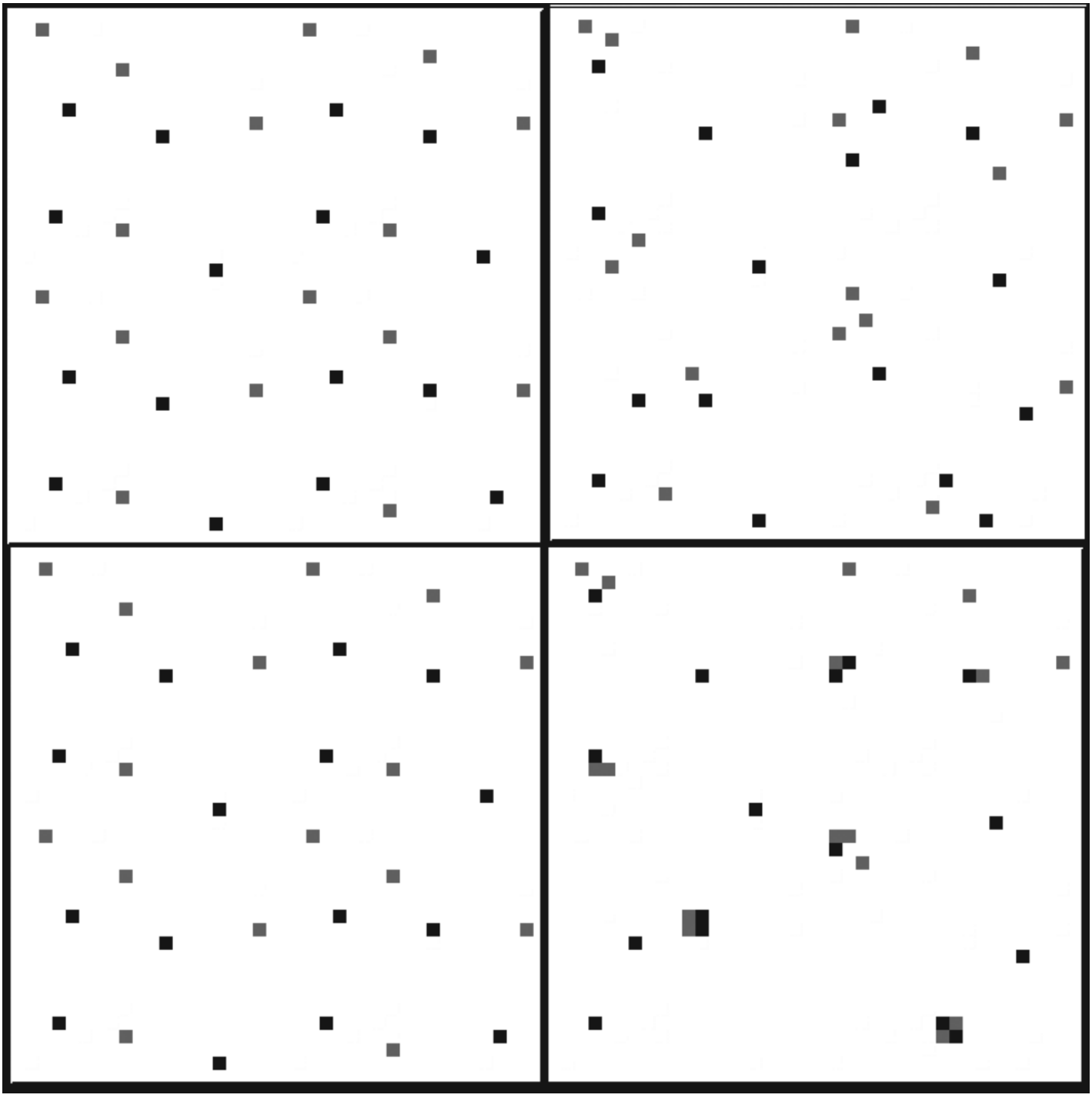
2%



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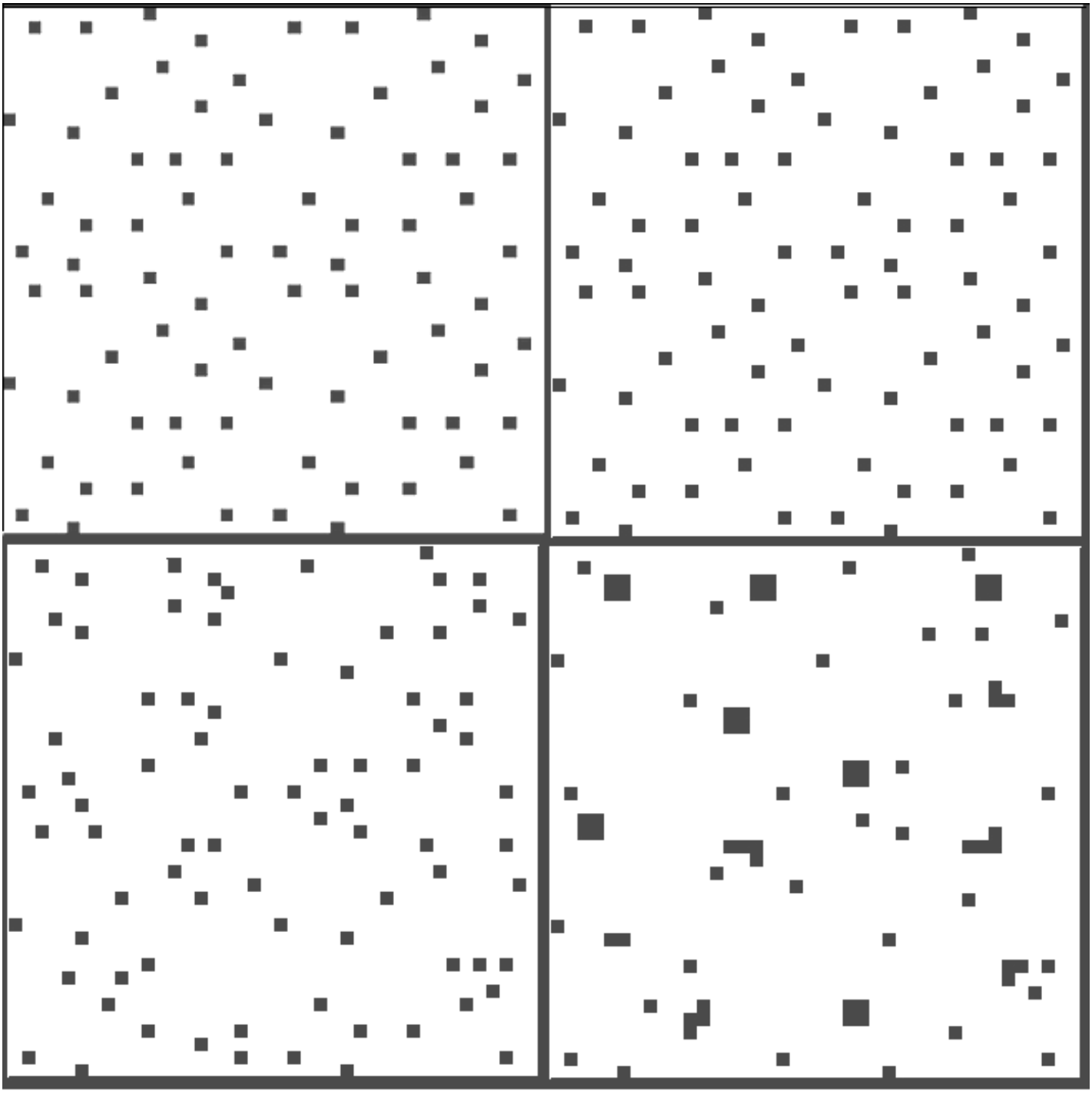

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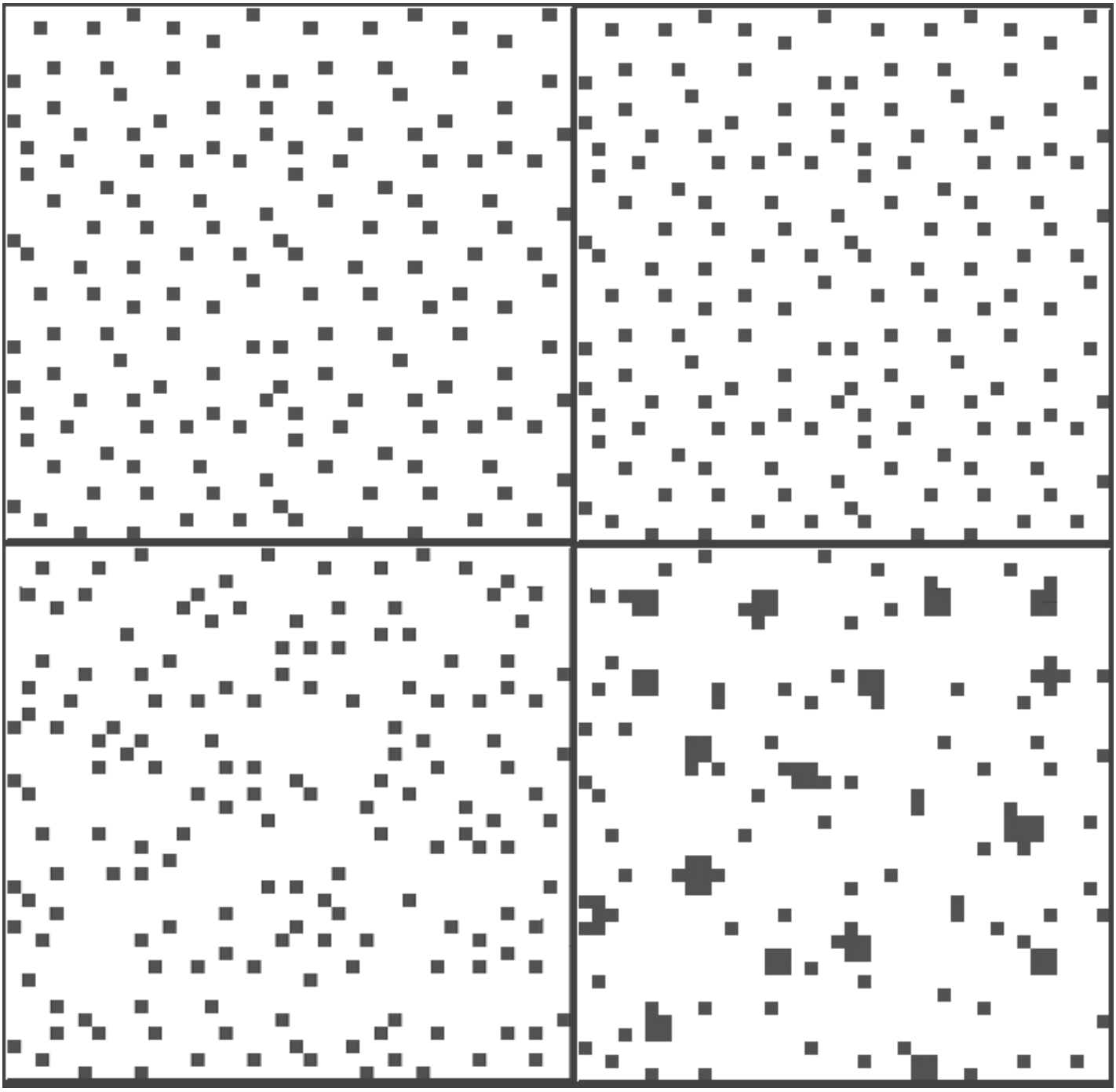

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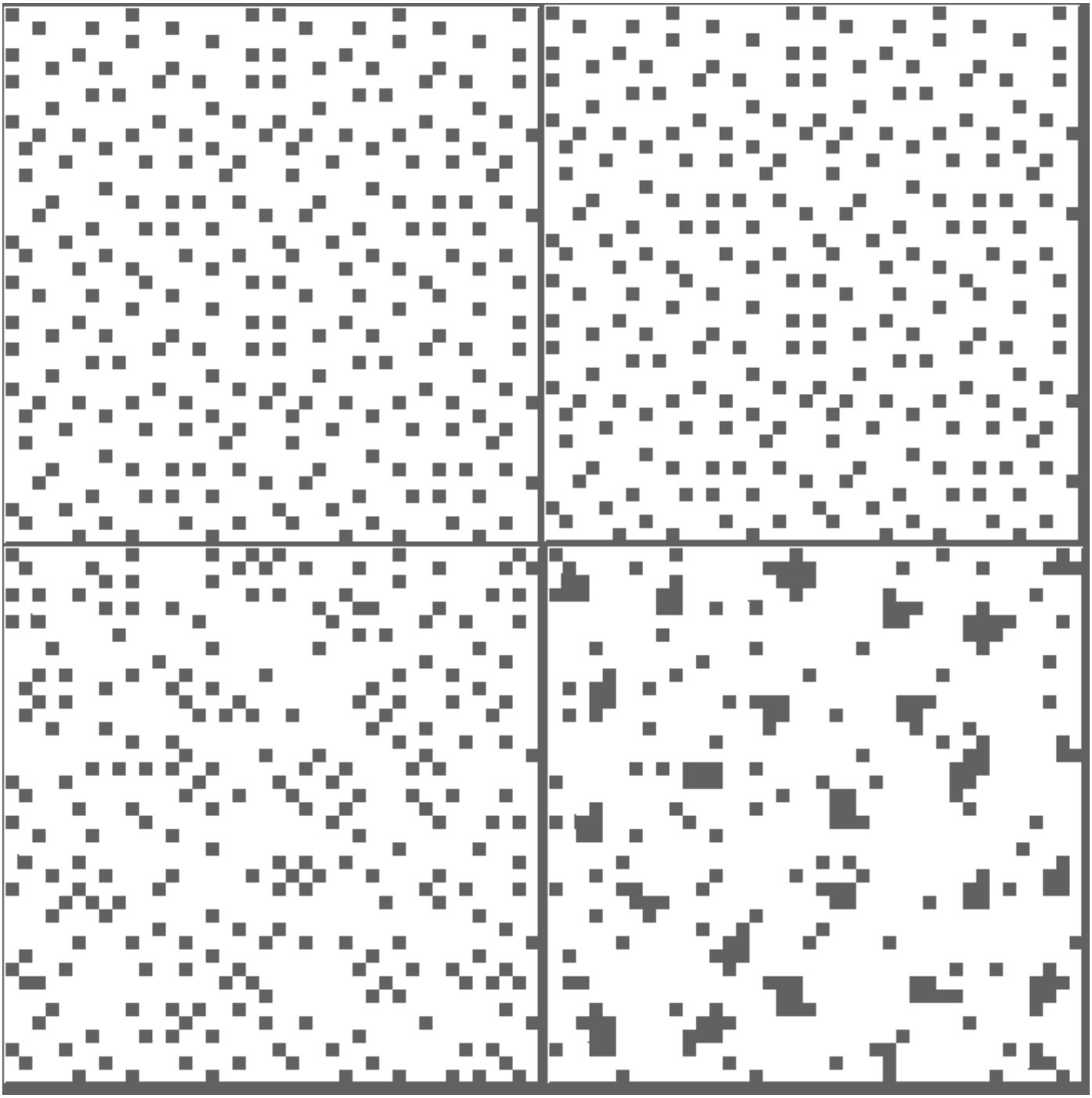
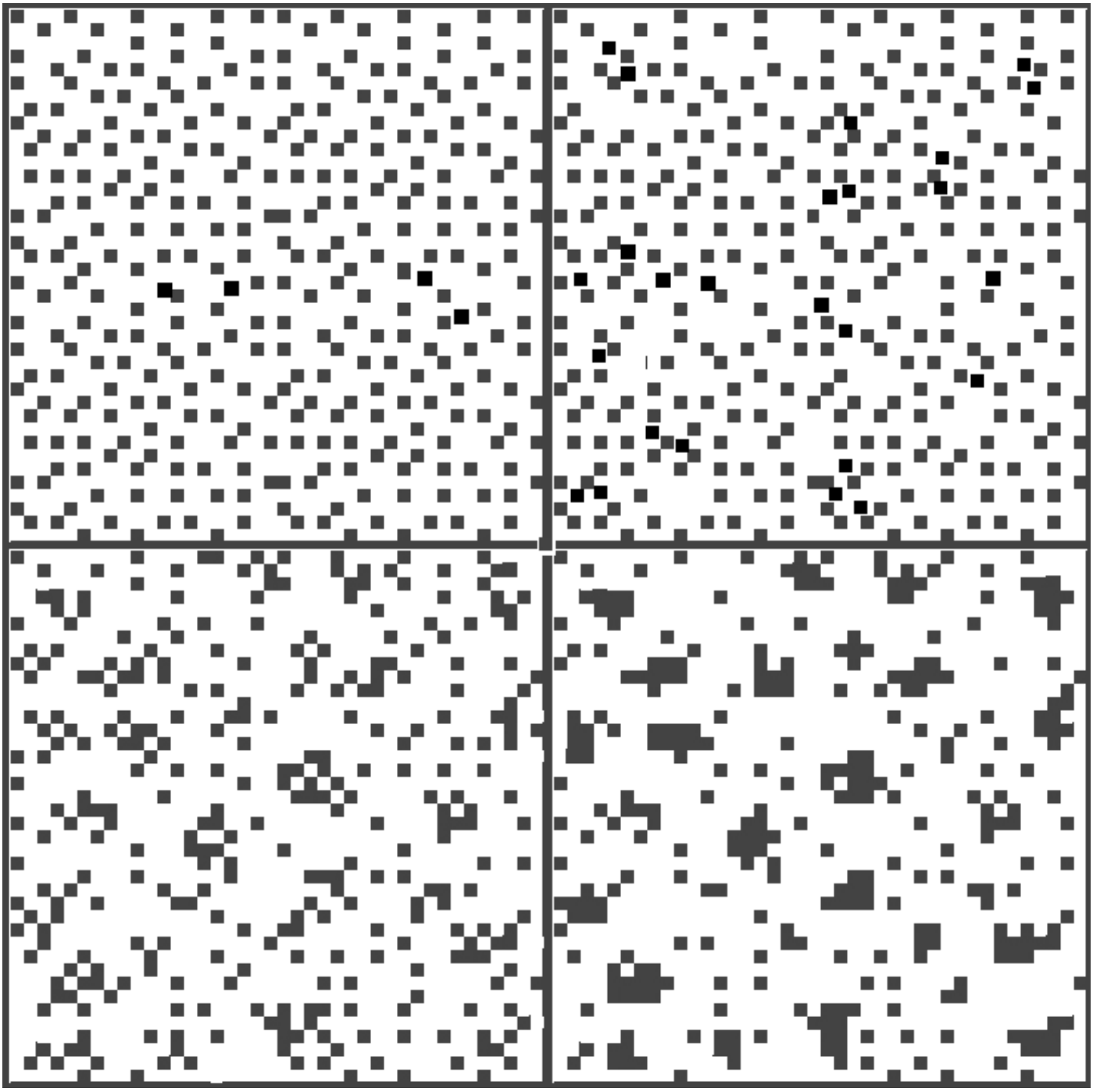


20%



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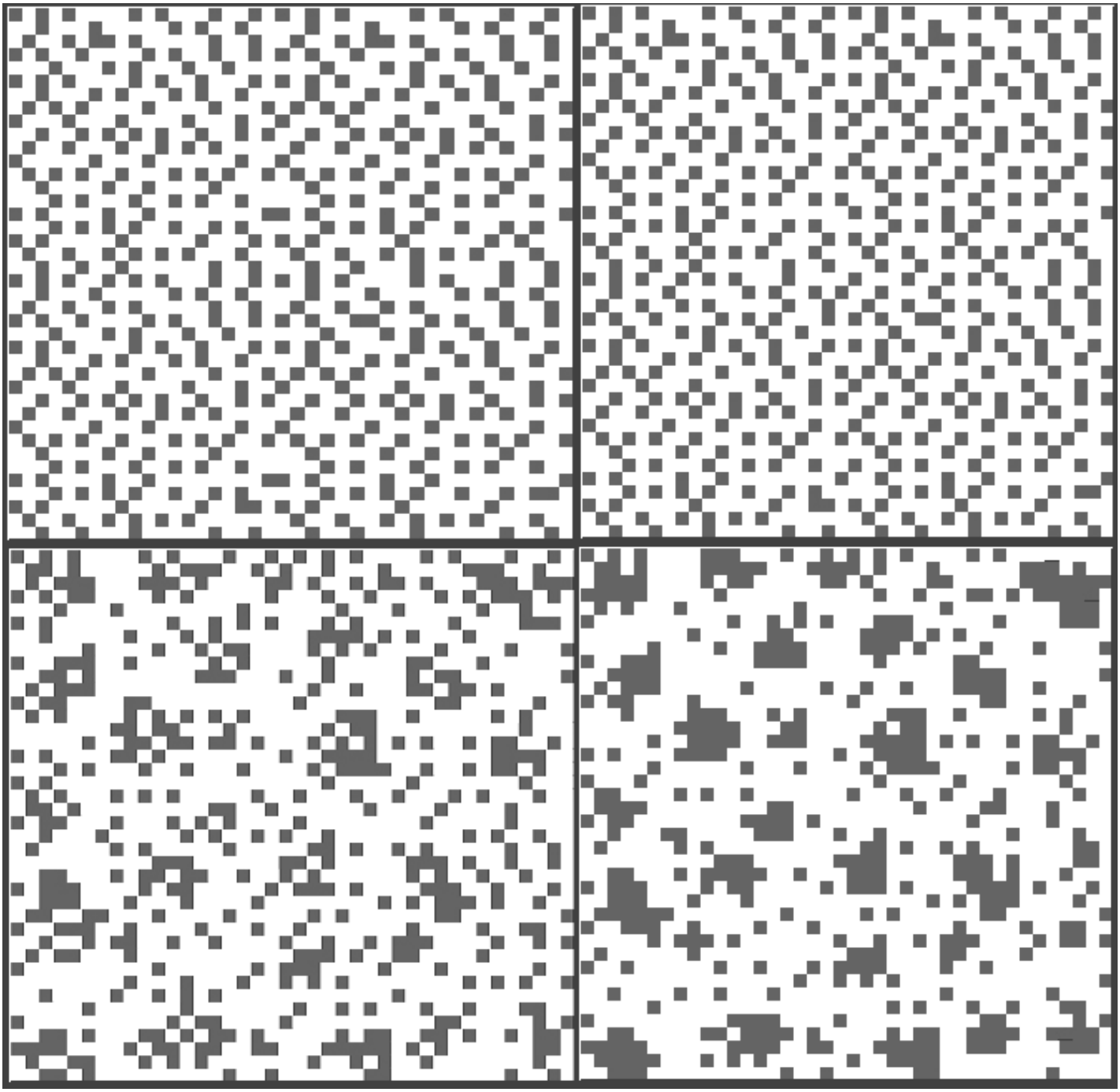

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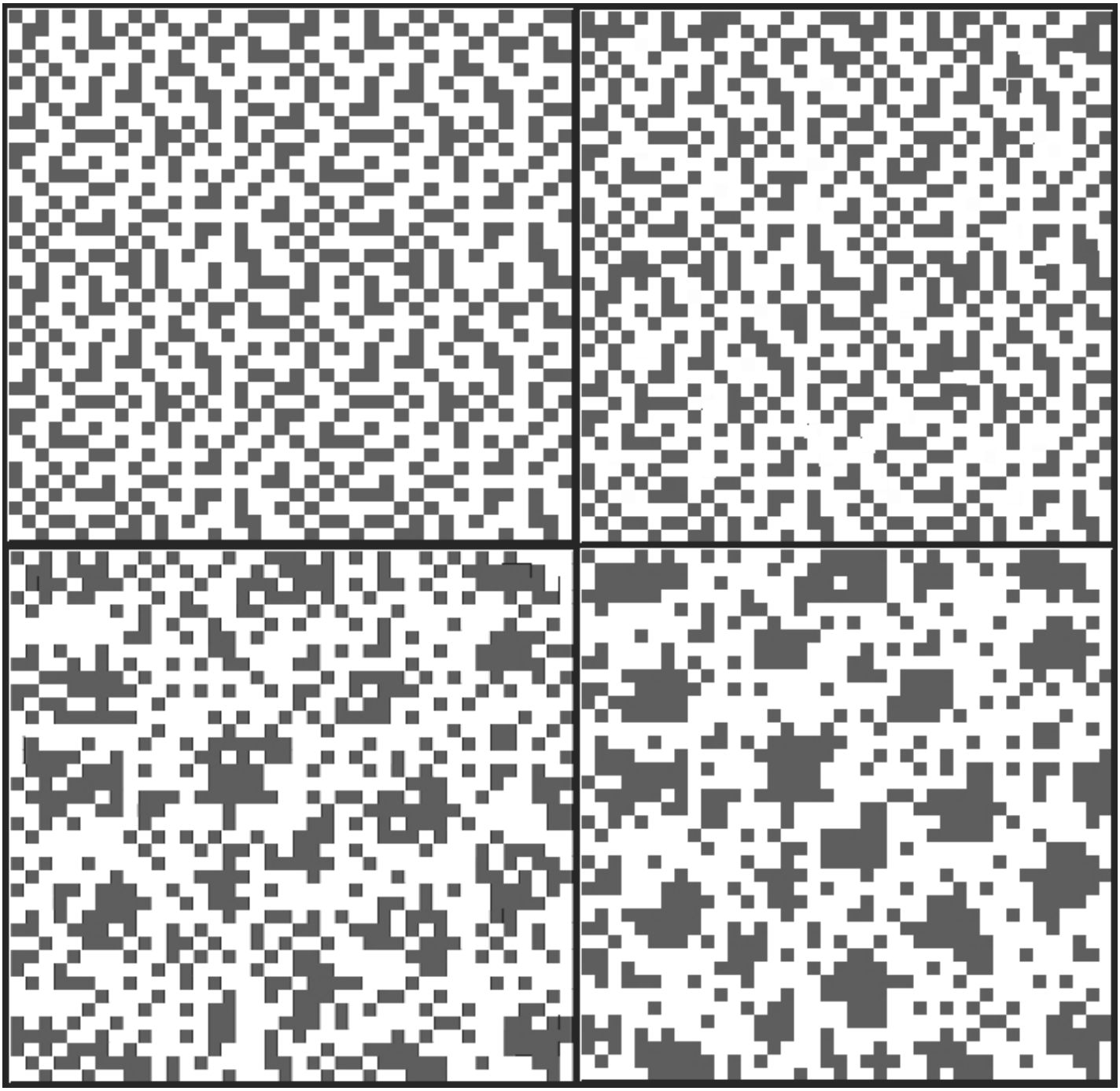
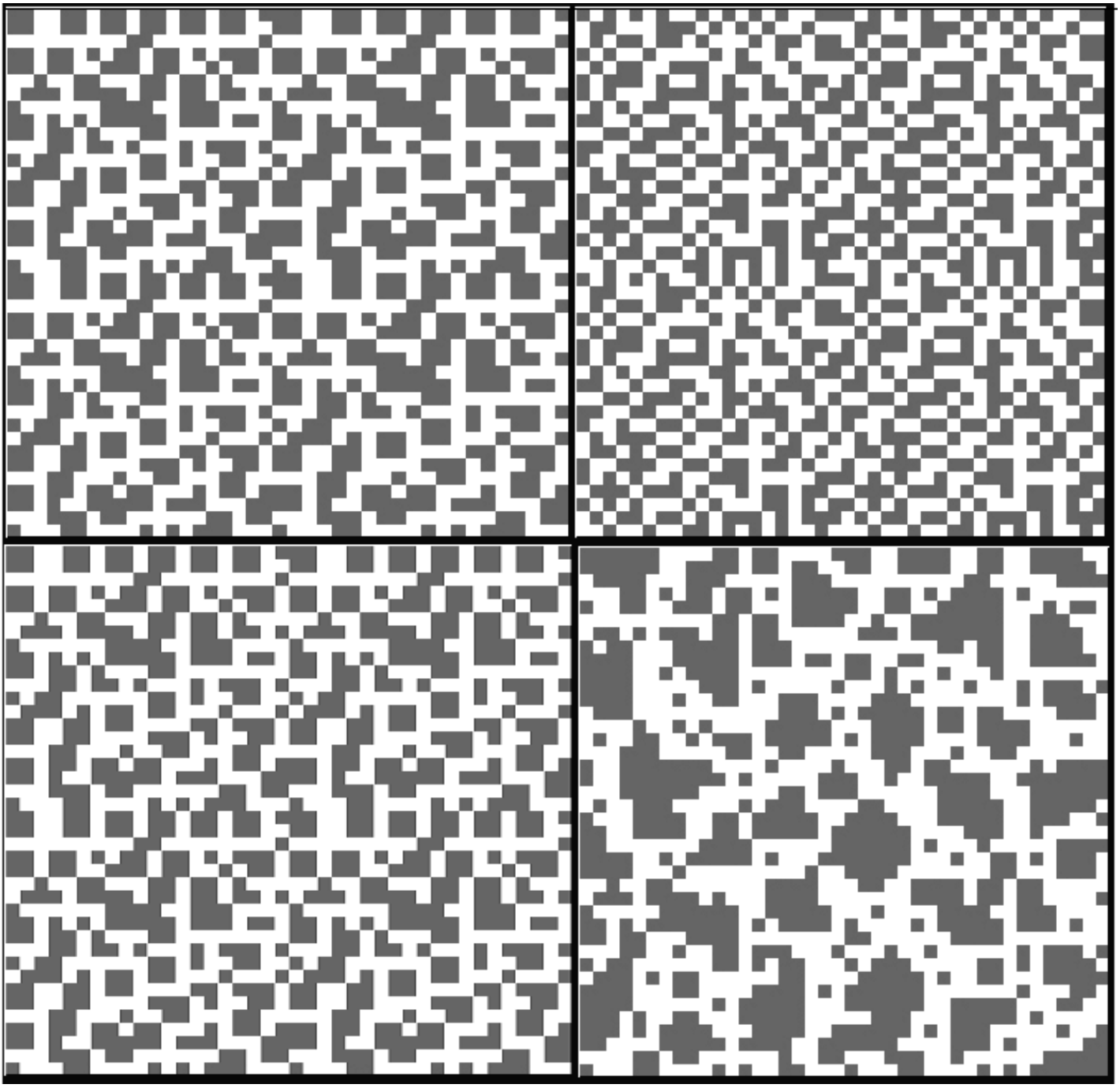
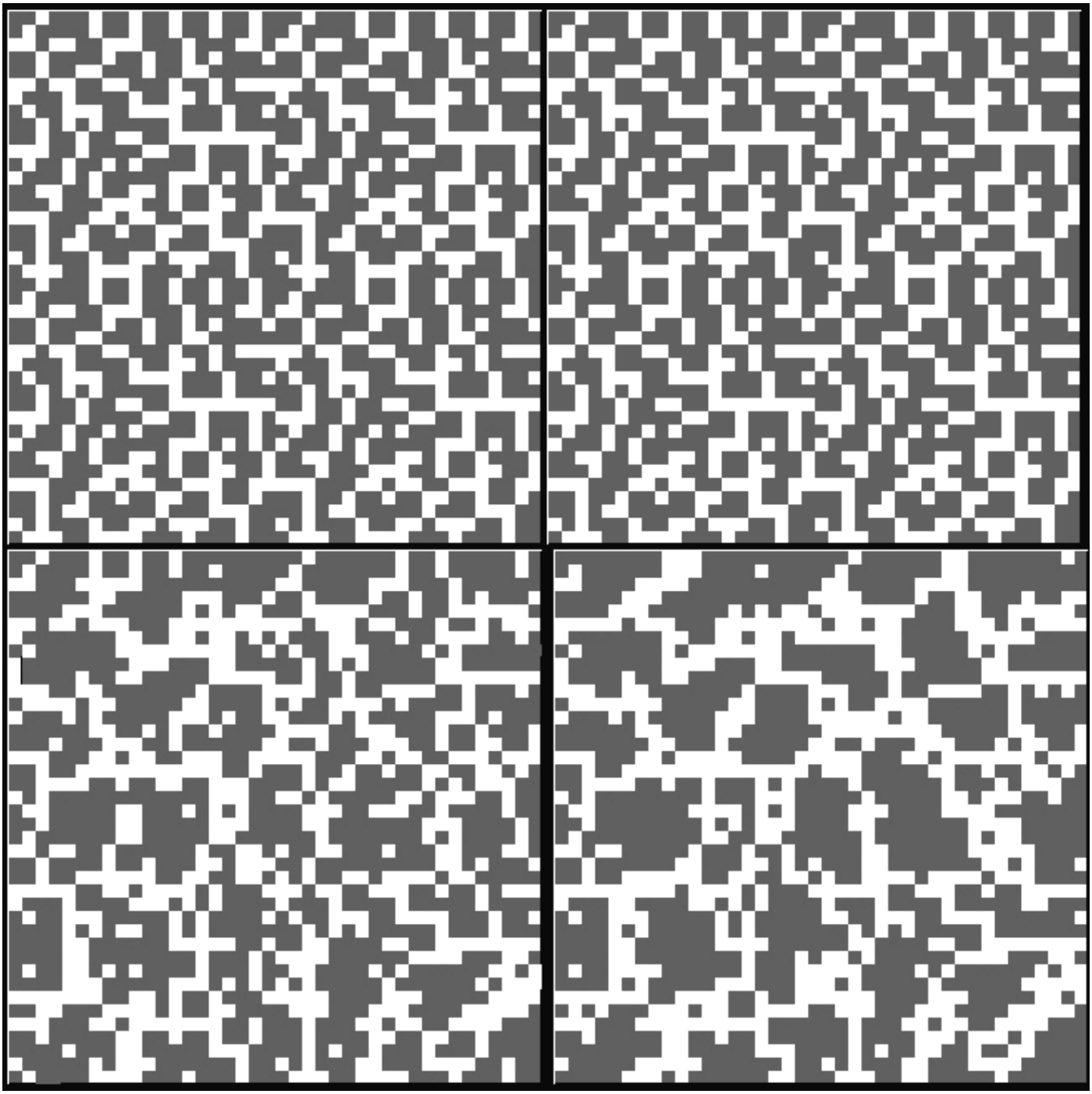


50%



60%



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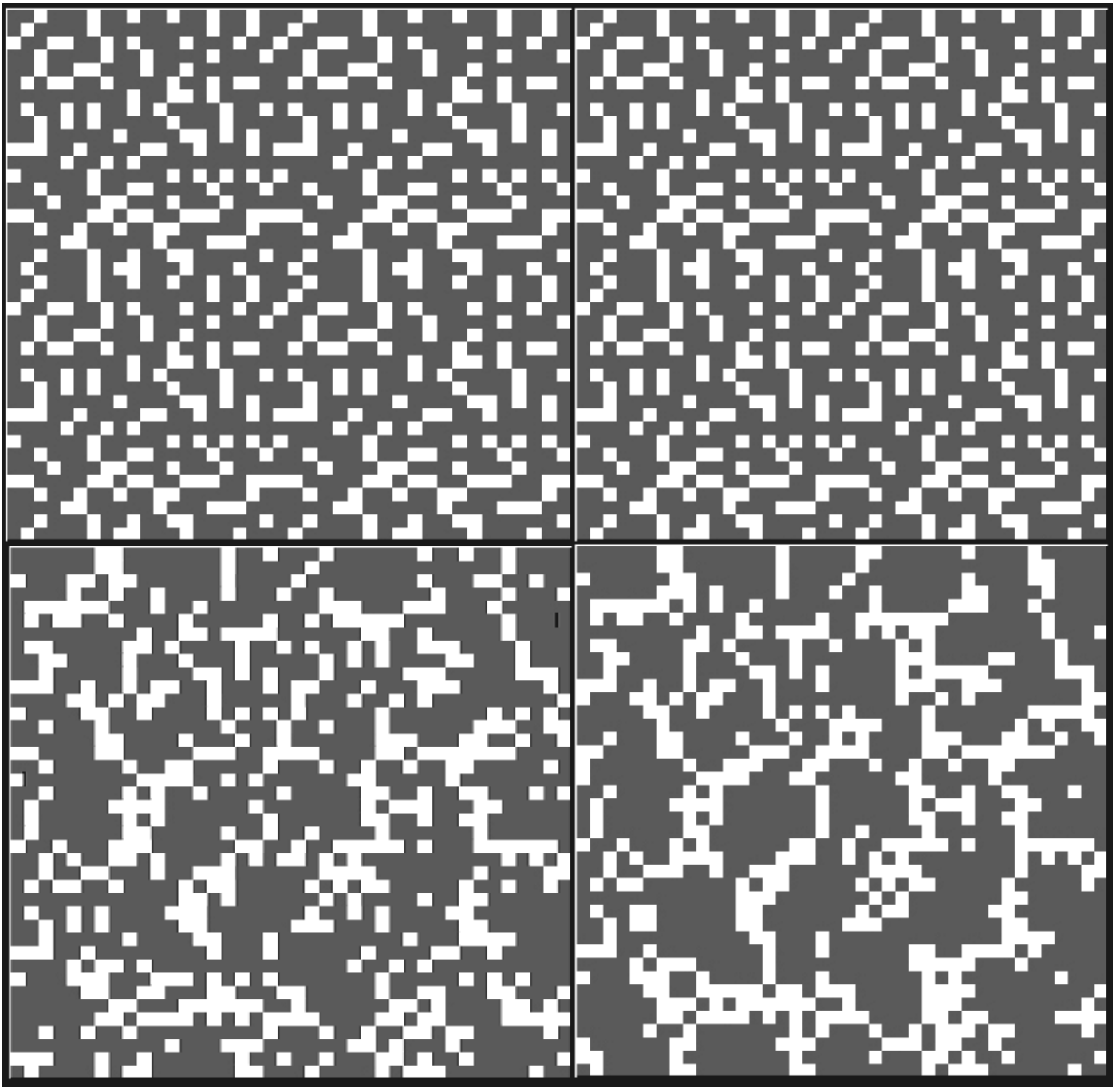
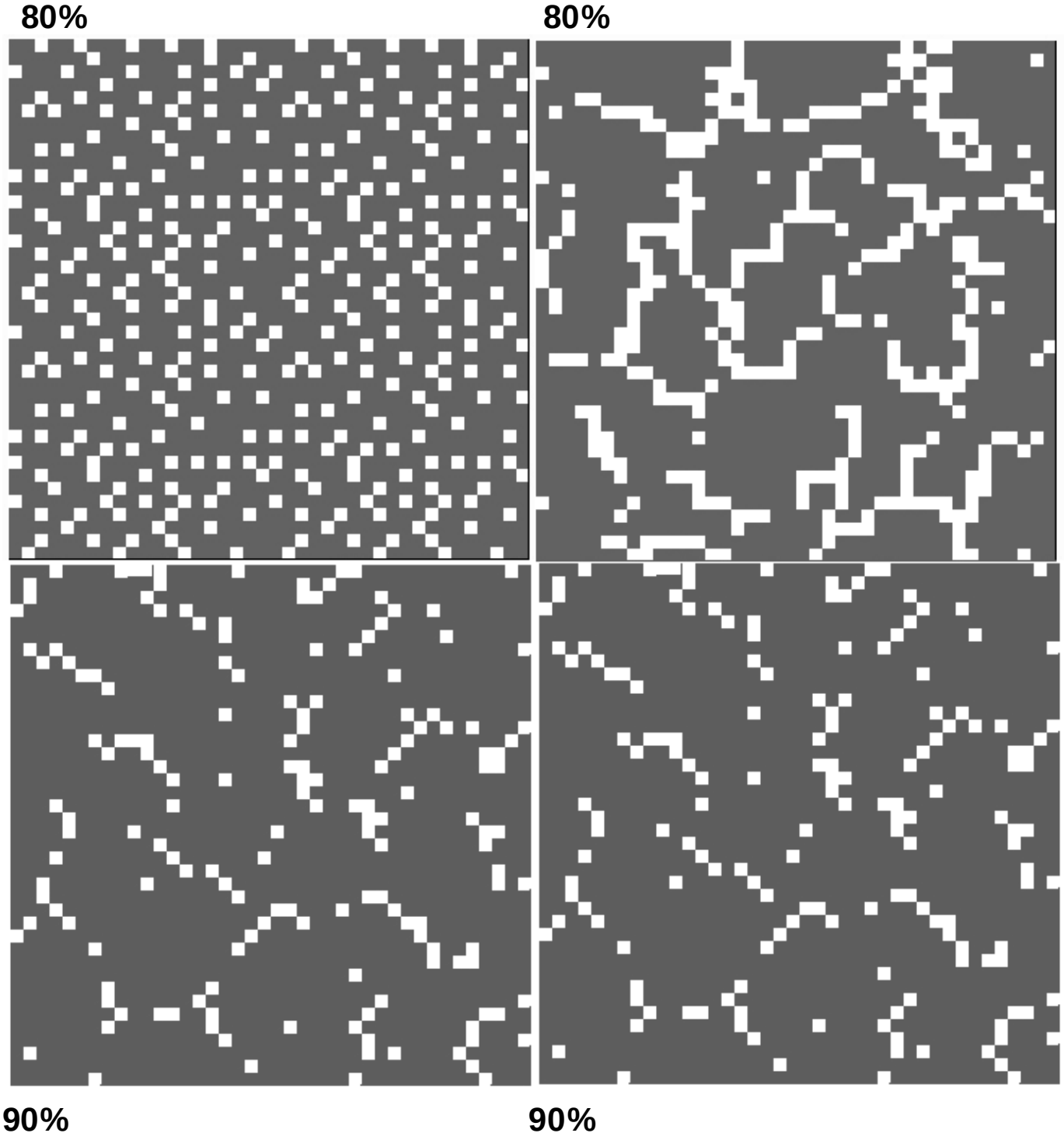
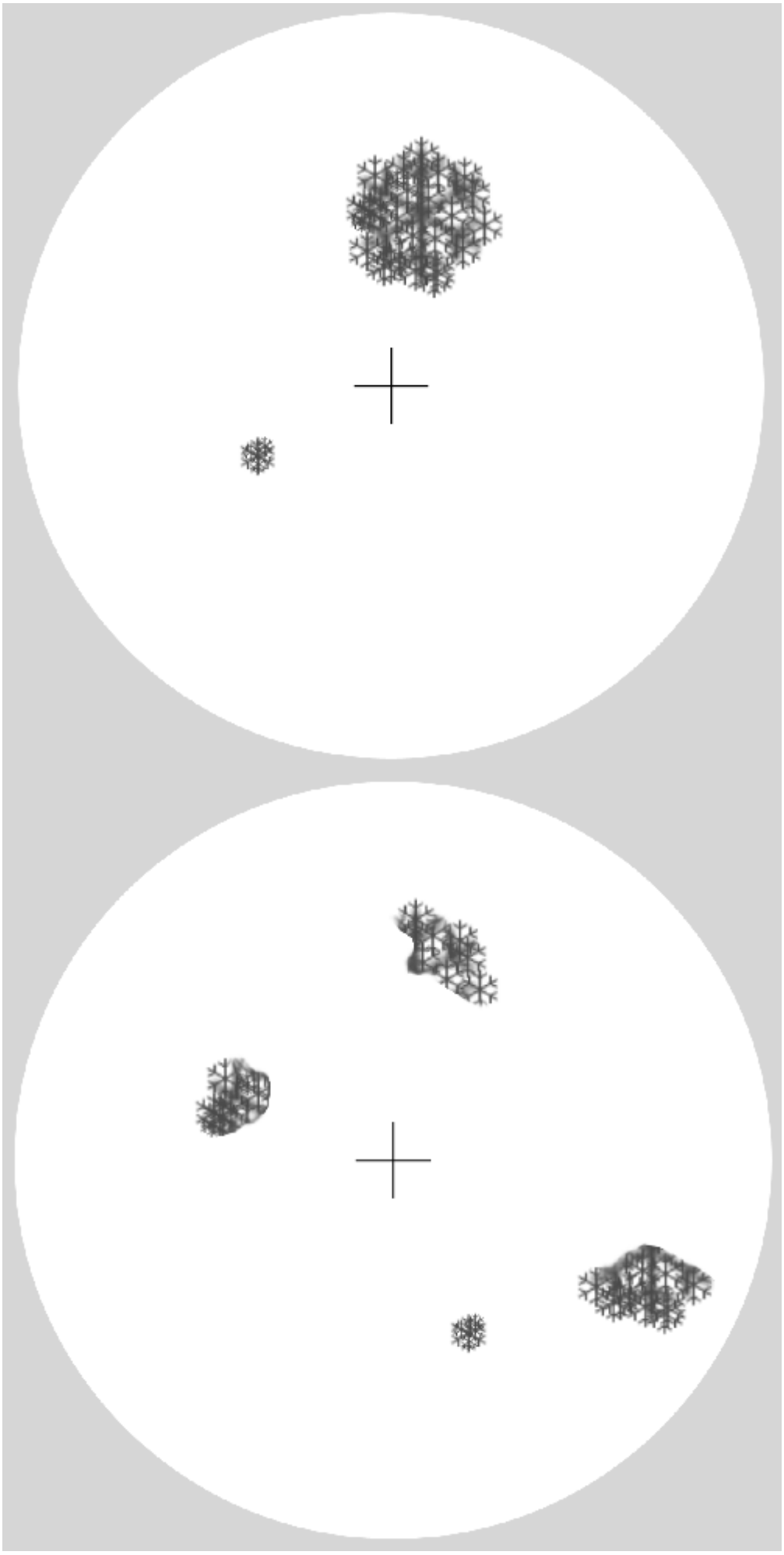



80%
80%
90%
90%

CLUMPS – 5%



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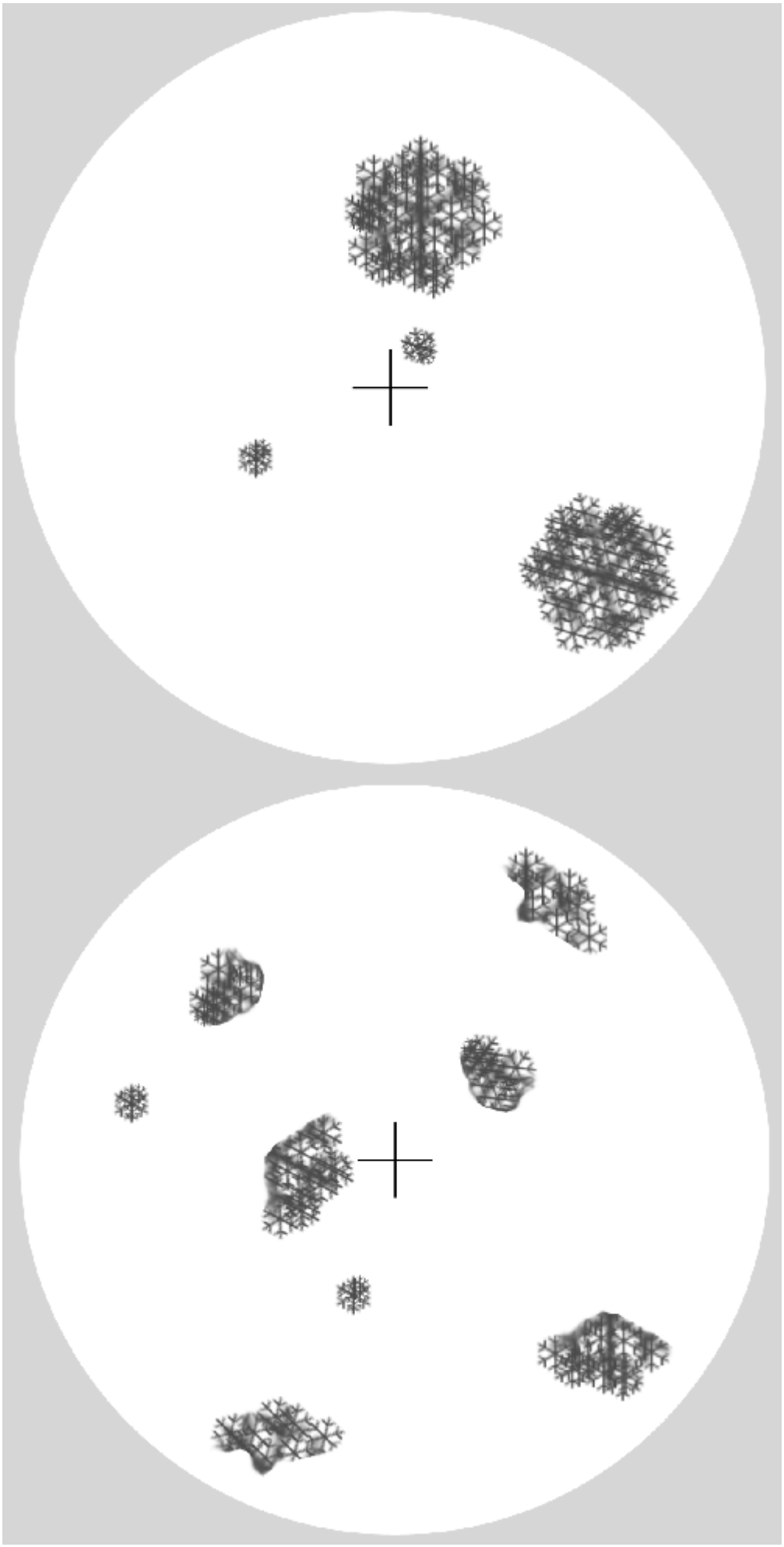

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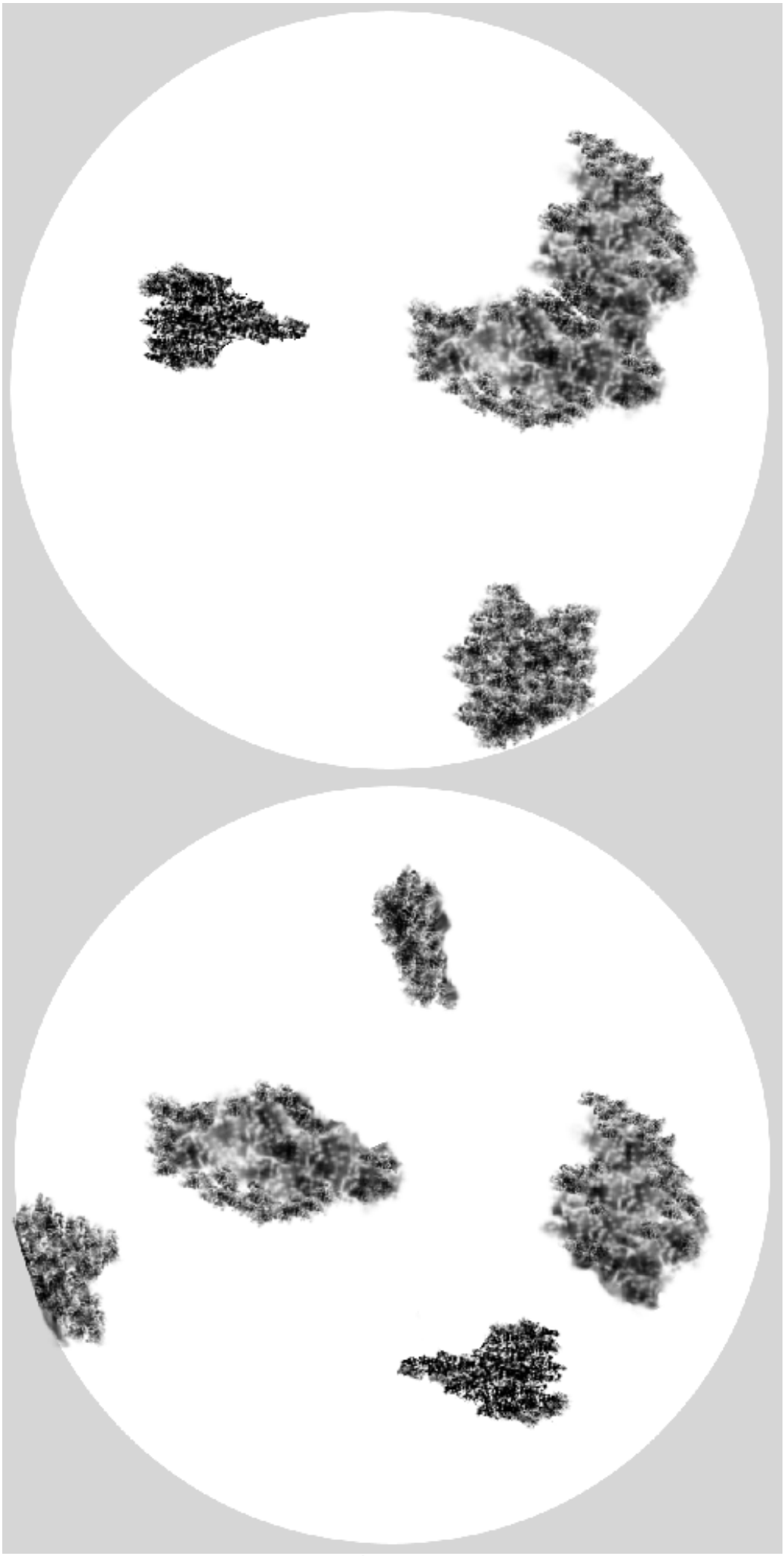
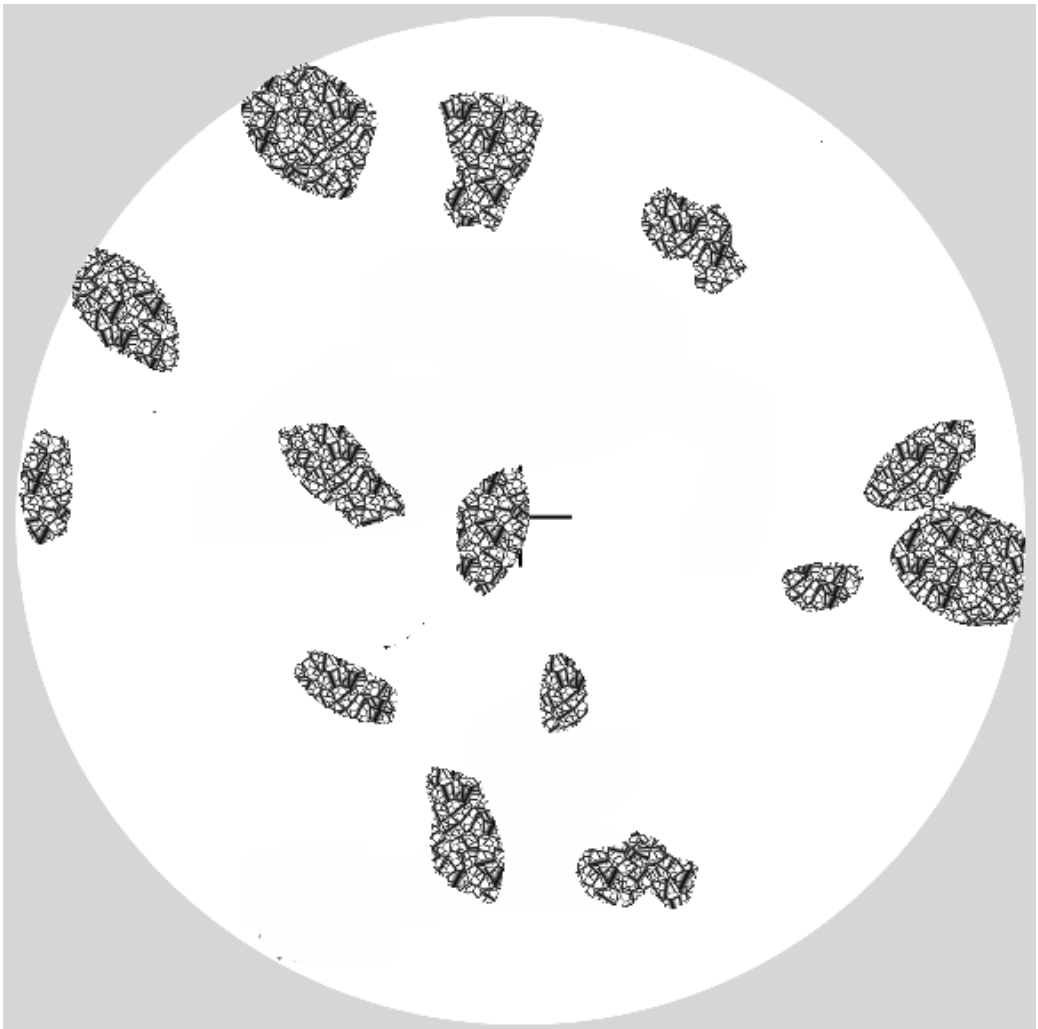
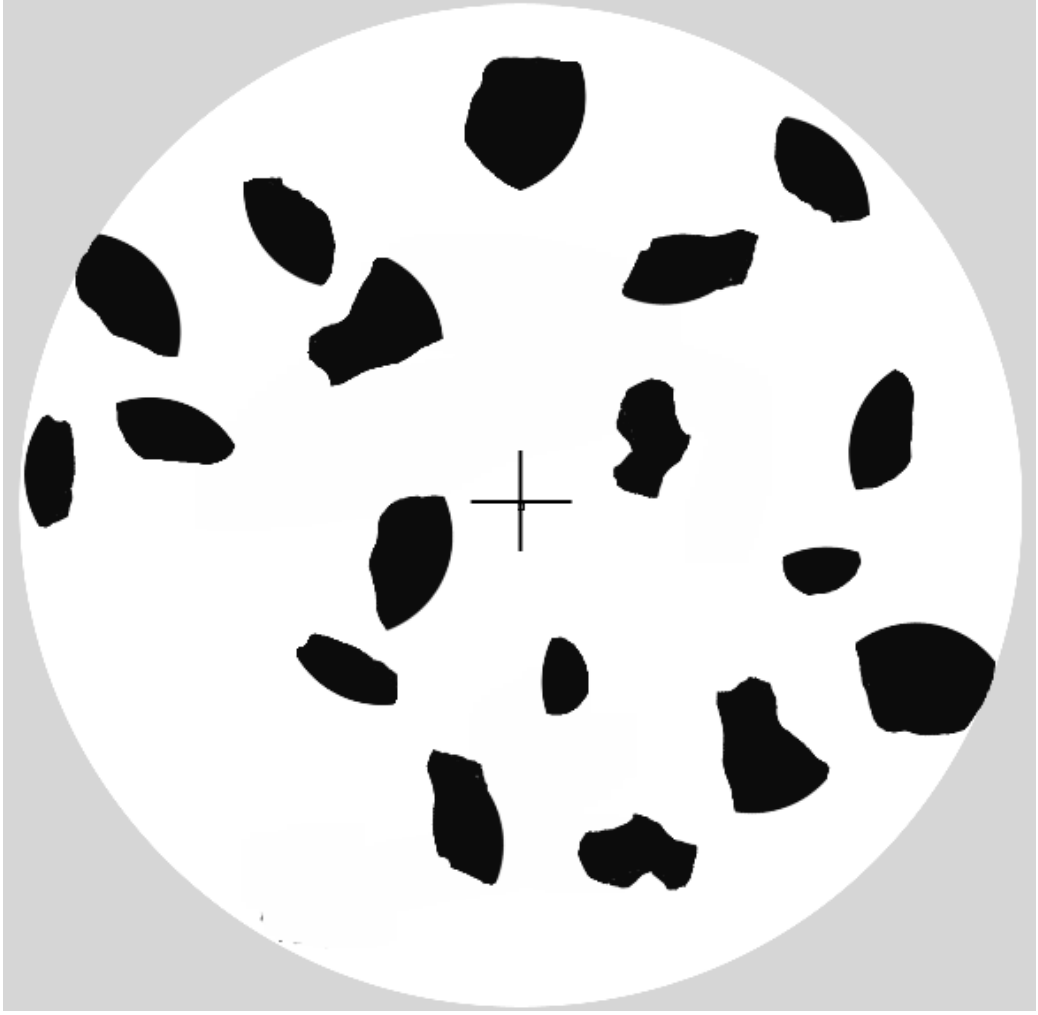


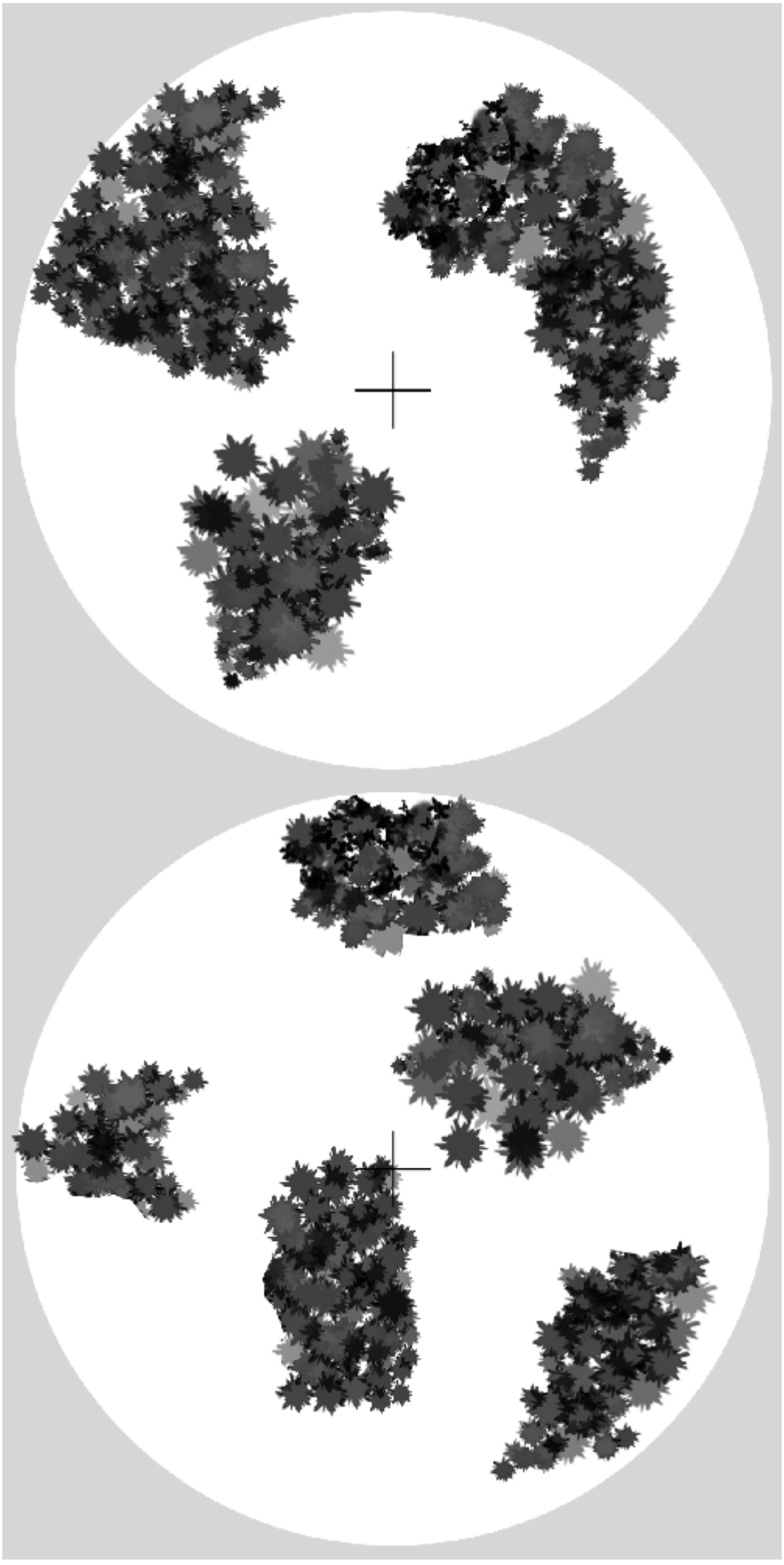


CLUMPS 16 %



CLUMPS 20 %

CLUMPS 30%



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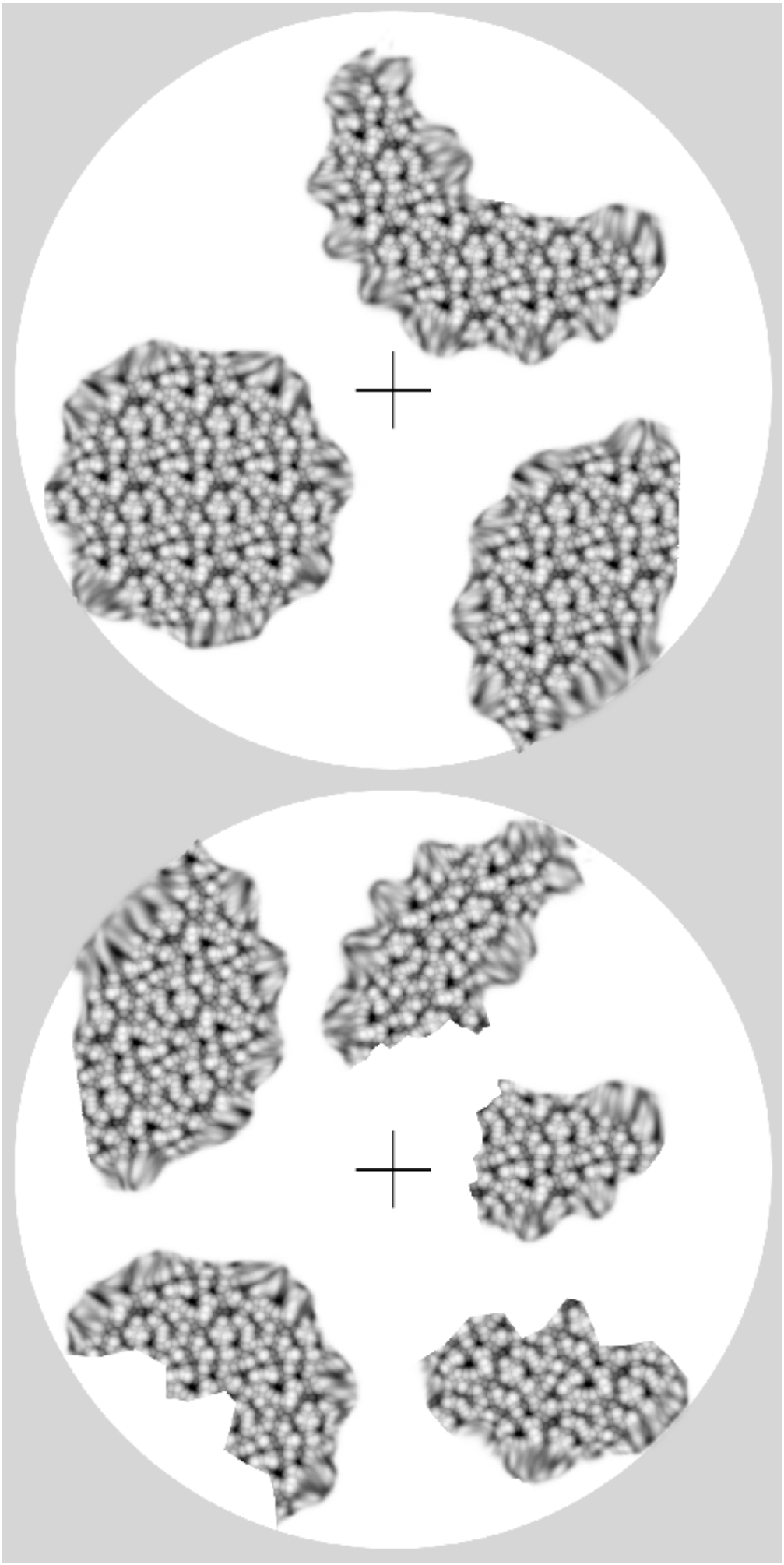
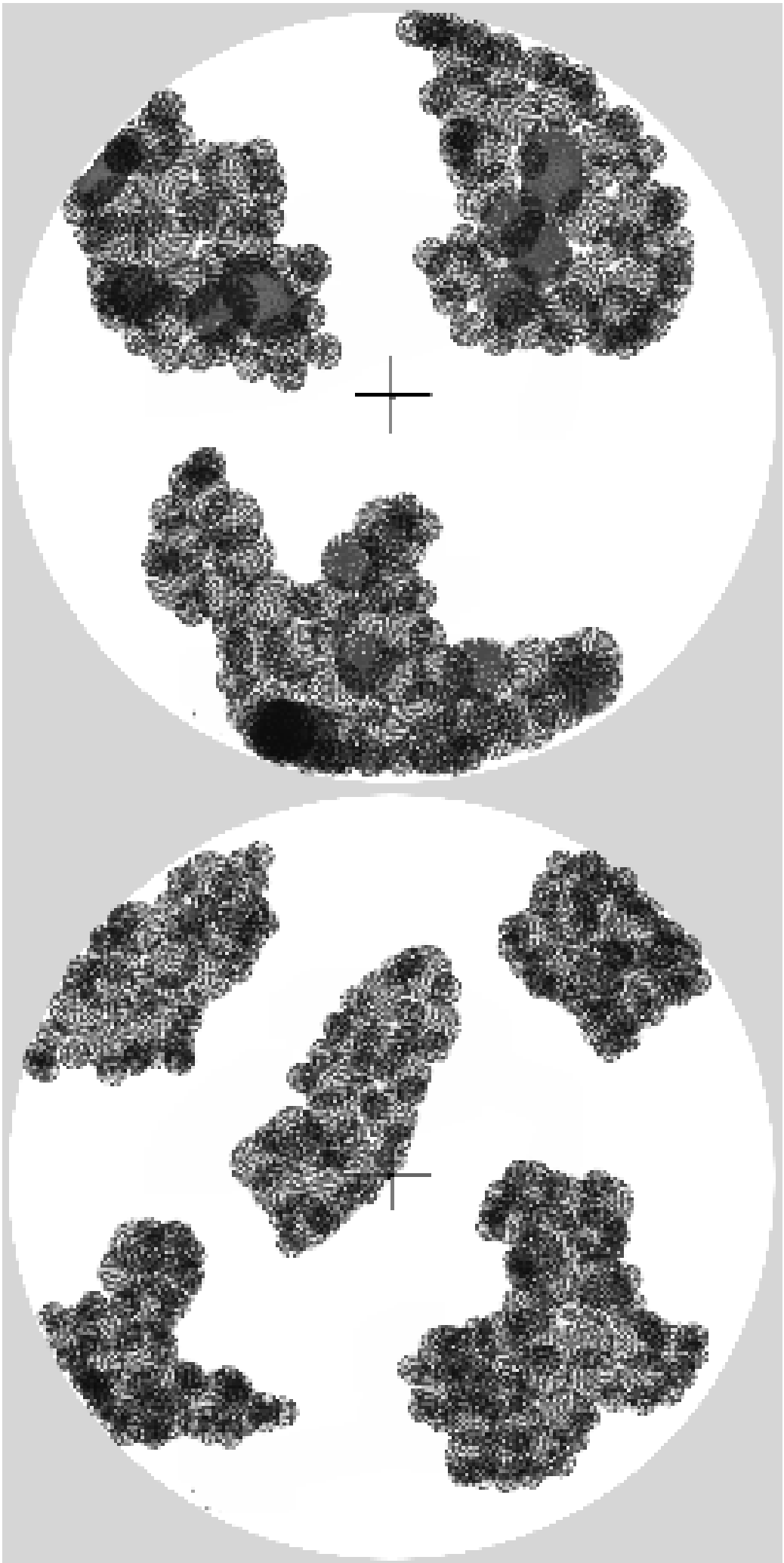


CLUMPS 50%



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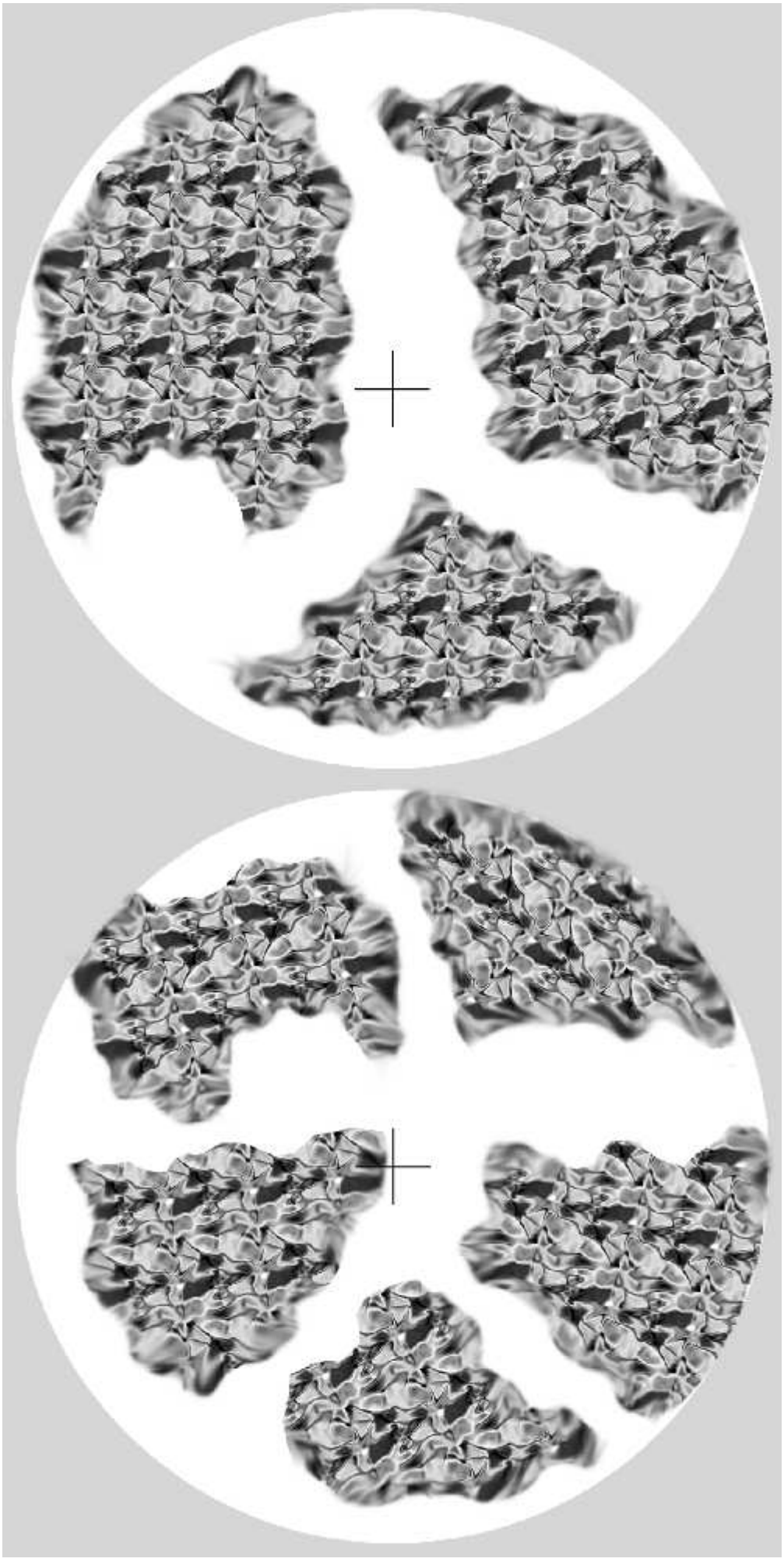
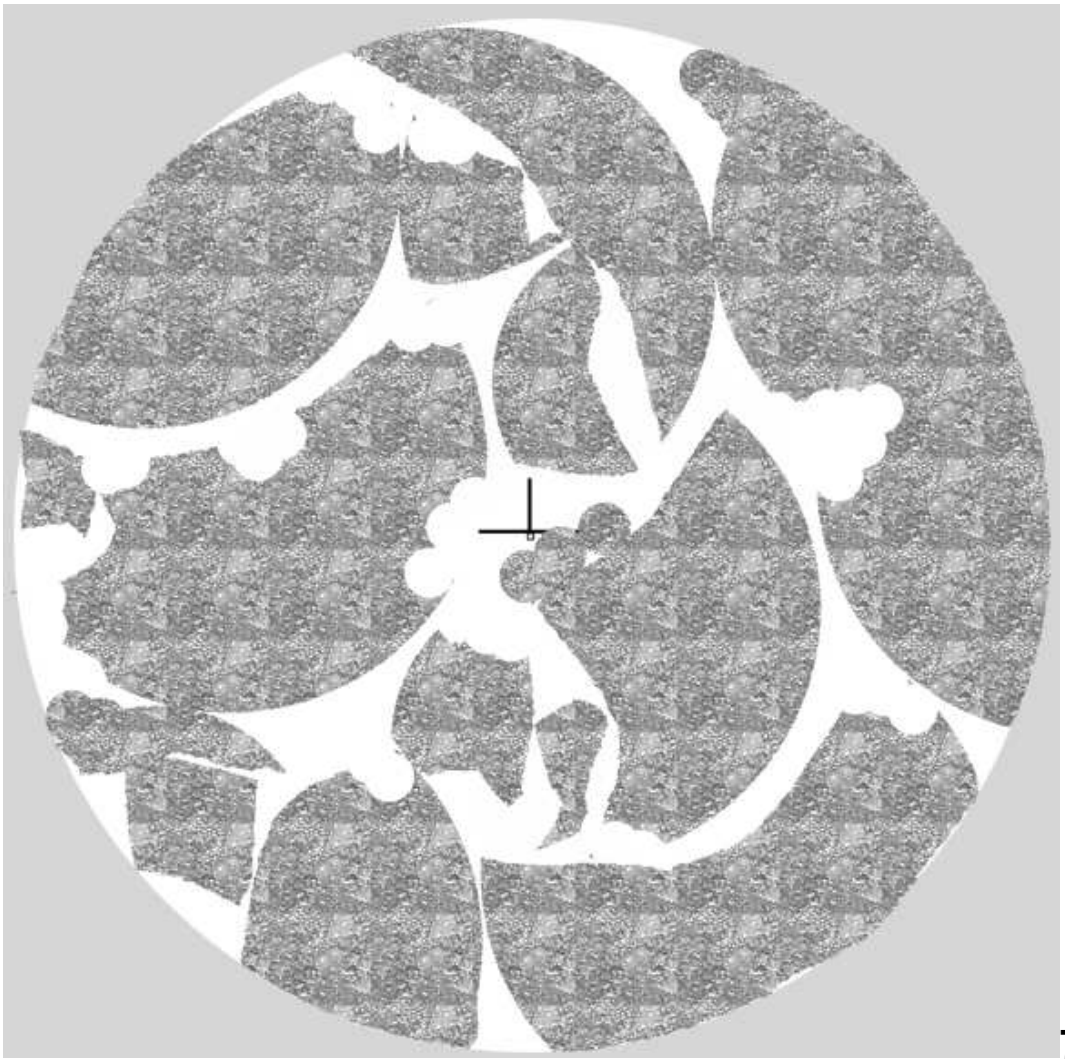
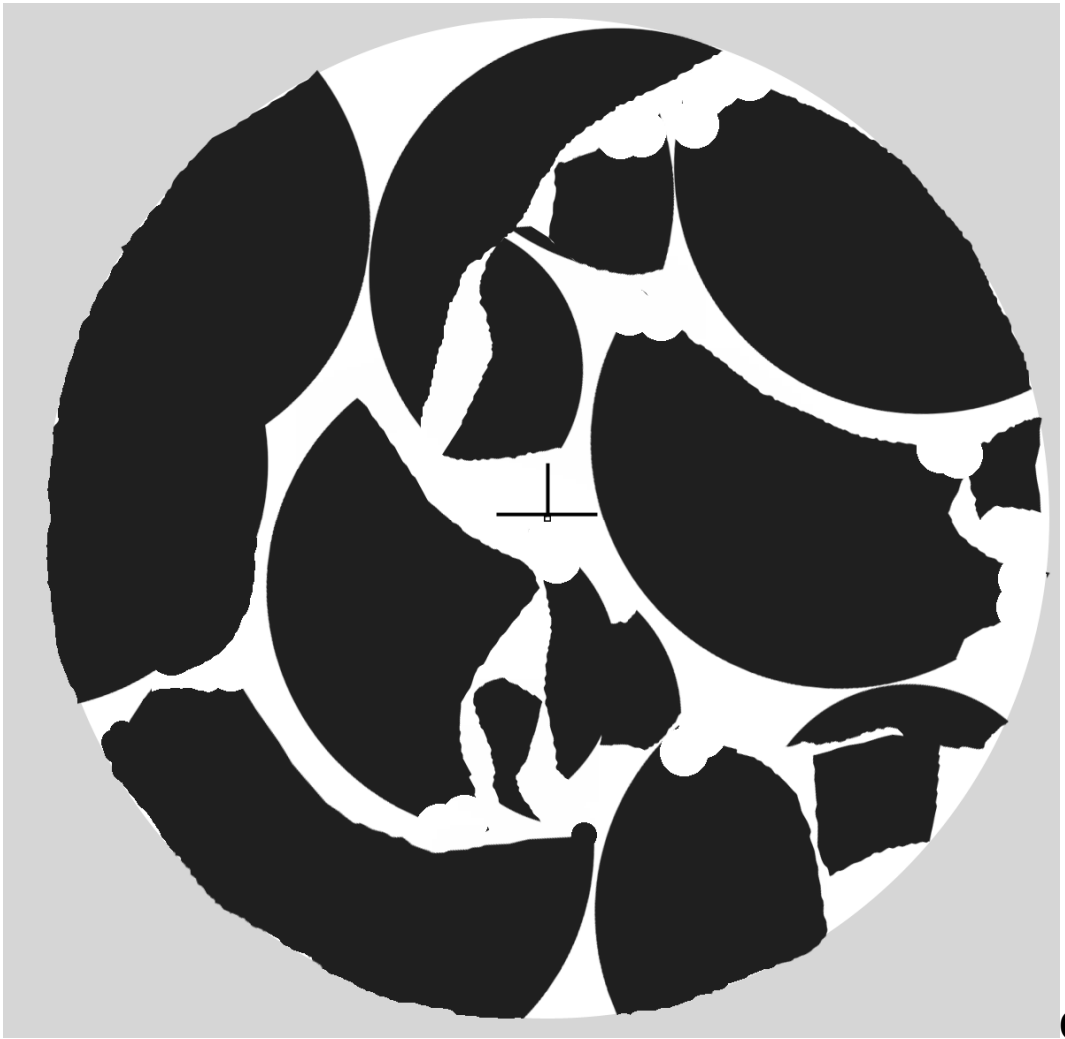


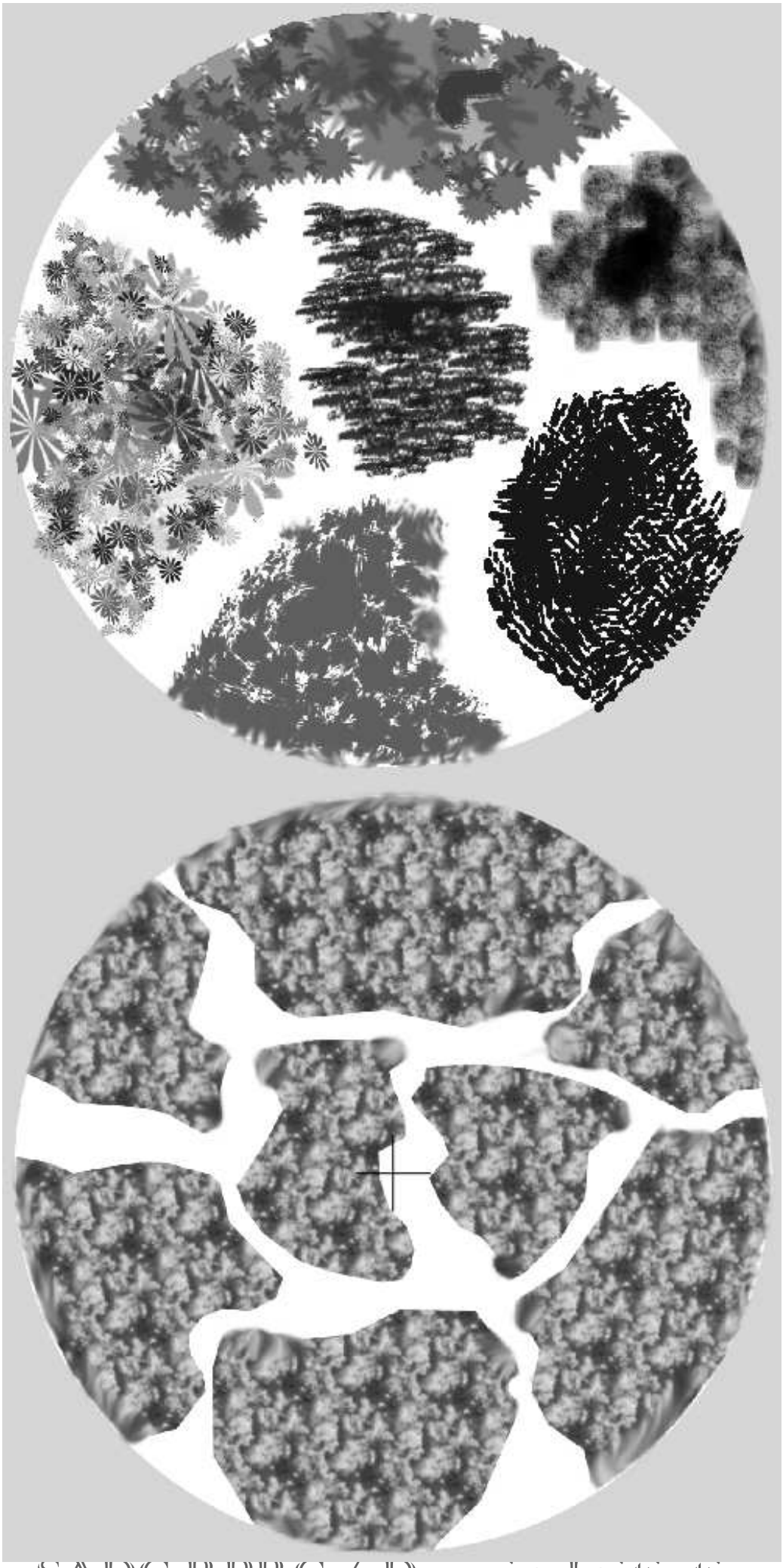


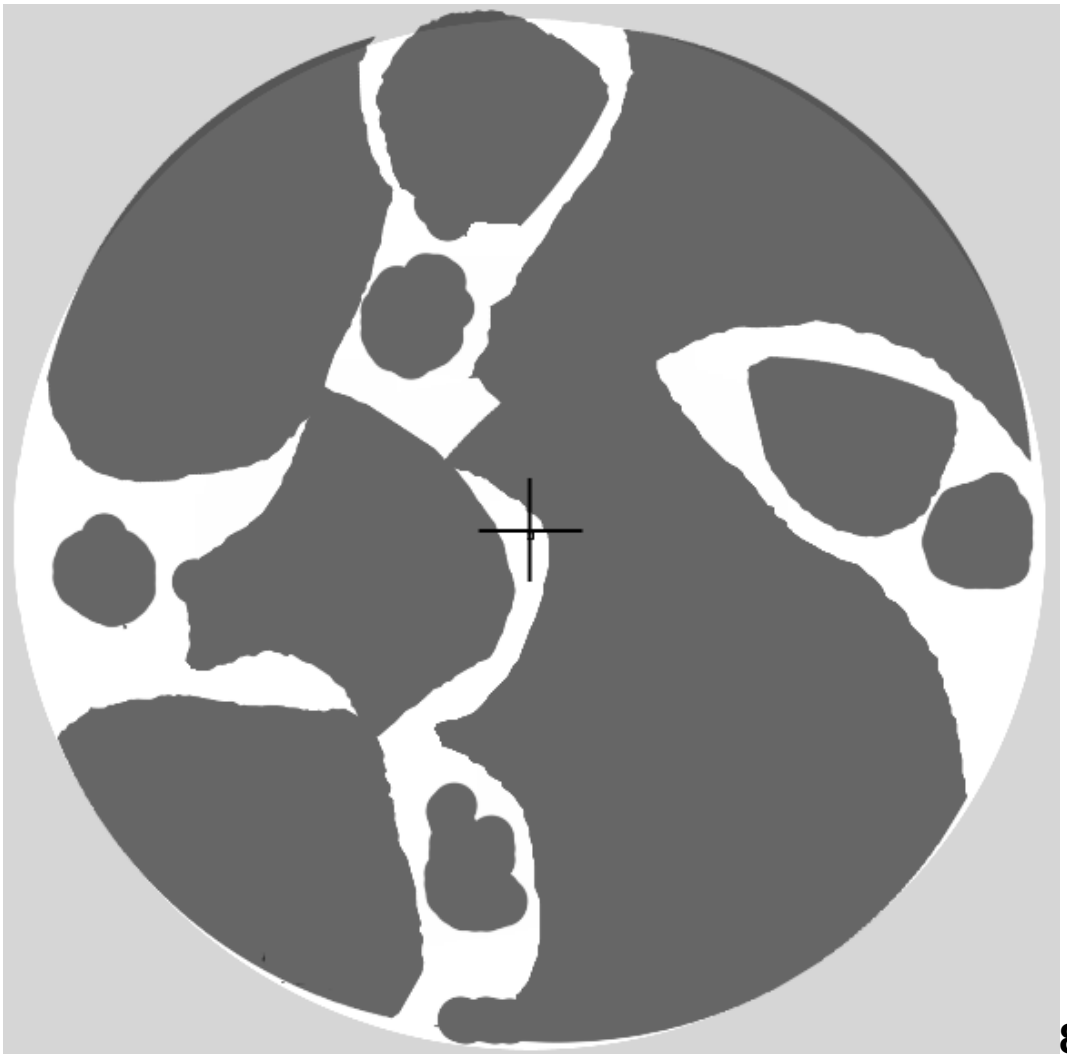
70%



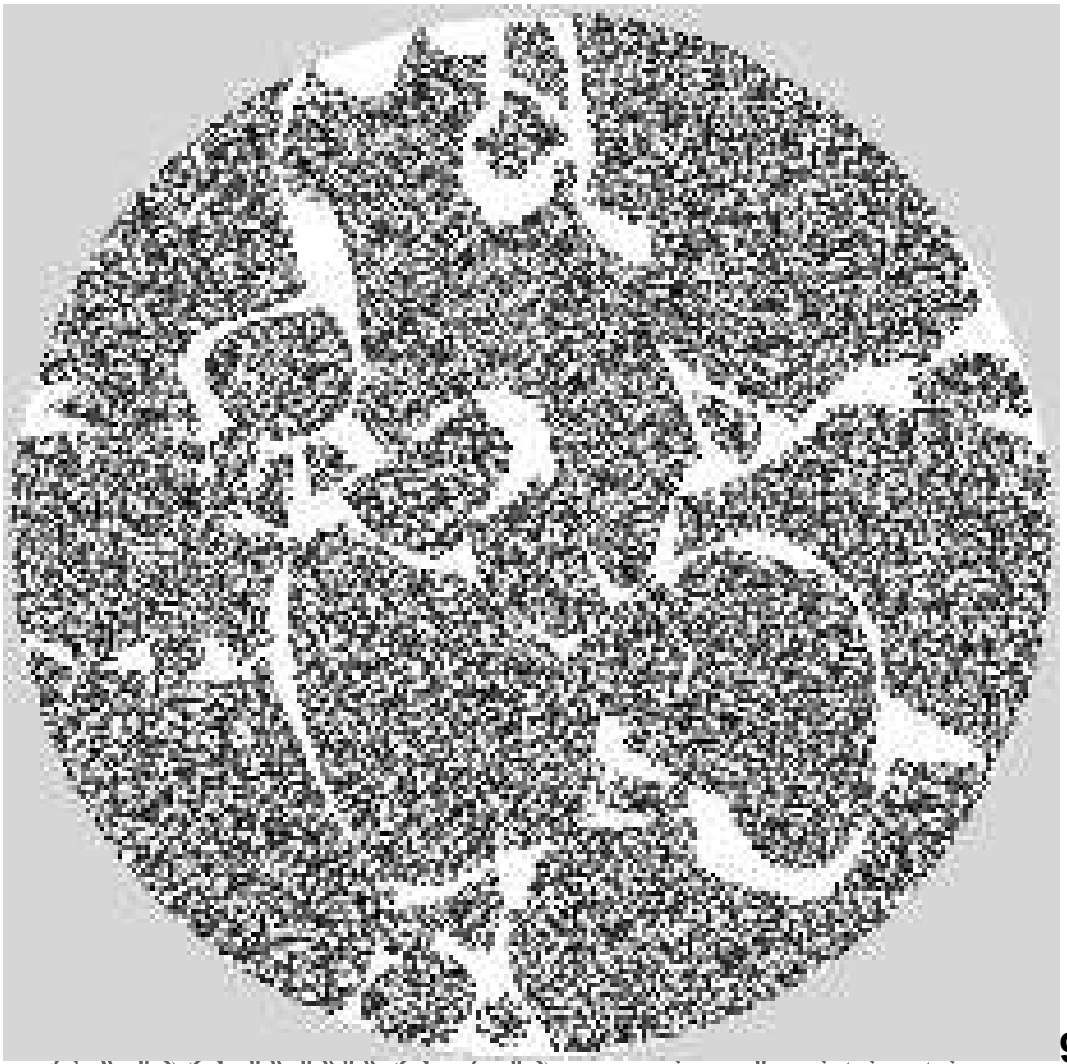
CLUMPS: 75%

CLUMPS 81%





84%



90%

APPENDIX 3A.

Learning to estimate canopy cover and depth

By Keryn Adcock

This document gives ….

- **A training session on methods to estimate**
    1. **Browsable canopy covers**
    2. **Browsable canopy depths.**

3 Answers to the practice pictures provided in Appendix 3b for canopy cover and depth.

4 Answers and tips to the 5 practice examples of estimating weighted average canopy depths, in Appendix 3b.

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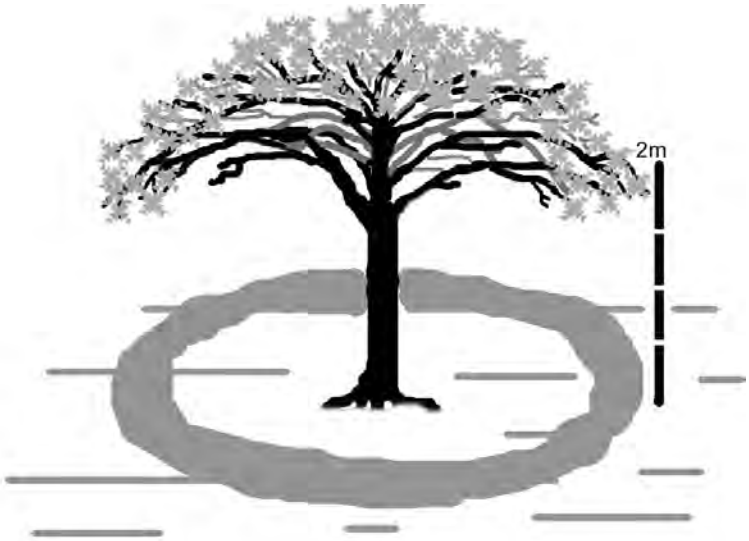
AFRICAN RHINO SPECIALIST GROUP

1. Projecting and Estimating Canopy Cover

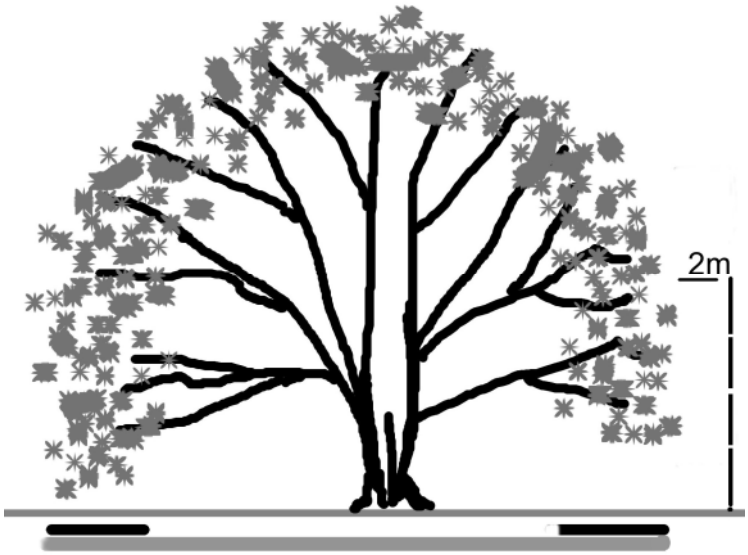
canopy depth 50cm to 1m thick, for example.



Umbrella Shaped Canopies
For umbrella– shaped trees, most of the browsable canopy can lie higher than 2m. Here, only an outer ring of branch tips falls below 2m within the rhino's "pie". This ring represents a doughnut-shaped projected canopy cover. The centre is empty with no browsable material or all material out of reach.

The reachable canopy cover may be 10-50% of the total canopy cover of the tree.

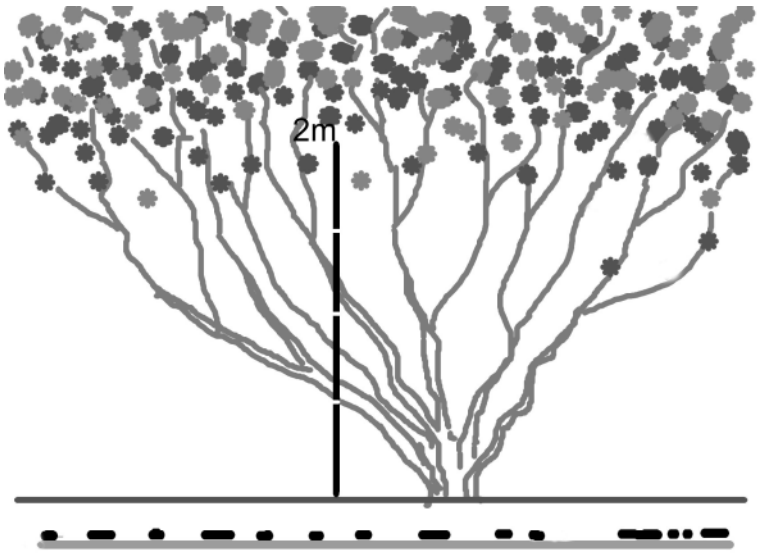
Examples: large *Acacia's, Gardenia, Erhetia, Maytenus*



Large Bushes
The centre of large bushes usually contains no browsable material, as shown in this cross section. As for umbrella trees, only an outer ring of browse is available (see black lines underneath bush).

The "empty" central area needs to be removed from the canopy cover— eg. If the whole bush would have made 60% cover in the plot, but +-two-thirds (67%) of the bush is empty inner area, then estimate +-20% actual browsable canopy cover instead.

Examples: *Rhus natalensis, Scutia myrtina, Acacia ataxacantha, Salvadora persica*



Large, Sparse Canopies
In some large bushes or trees may have only a few sparse patches of canopy dangling below 2m, or may be very sparse in terms of actual browse material. The whole bush may make eg. 40% cover in the plot, but reachable canopy bits only really fill say 20% of this. Then estimate +-8% actual browsable canopy cover instead. (20% of 40%=8%).

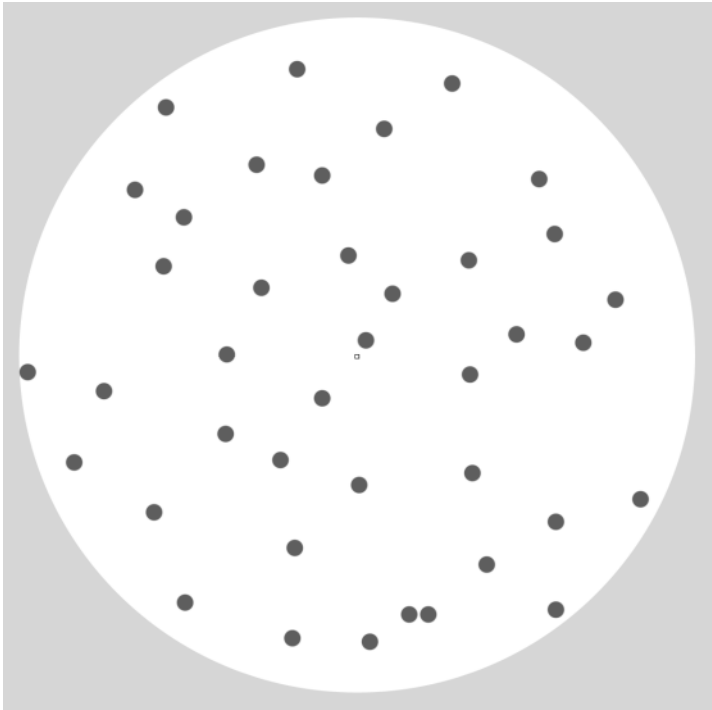
Examples: large *Euclea divinorum, A. mellifera, C.Mopane, Rhus lancea/ pentheri ,* many large trees of all kinds.

ESTIMATING TOTAL BROWSABLE CANOPY COVER.

***In the field,* you need to walk around inside your entire plot, gaining an impression of the sizes and distributions of browsable plant canopies within the area.**

For the herb layer or seedling layer in grassy areas, you need to search carefully to find plants obscured by grass and other plants.

When you're ready to make your final judgement, return to the centre of the plot which gives you an all-round perspective of the situation.

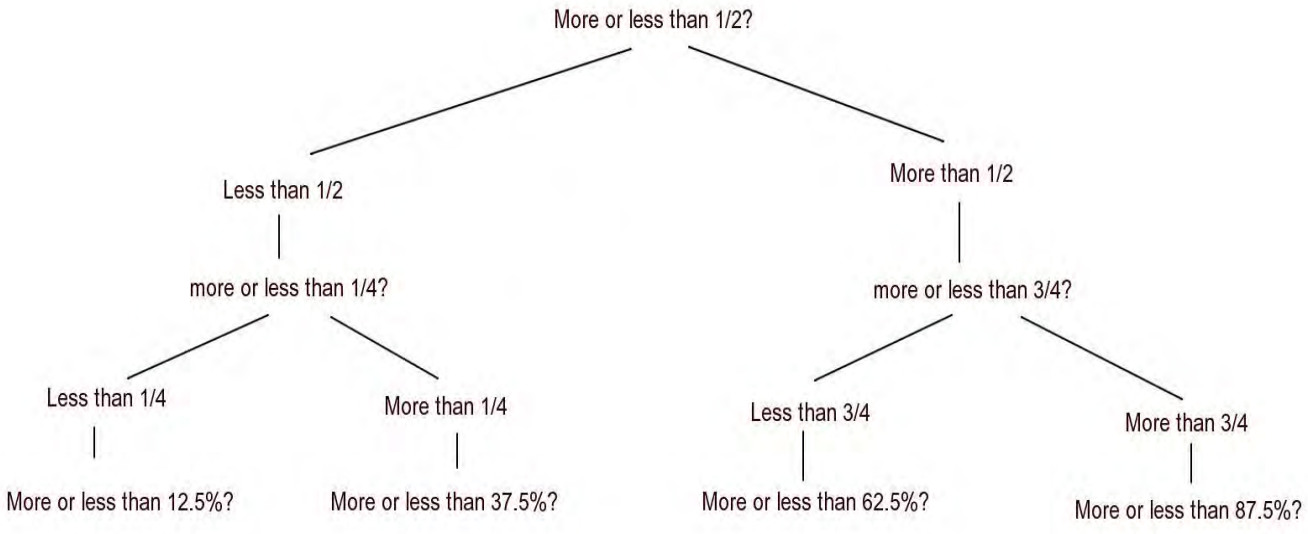


In your imagination, project browsable canopy areas onto the ground and ask…What % of the vegetation plot (shown as circular white area below) is covered by browsable plant canopies?

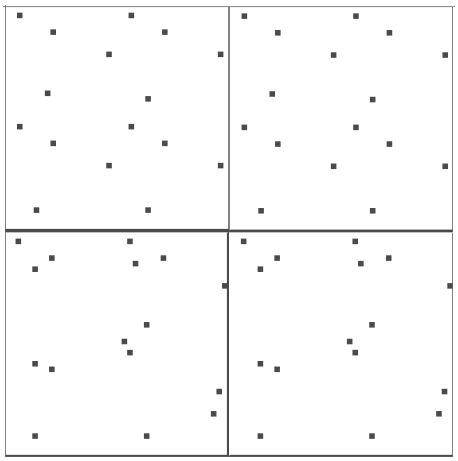
Use 1 or all 3 of the methods described below to make an estimate.

But first, a good way to start to get in the right ballpark with each of the 3 methods is to use the Successive Halving Approach…...

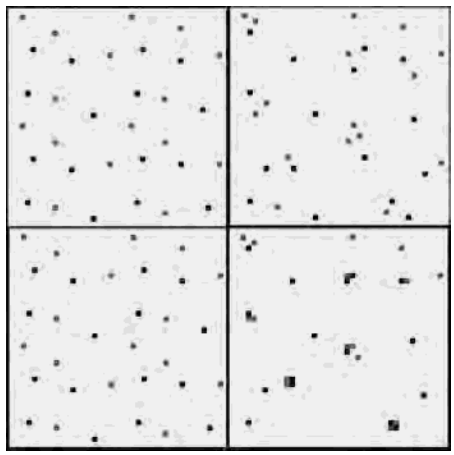
Do the canopy covers fill more or less than half the plot (50%)? If less than half, do they fill more or less than ¼ of the plot? If less than ¼, is the fill more or less than 12.5% (1/2 of 25%)? Etc…..



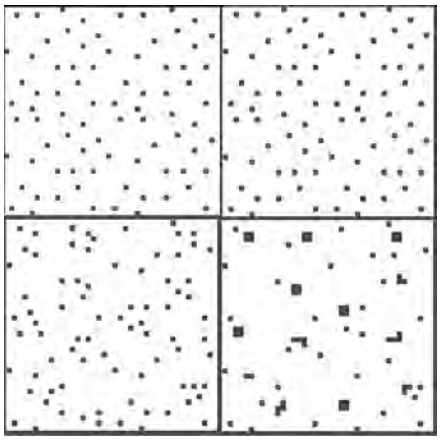
Method 1: CANOPY COVER PATTERN MATCHING: **Compare your vegetation area (e.g. the one above) to the Canopy Cover patterns in Appendix 1:**



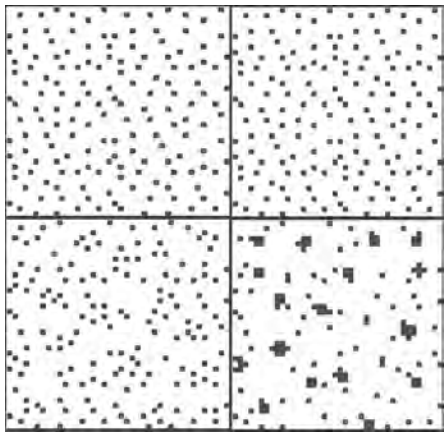
1%



2%

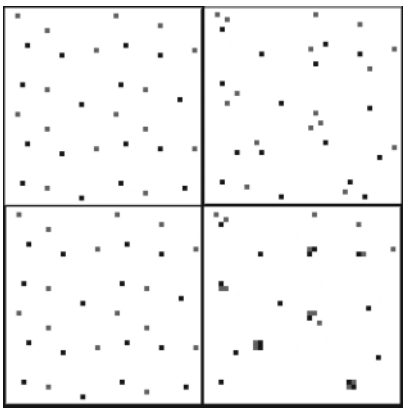


5%

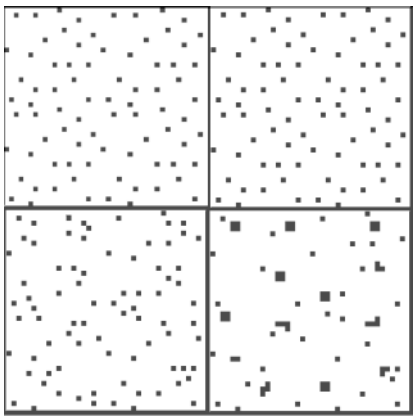


10%

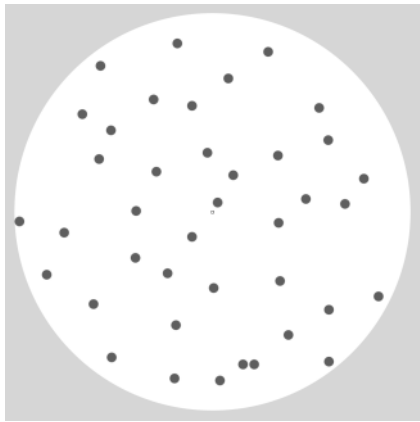
Compare the density of dots (= canopies), and the relative average amount of space between the dots relative to the average size (diameter) of the dots. Find one pattern that seems similar. Ask – is my canopy cover more or less than this? If yours seems less, look at the next lowest % canopy cover pattern. If yours seems more, look at the next highest % canopy cover



2%



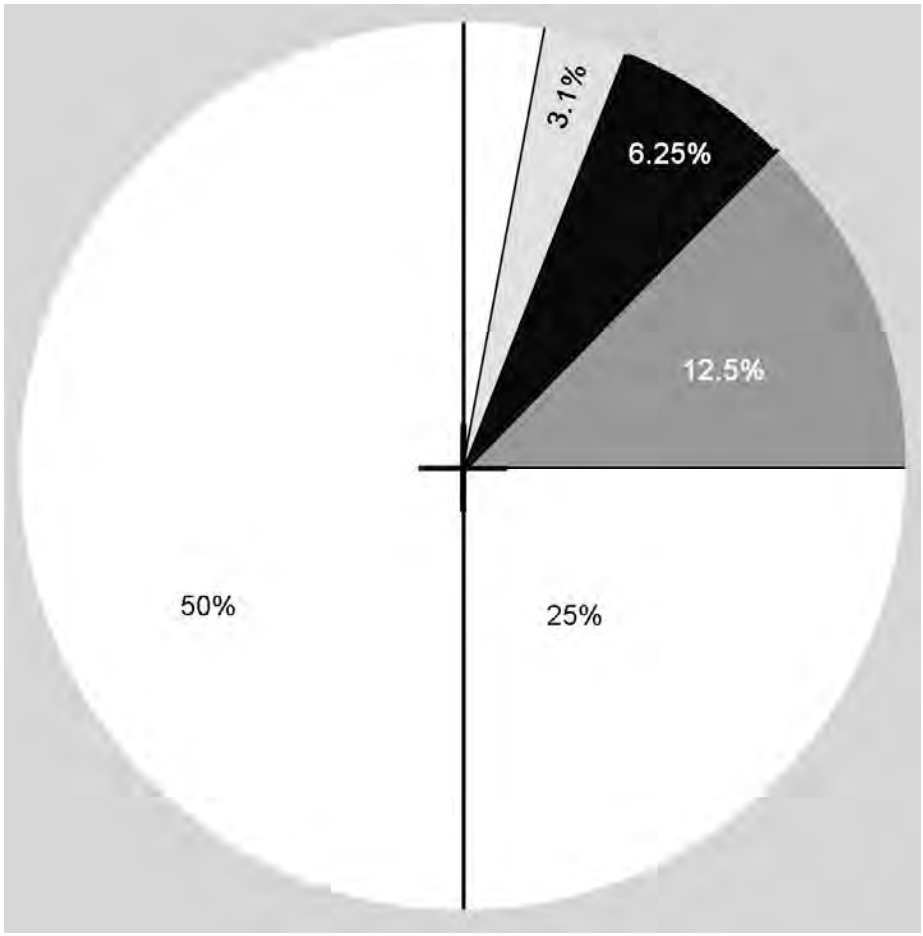
5%



Your circular area seems to have a pattern similar to the 2% picture – do you agree? Could it be as much as 5%? Or less than 2%? … or a bit more than 2% but not near 5%....? Decide on your best canopy cover estimate.

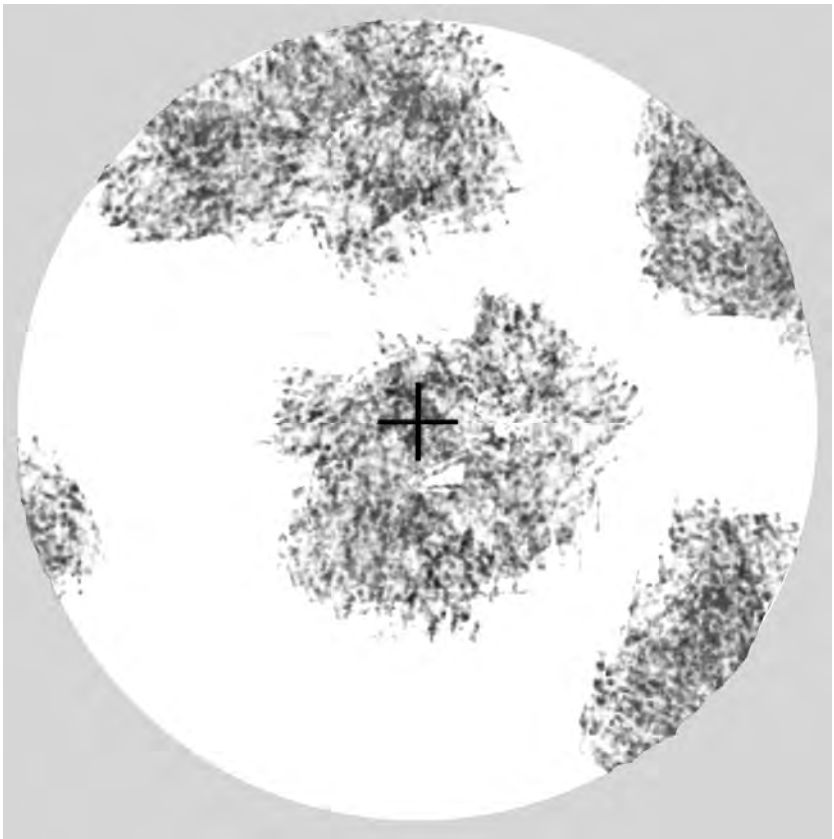
CHECK you decision to make sure it makes sense.

Method 2: For bigger bushes, the CANOPY RE-ORGANIZING METHOD can be used:



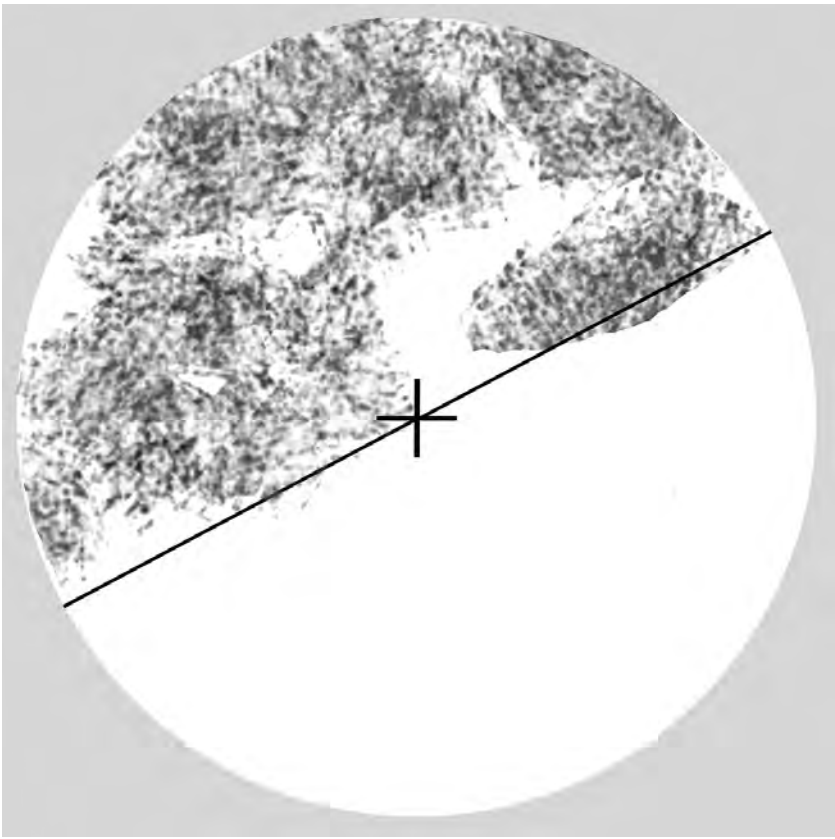
First, in your imagination, divide your plot area into segment representing different percentages of the total plot.

In the field: *get to know how to estimate a 25%, 12.5% , 6.35% etc wedge by standing in the centre of the plot and using your arms to mark out the angle representing such spaces.*

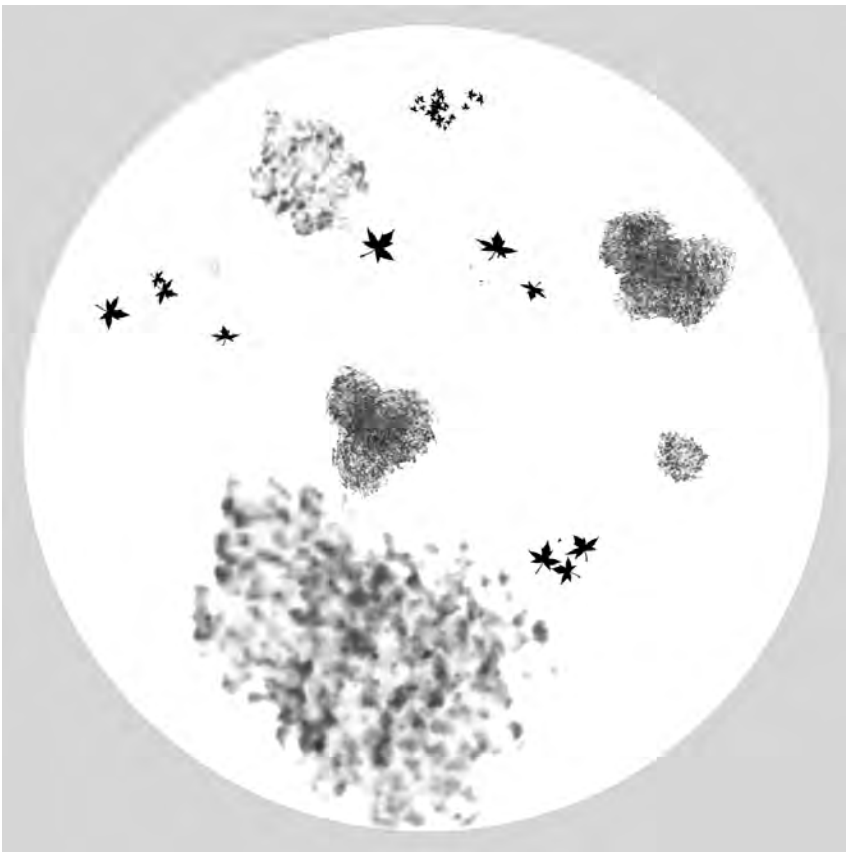


Look at the available plant canopies in your area……..

Then in you mind, move and lay out the canopies (tight together but in an approximately non overlapping manner) to fill up a segment of the area (eg in a 12, 25% or 50% segment).



In this example, you can "see" that one half (i.e. 50%) of the area is not quite filled with canopies. It looks like he canopy cover is somewhere between 40 and 45% !



Try this example…. in your mind's eye move the canopies around and lay them together:

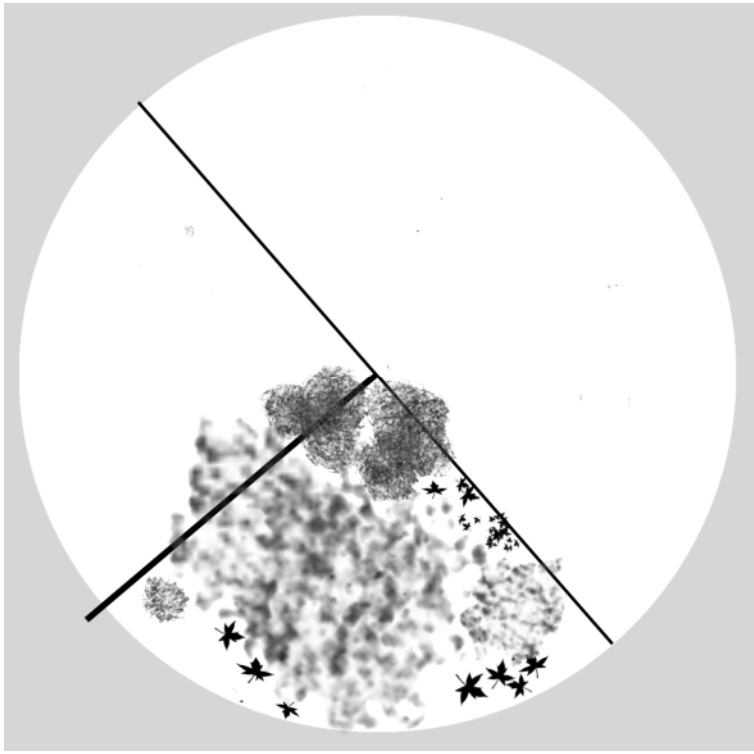
Do they fill more or less than half the plot?

If less than half, do they fill more or less than ¼ of the plot?

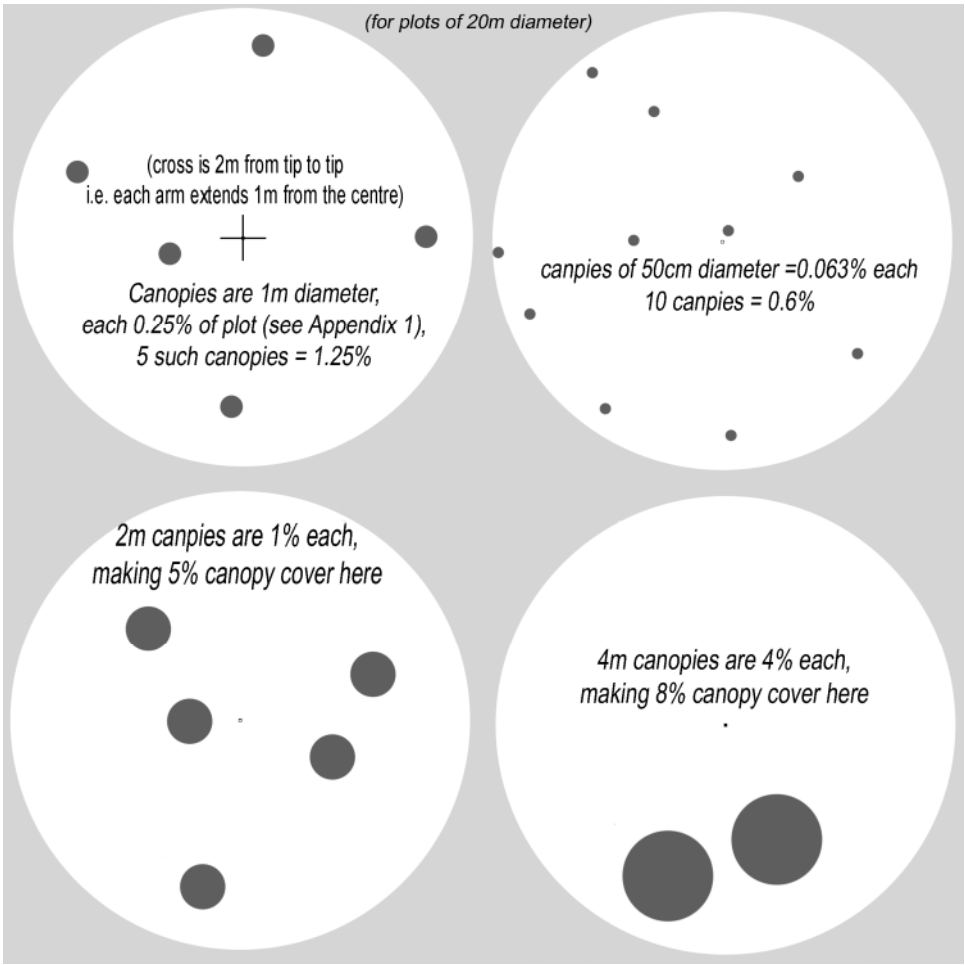
If more than ¼, is the fill more or less than 37.5% (25% +1/2 of 25%) …

Decide what % of the area they fill, approximately (see next page for picture example showing the approx. %)

25-28%

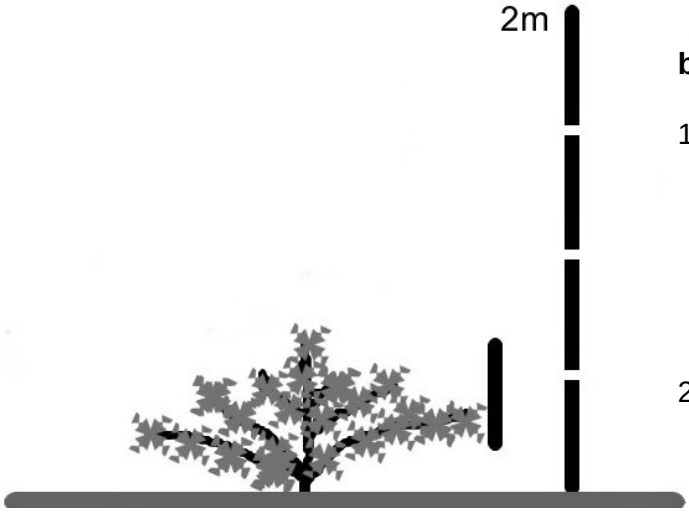


Method 3: CANOPY DIMENSIONS REPRESENTING KNOWN %'s OF A GIVEN PLOT SIZE



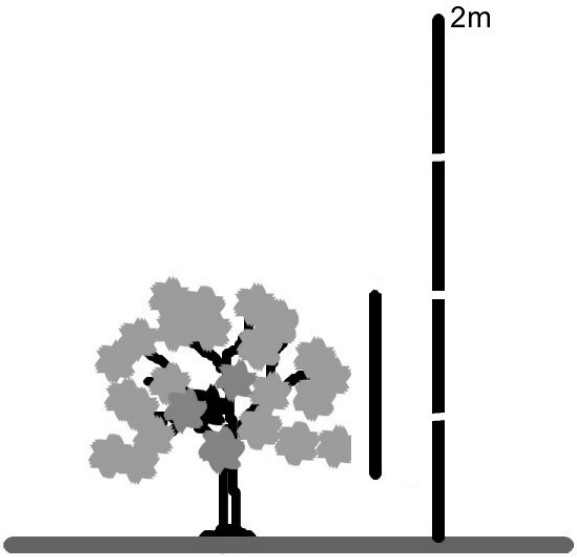
This method involves using the knowledge that certain canopy dimensions represent a certain % of an entire plot's area – See Appendix 1 for tables of such %'s.

2: ESTIMATING BROWSABLE CANOPY DEPTH



Smaller Plants—Seedlings, shrubs and bushes:

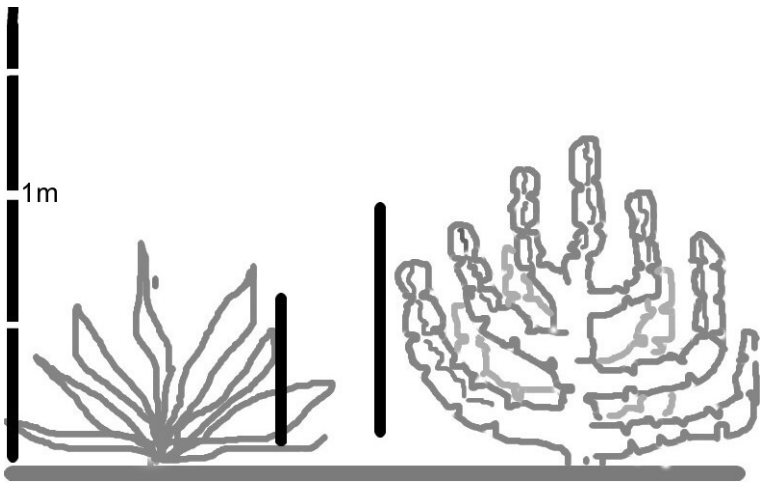
1. look out for dead space (with no real browse) underneath the lower branches. Do NOT automatically start measuring canopy depth from the ground level, but try to account for the dead space where this occurs (10-20cm up, for example)
2. If the lower branches slant upwards from the stem, start measuring +- 1/2 way up the slant
3. don't necessarily measure to the top of the absolute highest twig, but to the approximate average of the highest twigs across the canopy breadth.



Examples:

young or re-sprouting plants, dwarf or Karroid shrubs….

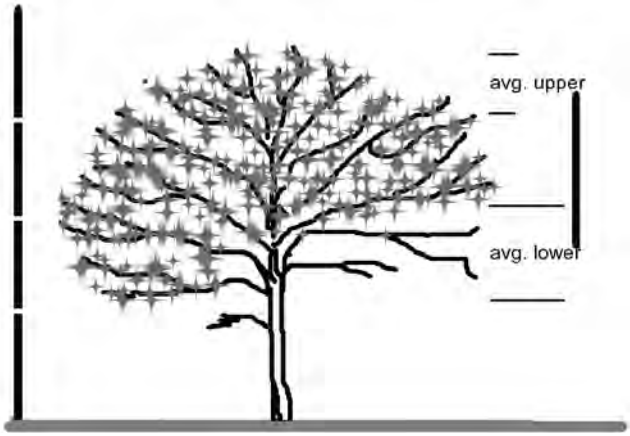
Acacia', Dicrostachys, Lippia, Euclea, Monechma, Petalidium, Cyathula, Barlaria taitensis, Psiadia, Asparagus, Catophractes, Monechme



***This also applies to spiky plants** like*

Sansavaria's and ground Euphorbia's

(E. bothae, E grandicornuta, E damarana, etc.)

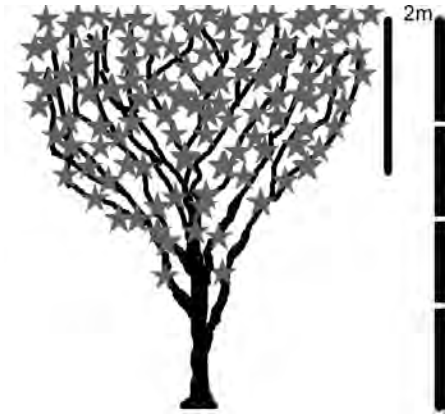


<— Lop-sided plant canopies:
Very often, woody plants have lop-sided canopies —the <u>browse reaches lower on one side than the other</u>.

You need to look at the lower canopy properly, all round the plant, to decide at which lower level to start measuring the canopy depth from. Take an <u>average of the lowest browsable branch levels</u> around the plant.

(For rounded upper canopies, take the upper level at an average level of all top branches as shown).

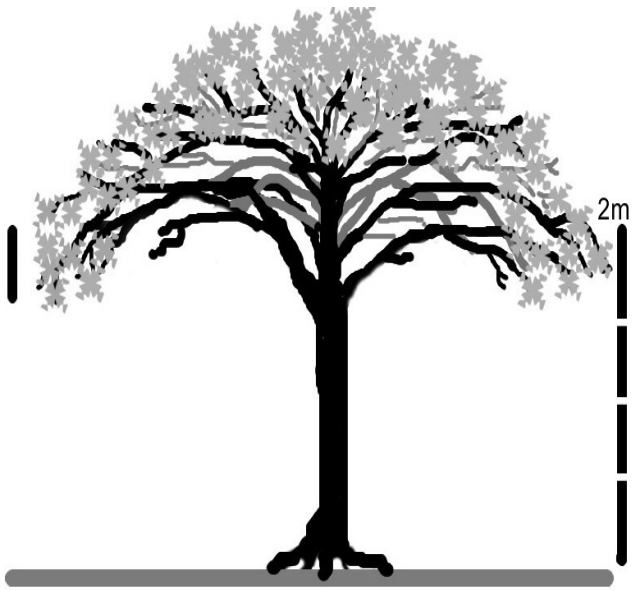
Examples: all species!



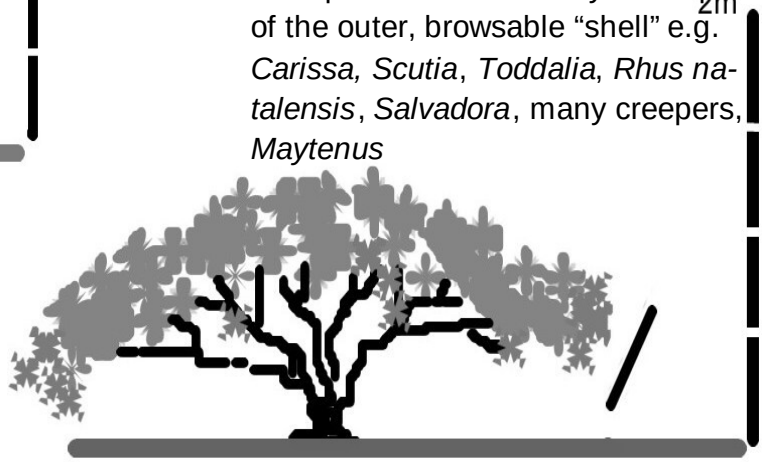
<— V or U-shaped plant canopies:
Many tall plants have branches which slant upwards and outwards from the centre stem(s).

Take the lower canopy level at an average level of all lower branches that have browse, as shown. E.g. *Acacia*, *Bauhinia, Maytenus*, *Croton*, pollarded *C.mopane*

Umbrella trees
(*lower left*) Measure only the average depth of the browsable material hanging into the 2m zone on the outer rim of the tree as shown. E.g large *Acacia, Gardenia, Erhetia, Maytenus*, *Combretum*



Low thicket-type bushes:
These usually have an outer "shell" of browsable material, with the inner / underneath parts lacking actual browse. Look carefully in/ under such plants-Measure only the depth of the outer, browsable "shell" e.g. *Carissa, Scutia*, *Toddalia*, *Rhus natalensis*, *Salvadora*, many creepers, *Maytenus*

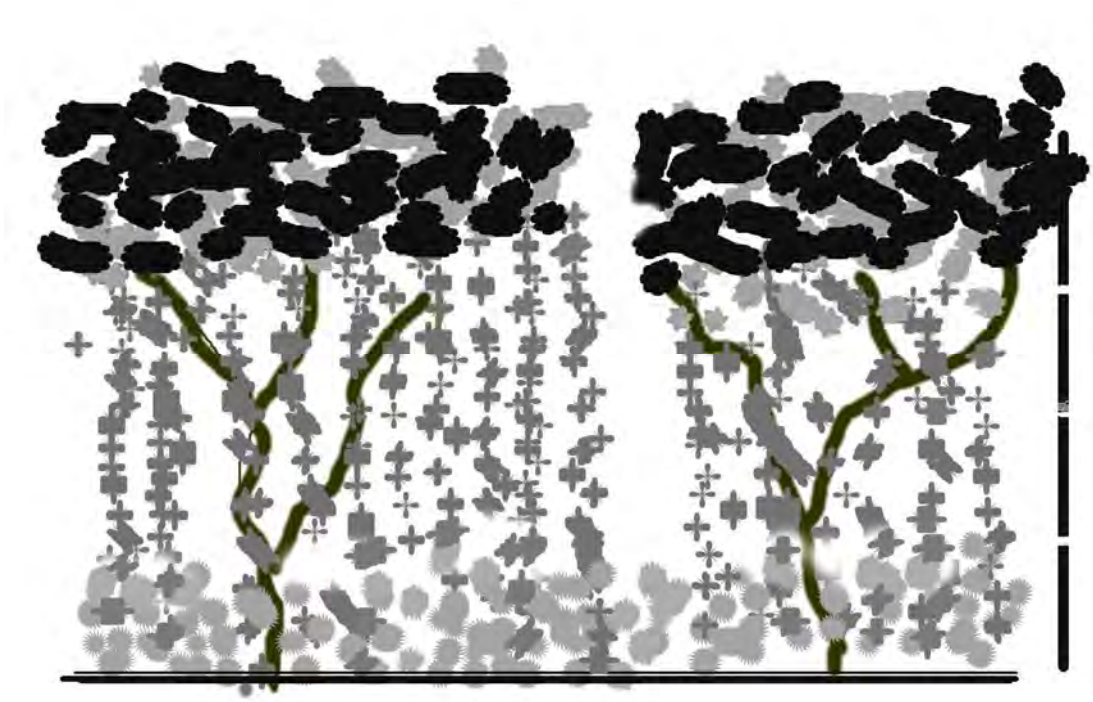


Sloping, uneven canopies:

look out for dead space (with no real browse) underneath the lower branches.

You need to judge the average depth of the actual browsable canopy.

Don't use the deepest or thinnest canopy section—take an average depth—accounting for the slop also.



If the canopies of the "understory" meet and intermix with the canopies of the "overstory" or upper browse layer, it can be difficult to work out where on layer begins and the other ends.

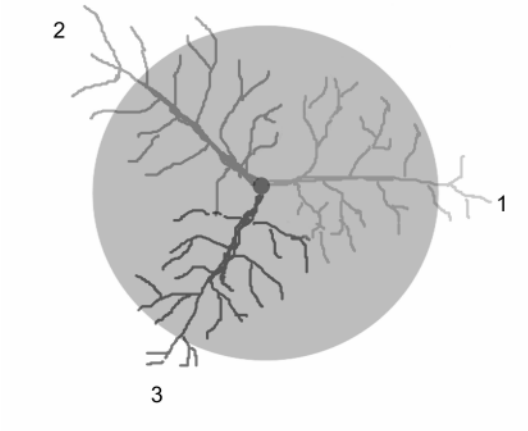
In this case, treat the entire bundle as one canopy and do not separate the canopy depths (or covers) of the upper and lower layers.

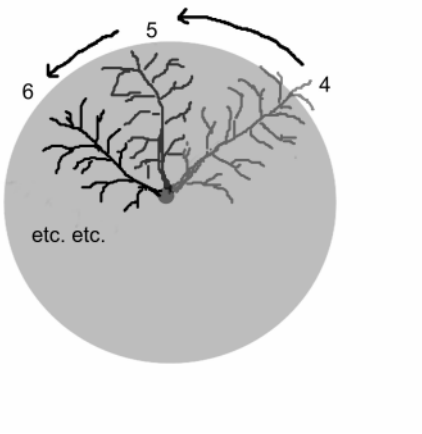
In this case, ***add the depths of the lower, mid and upper canopies***

(This is an unusual case—mostly you must never add the canopy depths of different layers—rather treat them each separately)

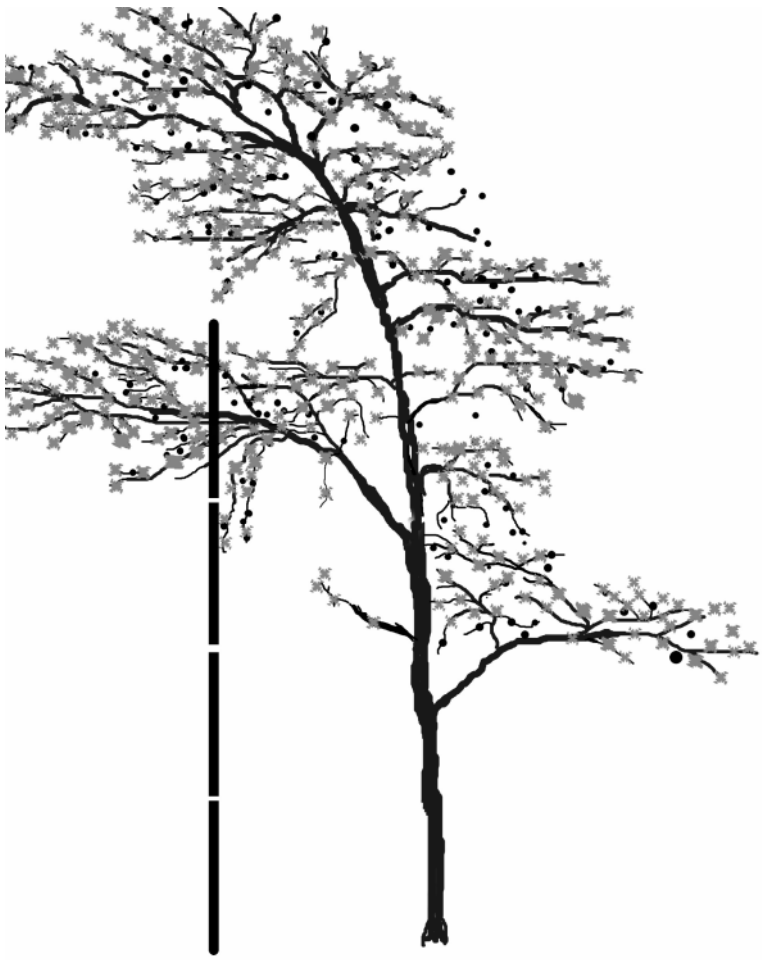
Measuring Canopy Depth for *Acacia drepanolobium* and *Acacia Senegal*:

Branches are usually arranged in a approximate spiral pattern around the central main stem, from the lowest branch (1) upwards (2,3...4,5,6 etc.). Consecutive branches overlap very little usually.

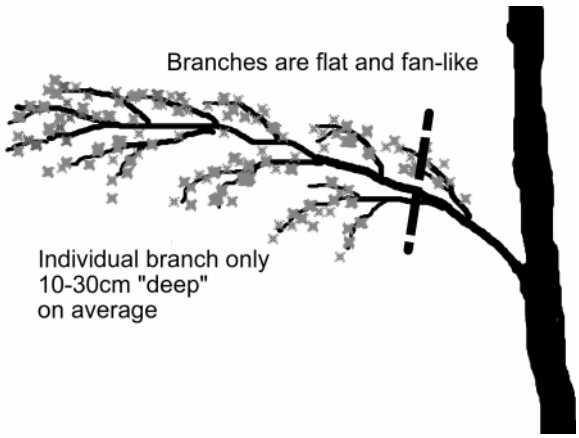




Each branch, is flat and fan-like, and usually only 10-30cm “deep”. Each covers its own patch of ground in terms of canopy cover. Or else a branch higher up may overlap a lower one as the spiral pattern (almost) repeats itself (probably following a Fibonacci series)



<—Thus, often the canopy depth (below 2m) on these trees is often only 10-30cm deep over any one point o n the ground.



Note: some *A.drepanolobium* or *A. sengal’s* may not form spiral branch arrangements and may have branches one above the other all around, making

Now you are ready to practice using the test cover patterns found in Appendix 3b.

Estimate the canopy cover of the 32 "plots" given in the appendix 3. Get a blank piece of paper, write down numbers 1 to 32, and enter your answers opposite these.

Desired Accuracy: This is not rocket science – a reasonable level of accuracy will still allow reasonable estimates of overall browse availability for a site:

You want to be within 0.3% for very low canopy cover areas,

within 1or 2% for plots of 2-9% cover,

2-5% for 10-25% covers,

and within 5-10% for covers over 30%.

Correct answers are found in on the next page here, below.

Repeat the practice session by trying to estimate the canopy cover using the 3 methods, until you can get all plots to within an acceptable level of accuracy.

3: Canopy Cover Practice Answers

DON'T LOOK AT THESE UNTIL YOU HAVE COMPLETED THE PRACTICE SESSION OF APPENDIX 3

Answers to the Canopy Cover Practice Test Patterns of Appendix 3

1	0.31%		**11**	8%		**21**	25%		**31**	28%	
2	1%		**12**	26.5%		**22**	0.63%		**32**	7%	
3	42.5%		**13**	0.5%		**23**	70%				
4	1%		**14**	0.62%		**24**	28%				
5	7%		**15**	5%		**25**	1.7%				
6	2.4%		**16**	2.5%		**26**	10%				
7	43%		**17**	60%		**27**	78%				
8	30%		**18**	15%		**28**	7.5%				
9	17%		**19**	2.5%		**29**	38%				
10	50%		**20**	10%		**30**	1.5%				

4. Answers to the examples of estimating weighted average canopy depth.

Your final estimate of average height for each example should be within less than 10 cm of the answers given below.

Repeat the example if you are more than 10 cm out on any answer.

Remember:

If you estimate canopy depth to within 5 cm, (eg. 25cm), round down the canopy depth to the nearest 10 cm for use in the table. (one tends to over-estimate average depth).

Don't take the canopy depth as the distance between the absolute extreme highest and lowest bits of a skew canopy, but rather as the "average upper and lower point across the canopy.

For curved canopies, take the thickness of the canopy layer, not the absolute lowest and highest canopy levels on the bush.

EXAMPLE 1

2											**0**
1.9											**0**
1.8											**0**
1.7											**0**
1.6											**0**
1.5										1	**1**
1.4										1	**1**
1.3										1	**1**
1.2										1	**1**
1.1										1	**1**
1										1	**1**
0.9										1	**1**
0.8									1	1	**2**
0.7					1	1	1	1	1	1	**6**
0.6					1	1	1	1	1	1	**6**
0.5					1	1	1	1	1	1	**6**
0.4					1	1	1	1	1	1	**6**
0.3					1	1	1	1	1	1	**6**
0.2	1	1	1	1	1	1	1	1	1	1	**10**
0.1	1	1	1	1	1	1	1	1	1	1	**10**
	10	20	30	40	50	60	70	80	90	100	**59**
											100

0.59m= answer

EXAMPLE 2

2											**0**
1.9											**0**
1.8											**0**
1.7											**0**
1.6											**0**
1.5											**0**
1.4	1	1	1								**3**
1.3	1	1	1								**3**
1.2	1	1	1								**3**
1.1	1	1	1								**3**
1	1	1	1								**3**
0.9	1	1	1								**3**
0.8	1	1	1								**3**
0.7	1	1	1								**3**
0.6	1	1	1								**3**
0.5	1	1	1								**3**
0.4	1	1	1								**3**
0.3	1	1	1								**3**
0.2	1	1	1	1	1	1	1	1	1	1	**10**
0.1	1	1	1	1	1	1	1	1	1	1	**10**
	10	20	30	40	50	60	70	80	90	100	**56**
											100

0.56m =answer

EXAMPLE 3

2											**0**
1.9											**0**
1.8											**0**
1.7	1	1	1	1							**4**
1.6	1	1	1	1							**4**
1.5	1	1	1	1							**4**
1.4	1	1	1	1							**4**
1.3	1	1	1	1							**4**
1.2	1	1	1	1							**4**
1.1	1	1	1	1							**4**
1	1	1	1	1							**4**
0.9	1	1	1	1							**4**
0.8	1	1	1	1							**4**
0.7	1	1	1	1					1	1	**6**
0.6	1	1	1	1					1	1	**6**
0.5	1	1	1	1					1	1	**6**
0.4	1	1	1	1					1	1	**6**
0.3	1	1	1	1					1	1	**6**
0.2	1	1	1	1					1	1	**6**
0.1	1	1	1	1	1	1	1	1	1	1	**10**
	10	20	30	40	50	60	70	80	90	100	**86**
											100

0.86m =answer

EXAMPLE 4

2											**0**
1.9											**0**
1.8											**0**
1.7	1	1									**2**
1.6	1	1									**2**
1.5	1	1									**2**
1.4	1	1									**2**
1.3	1	1									**2**
1.2	1	1									**2**
1.1	1	1									**2**
1	1	1									**2**
0.9	1	1									**2**
0.8	1	1									**2**
0.7	1	1									**2**
0.6	1	1	1	1							**4**
0.5	1	1	1	1	1	1	1	1	1	1	**10**
0.4	1	1	1	1	1	1	1	1	1	1	**10**
0.3	1	1	1	1	1	1	1	1	1	1	**10**
0.2	1	1	1	1	1	1	1	1	1	1	**10**
0.1	1	1	1	1	1	1	1	1	1	1	**10**
	10	20	30	40	50	60	70	80	90	100	**76**
											100

0.76m =answer

EXAMPLE 5

2											**0**
1.9											**0**
1.8											**0**
1.7											**0**
1.6											**0**
1.5											**0**
1.4											**0**
1.3											**0**
1.2											**0**
1.1											**0**
1											**0**
0.9											**0**
0.8									1	1	**2**
0.7									1	1	**2**
0.6									1	1	**2**
0.5									1	1	**2**
0.4									1	1	**2**
0.3							1	1	1	1	**4**
0.2	1	1	1	1	1	1	1	1	1	1	**10**
0.1	1	1	1	1	1	1	1	1	1	1	**10**
	10	20	30	40	50	60	70	80	90	100	**34**
											100

0.34m =answer

EXAMPLE DATA (see red tooltips for info on each column)

TEAM	PLOT NO.	VegTypeCode	Group No.	GROUP TYPE	SPECIES	NO. OF PLANTS	DEPTH	DIAM
FOR CASE WHERE ONE PLANT, OR SPECIES SIZE/SHAPE WAS GROUPED AND TOTAL PLAN								
KA	**72**	**Riv**	**S**	0.5-1m	acgra	1	20	79
KA	**72**	**Riv**	**S**	T >4m	acgra	1	50	350
KA	**72**	**Riv**	**S**	T 2-4m	acgra	1	65	205
KA	**72**	**Riv**	**S**	1-2m	acgra	1	90	230
KA	**72**	**Riv**	**S**	T >4m	acgra	1	110	230
KA	**72**	**Riv**	**S**	<0.5m	aspar	3	20	20
KA	**72**	**Riv**	**S**	<1m	aztet	31	30	30
KA	**72**	**Riv**	**S**	1-2m	aztet	2	60	100
KA	**72**	**Riv**	**S**	1-2m	mahet	1	50	100
FOR CASE OF A BUSH CLUMP comprised of one or more species, WHERE THE ENTIRE CLUMI								
KA	**72**	**Riv**	**Clump1**		Carissa bispinosa	**1**	75	260
KA	**72**	**Riv**	**Clump1**		Azima tetracantha	**1**	75	260
KA	**72**	**Riv**	**Clump1**		Grewia occidentalis	**1**	75	260
FOR CASE Where SIMILAR SIZED plants of one or more species were considered as a group, a								
KA	**72**	**Riv**	**G1**	1-2m	actor	26	55	65
KA	**72**	**Riv**	**G1**	1-2m	ackar	26	55	65
KA	**72**	**Riv**	**G1**	1-2m	dicin	26	55	65
KA	**72**	**Riv**	**G1**	1-2m	acger	26	55	65
FOR CASE WHERE SEVERAL SPECIES were considered as a Group, and GROUP TOTAL CANC								
KA	**72**	**Riv**	**G2**	T 2-4m	canat		60	
KA	**72**	**Riv**	**G2**	T 2-4m	docym		60	
KA	**72**	**Riv**	**G2**	T 2-4m	mamar		60	
FOR CASE WHERE SEVERAL SPECIES were considered as a Group, and GROUP TOTAL CANC								
KA	**72**	**Riv**	**G3**	<1m	abhis		50	
KA	**72**	**Riv**	**G3**	<1m	accaf		50	
KA	**72**	**Riv**	**G3**	<1m	dorot		50	
KA	**72**	**Riv**	**G3**	<1m	casep		50	
KA	**72**	**Riv**	**G3**	<1m	cissu		50	
KA	**72**	**Riv**	**G3**	<1m	dicin		50	
KA	**72**	**Riv**	**G3**	<1m	docym		50	
KA	**72**	**Riv**	**G3**	<1m	erber		50	
KA	**72**	**Riv**	**G3**	<1m	justi		50	
KA	**72**	**Riv**	**G3**	<1m	ocimu		50	
KA	**72**	**Riv**	**G3**	<1m	solan		50	

Enter your data in the columns below

TEAM	PLOT NO.	Group No.	PLANT SIZE / GROUP TYPE	SPECIES	NO. OF PLANTS	DEPTH	DIAM

(see red tooltips for info on each column) 16m DIAMETER F

CANOPY COVER	SPECIES RANK	cover adjutment	NOTES	RatingSum	pRating	pCCov
T NUMBER WAS COUNTED; WHILE AVERAGE CANOPY DEPTH AND DIAMETER WAS MEAS						
					1.00000	0.00244
		-40%			1.00000	0.04785
					1.00000	0.01642
					1.00000	0.02066
		-35%			1.00000	0.02066
					1.00000	0.00047
					1.00000	0.01090
					1.00000	0.00781
					1.00000	0.00391
P ITSELF'S AVERAGE CANOPY DEPTH AND DIAMETER WAS MEASURED AND SPECIES IN I						
	60			**165**	0.36364	*0.00960*
	100			165	0.60606	*0.01600*
	5			165	0.03030	*0.00080*
nd TOTAL PLANT NUMBER WAS COUNTED, WHILE AVERAGE CANOPY DEPTH AND DIAME						
	100			**195**	0.51282	*0.02201*
	25			195	0.12821	*0.00550*
	60			195	0.30769	*0.01320*
	10			195	0.05128	*0.00220*
OPY COVER % WAS ESTIMATED ALONG WITH GROUP AVERAGE DEPTH						
22.0%	25			**142**	0.17606	0.03873
22.0%	17			142	0.11972	0.02634
22.0%	100			142	0.70423	0.15493
OPY COVER % WAS ESTIMATED ALONG WITH GROUP AVERAGE DEPTH						
22.0%	2			**240**	0.00833	0.00183
22.0%	100			240	0.41667	0.09167
22.0%	10			240	0.04167	0.00917
22.0%	5			240	0.02083	0.00458
22.0%	5			240	0.02083	0.00458
22.0%	60	-20%		240	0.25000	0.05500
22.0%	6			240	0.02500	0.00550
22.0%	5			240	0.02083	0.00458
22.0%	40		justicia white	240	0.16667	0.03667
22.0%	5			240	0.02083	0.00458
22.0%	2			240	0.00833	0.00183
				Copy the relevant formula and method		
CANOPY COVER	RANK	cover adjutment	NOTES	**RatingSum**	**pRating**	**pCCov**
				formulas	formulas	formulas

PLOTS

pDepth	Adj pCCov	pBA	
URED			
0.10000	*0.00244*	0.00024	Blue = formula for single plants (or count of plants of one species/siz
0.25000	*0.02871*	0.00718	Blue = formula for single plants (or count of plants of one species/siz
0.32500	*0.01642*	0.00534	Blue = formula for single plants (or count of plants of one species/siz
0.45000	*0.02066*	0.00930	Blue = formula for single plants (or count of plants of one species/siz
0.55000	*0.01343*	0.00739	Blue = formula for single plants (or count of plants of one species/siz
0.10000	*0.00047*	0.00005	Blue = formula for single plants (or count of plants of one species/siz
0.15000	*0.01090*	0.00163	Blue = formula for single plants (or count of plants of one species/siz
0.30000	*0.00781*	0.00234	Blue = formula for single plants (or count of plants of one species/siz
0.25000	*0.00391*	0.00098	Blue = formula for single plants (or count of plants of one species/siz
T WERE RANKED			
0.37500	*0.00960*	0.00360	Maroon = formula for multi-species bush clump - the clump's averag
0.37500	*0.01600*	0.00600	
0.37500	*0.00080*	0.00030	
ETER OF THE PLANTS OF THIS TYPE WERE MEASURED, AND SPECIES WERE RANKED			
0.27500	*0.02201*	0.00605	Maroon = formula for multi-species group where average canopy dim
0.27500	*0.00550*	0.00151	Maroon = formula for multi-species group where average canopy dim
0.27500	*0.01320*	0.00363	Maroon = formula for multi-species group where average canopy dim
0.27500	*0.00220*	0.00061	**0.01180**
0.30000	0.03873	0.01162	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.30000	0.02634	0.00790	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.30000	0.15493	0.04648	**0.06600** 0.066
0.25000	0.00183	0.00046	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.09167	0.02292	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.00917	0.00229	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.00458	0.00115	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.00458	0.00115	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.04400	0.01100	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.00550	0.00138	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.00458	0.00115	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.03667	0.00917	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.00458	0.00115	Green = formula for mixed sp. Group WHER CANOPY COVER% W
0.25000	0.00183	0.00046	Green = formula for mixed sp. Group WHER CANOPY COVER% W
		0.17440	< Total Plot BA = % available canopy fill of 0-2m layer

from above to calculate BA for each record of your own data

pDepth	Adj pCCov	pBA	
formulas	formulas	formulas	**Once all data is calpured you can use a Pivot table to sum the B**

e)
e)
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e)

e canopy dimensions (depth/diameter) was measured/estimated: plant no. (No of plants = 1 Only mean

ıensions (depth/diameter) of group members was measured/estimated: copy plant no. (Group = 1 only ,
ıensions (depth/diameter) of group members was measured/estimated: copy plant no. (Group = 1 only ,
ıensions (depth/diameter) of group members was measured/estimated: copy plant no. (Group = 1 only ,

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[redacted]A for each species in each plot.

ing 1 CLUMP)

or else count) and depth/ diameter to all members of this kind of group
or else count) and depth/ diameter to all members of this kind of group
or else count) and depth/ diameter to all members of this kind of group

[redacted]

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TEAM	PLOT NO.	Plot Radius	DATE	Latitude	Longitude	VEGETATION TYPE

TERRAIN	)etails / Comments (eg main species, burned)

PLOT	Species	Plant Height	Number of Browse Units Removed

Old / new?

	THIS DATA COLLECTION IS DATA COMPILED BY KERYN ADCOCK			Av
ROW ORDER	RESERVE	*SPECIES*	Suitability (for CC)	Questions
117	ITA-ALL	*Acacia ataxacantha*	1	
187	WPP-R	*Acacia ataxacantha*	1	
218	WPP-PL	*Acacia ataxacantha*	1	
441	TEMBE08	*Acacia burkei*	1	
61	ITA-WTH	*Acacia caffra*	1	
75	ITA-ALL	*Acacia caffra*	1	
2	ESH-R	*Acacia cosiensis*	1	
362	ESH-09	*Acacia cosiensis*	1	
78	ITA-ALL	*Acacia davyi*	1	
241	WPP-PL	*Acacia erubescens*	1	
297	NL-Sanc	*Acacia erubescens*	1	
200	WPP-R	*Acacia fleckii*	1	
222	WPP-PL	*Acacia fleckii*	1	
58	ITA-WTH	*Acacia gerrardii*	1	
82	ITA-ALL	*Acacia gerrardii*	1	
250	NL-Sanc	*Acacia gerrardii*	1	
201	WPP-R	*Acacia hebeclada*	3	3 based on Tswa
290	NL-Sanc	*Acacia hockii*	1	
54	ITA-WTH	*Acacia karroo*	1	
74	ITA-ALL	*Acacia karroo*	1	
449	TEMBE08	*Acacia karroo*	1	
556	MAJE	*Acacia karroo*	1	
9	ESH-R	*Acacia kraussiana*	1	
363	ESH-09	*Acacia kraussiana*	1	
528	MAJE	*Acacia nigrescens*	1	
52	ITA-WTH	*Acacia nilotica*	1	
73	ITA-ALL	*Acacia nilotica*	1	
254	NL-Sanc	*Acacia nilotica*	1	
465	TEMBE08	*Acacia nilotica*	1	
526	MAJE	*Acacia nilotica*	1	
479	TEMBE08	*Acacia senegalensis*	1	
161	ITA-ALL	*Acacia sieberiana*	1	
261	NL-Sanc	*Acacia sieberiana*	1	
79	ITA-ALL	*Acacia tortilis*	1	
563	MAJE	*Acacia tortilis*	1	*Not seen du*
570	MAJE	*Acacia xanthophloea*	1	
3	ESH-R	*Acalypha glabrata*	1	
364	ESH-09	*Acalypha glabrata*	1	
450	TEMBE08	*Acalypha glabrata*	1	
283	NL-Sanc	*Acalypha ornata*		prob 1
160	ITA-ALL	*Acokanthera oppositifolia*	3	?
489	TEMBE08	*Acridicarpus nataliatus*		
320	NL-Sanc	*Aeschynomene leptostachya*		
365	ESH-09	*Albizia adianthifolia*	3	
572	MAJE	*Albizia anthelmintica*	3	*Not seen du*
275	NL-Sanc	*Albizia harveyi*	1	1 or 2
558	MAJE	*Albizia harveyi*	1	1 or 2
159	ITA-ALL	*Albizia versicolor*	3	
366	ESH-09	*Allophylus*	3	3?
537	MAJE	*Allophylus africanus*	3	3?

158	ITA-ALL	*Aloe spectabilis*	2	
367	ESH-09	*Ancylobathrys petersiana*		
310	NL-Sanc	*Antidesma venosum*	3	
29	ESH-R	*Asclepias fruticosa*	3	
368	ESH-09	*Asclepias fruticosa*	3	
466	TEMBE08	*Asparagus sp 1*	2	
476	TEMBE08	*Asparagus sp 2*	2	
477	TEMBE08	*Azima tetracantha*	2	
311	NL-Sanc	*Balanites aegyptiaca*	2	
44	ESH-R	*Balanites maughamii*	2	
369	ESH-09	*Balanites maughamii*	2	
276	NL-Sanc	*Baphia massaiensis*		3?
96	ITA-ALL	*Bauhinia galpinii*	3	
214	WPP-R	*Bauhinia petersiana*	3	
234	WPP-PL	*Bauhinia petersiana*	3	
294	NL-Sanc	*Bauhinia petersiana*	3	
28	ESH-R	*Bauhinia tomentosa*	3	
370	ESH-09	*Bauhinia tomentosa*	3	
543	MAJE	*Becium grandiflorum*	2	1 or 2
298	NL-Sanc	*Berchemia discolor*	1	?
60	ITA-WTH	*Berchemia zeyheri*	1	
97	ITA-ALL	*Berchemia zeyheri*	1	
199	WPP-R	*Blepharis sp*	2	
490	TEMBE08	*Boscia albitrunca*	2	?
312	NL-Sanc	*Boscia angustifolia*	2	?
15	ESH-R	*Brachylaena discolor*	3	
371	ESH-09	*Brachylaena discolor*	3	
505	TEMBE08	*Brachylaena discolor*	3	
116	ITA-ALL	*Brachylaena ilicifolia*	2	
313	NL-Sanc	*Brachystegia allenii*	3	2 or 3
265	NL-Sanc	*Brachystegia boehmii*	3	2 or 3
299	NL-Sanc	*Brachystegia stipulata*	3	2 or 3
314	NL-Sanc	*Bridelia cathartica*	3	?
213	WPP-R	*Burkea africana*	3	
233	WPP-PL	*Burkea africana*	3	
321	NL-Sanc	*Burkea africana*	3	
571	MAJE	*Burkea africana*	3	*Not seen du*
322	NL-Sanc	*Canthium crassum*	2	
257	NL-Sanc	*Canthium glaucum*	2	
372	ESH-09	*Canthium inerme*	2	
316	NL-Sanc	*Canthium lactescens*	2	
176	MARAK	*Canthium sp*	2	
26	ESH-R	*Canthium spinosum*	2	
480	TEMBE08	*Capparis sp*	3	
323	NL-Sanc	*Capparis tomentosa*	3	
552	MAJE	*Cardiogyne africana*		*Not seen during*
373	ESH-09	*Carissa bispinosa*	3	
448	TEMBE08	*Carissa tetramera*	3	
317	NL-Sanc	*Cassia abbreviata*	2	
67	ITA-WTH	*Cassine transvaalensis*	2	
157	ITA-ALL	*Cassine transvaalensis*	2	
284	NL-Sanc	*Cassipourea mollis*		

12	ESH-R	*Catunaregam spinosa*	1	
247	NL-Sanc	*Catunaregam spinosa*	1	
374	ESH-09	*Catunaregam spinosa*	1	
439	TEMBE08	*Catunaregam spinosa*	1	
544	MAJE	*Catunaregam spinosa*	1	
36	ESH-R	*Celtis africana*	1	
377	ESH-09	*Celtis africana*	1	
324	NL-Sanc	*Cissus cornifolia*		
325	NL-Sanc	*Cissus integrifolia*		
485	TEMBE08	*Cleome angustifolia*		
115	ITA-ALL	*Clerodendrum glabrum*	2	
287	NL-Sanc	*Clerodendrum myricoides*		
56	ITA-WTH	*Coddia rudis*	1	
80	ITA-ALL	*Coddia rudis*	1	
445	TEMBE08	*Coddia rudis*	1	
280	NL-Sanc	*Colophospermum mopane*	3	
547	MAJE	*Combretum adenogonium*		*Not seen du*
95	ITA-ALL	*Combretum apiculatum*	3	
268	NL-Sanc	*Combretum apiculatum*	3	
549	MAJE	*Combretum apiculatum*	3	
183	WPP-R	*Combretum apiculatum subsp. leut*	2	
227	WPP-PL	*Combretum apiculatum subsp. leut*	2	
198	WPP-R	*Combretum collinum*	3	
235	WPP-PL	*Combretum collinum*	3	
300	NL-Sanc	*Combretum collinum*	3	
567	MAJE	*Combretum collinum*	3	
301	NL-Sanc	*Combretum elaeagnoides*		
375	ESH-09	*Combretum erythrophyllum*	2	2 or 3
273	NL-Sanc	*Combretum fragrans*		
175	MARAK	*Combretum hereroense*	1	prob 2 maybe1
94	ITA-ALL	*Combretum molle*	2	
545	MAJE	*Combretum mossambicense*		
326	NL-Sanc	*Combretum obovatum*		
156	ITA-ALL	*Combretum paniculatum*	2	
217	WPP-PL	*Combretum psidioides*	1	Unusual for a Co
186	WPP-R	*Combretum psidioides*	1	Unusual for a Co
266	NL-Sanc	*Combretum spp.*		
155	ITA-ALL	*Combretum zeyheri*	2	
550	MAJE	*Combretum zeyheri*	2	
212	WPP-R	*Commiphora africana*	2	2 or 3
258	NL-Sanc	*Commiphora africana*	2	2 or 3
540	MAJE	*Commiphora africana*	2	2 or 3
295	NL-Sanc	*Commiphora marlothii*	2	
274	NL-Sanc	*Commiphora mollis*	2	
302	NL-Sanc	*Commiphora mossambicensis*	2	
35	ESH-R	*Commiphora neglecta*	1	eaten a lot elsewl
376	ESH-09	*Commiphora neglecta*	1	eaten a lot elsewl
451	TEMBE08	*Commiphora neglecta*	1	eaten a lot elsewl
327	NL-Sanc	*Commiphora pyracanthoides*	3	
491	TEMBE08	*Commiphora sp*	2	
328	NL-Sanc	*Convolvulaceae sp.*		
114	ITA-ALL	*Cordia monoica*	2	

329	NL-Sanc	*Crosopteryx febrifuga*		
185	WPP-R	*Croton gratissimus*	3	
236	WPP-PL	*Croton gratissimus*	3	
532	MAJE	*Croton macrostachyus*		prob 3
454	TEMBE08	*Croton pseudopulchellus*	3	
492	TEMBE08	*Croton steenkampensis*		prob 3
154	ITA-ALL	*Cussonia spicata*	1	
50	ESH-R	*Cussonia zuluensis*	1	
378	ESH-09	*Cussonia zuluensis*	1	
288	NL-Sanc	*Dalbergia arbutifolia*		
45	ESH-R	*Dalbergia armata*	2	prob 1 or 2
68	ITA-WTH	*Dalbergia armata*	2	prob 1 or 2
153	ITA-ALL	*Dalbergia armata*	2	prob 1 or 2
380	ESH-09	*Dalbergia armata*		prob 1 or 2
249	NL-Sanc	*Dalbergia melanoxylon*	1	prob 1
525	MAJE	*Dalbergia melanoxylon*	1	
330	NL-Sanc	*Dalbergia nitidula*	1	
507	TEMBE08	*Dalbergia nitidula*	1	
93	ITA-ALL	*Dalbergia obovata*	2	prob 1 or 2
468	TEMBE08	*Dalium schlecteri*	3	
379	ESH-09	*Deinbolla oblongifolia*	3	
555	MAJE	*Deinbollia nyikensis*	3	
32	ESH-R	*Dialium schlechteri*	3	seems 3
381	ESH-09	*Dialium schlechteri*	3	seems 3
53	ITA-WTH	*Dichrostachys cinerea*	1	
72	ITA-ALL	*Dichrostachys cinerea*	1	
193	WPP-R	*Dichrostachys cinerea*	1	
229	WPP-PL	*Dichrostachys cinerea*	1	
245	NL-Sanc	*Dichrostachys cinerea*	1	
442	TEMBE08	*Dichrostachys cinerea*	1	
520	MAJE	*Dichrostachys cinerea*	1	
4	ESH-R	*Diospyros inhacaensis*	3	2 or 3
382	ESH-09	*Diospyros inhacaensis*		2 or 3
318	NL-Sanc	*Diospyros kirkii*		
481	TEMBE08	*Diospyros lyciodes/ dichrophylla*	3	2 or 3
285	NL-Sanc	*Diospyros mespiliformis*		
21	ESH-R	*Diospyros natalensis*	3	2 or 3
383	ESH-09	*Diospyros natalensis*		2 or 3
255	NL-Sanc	*Diospyros quiloensis*	2	
534	MAJE	*Diospyros quiloensis*	2	
90	ITA-ALL	*Diospyros scabrida*	3	
264	NL-Sanc	*Diospyros senensis*		
152	ITA-ALL	*Diospyros simii*	3	
559	MAJE	*Diospyros sinensis*		
553	MAJE	*Diospyros squarrosa*		2 or 3
384	ESH-09	*Diospyros whyteana*	2	2 or 3
527	MAJE	*Diospyros zombensis*		
174	MARAK	*Diplorhynchus condylocarpon*	2	1 or 2
246	NL-Sanc	*Diplorhynchus condylocarpon*	2	1 or 2
521	MAJE	*Diplorhynchus condylocarpon*	2	1 or 2
65	ITA-WTH	*Dombeya rotundifolia*	1	

77	ITA-ALL	*Dombeya rotundifolia*	1	
173	MARAK	*Dombeya rotundifolia*	1	
211	WPP-R	*Dombeya rotundifolia*	1	
464	TEMBE08	*Dombeya rotundifolia*	1	
113	ITA-ALL	*Dovyalis caffra*	2	
14	ESH-R	*Dovyalis longispina*	2	
385	ESH-09	*Dovyalis longispina*	2	
386	ESH-09	*Dovyalis rhamnoides*	3	
517	TEMBE08	*Drypetes arguta*	3	
27	ESH-R	*Drypetes natalensis*	3	
387	ESH-09	*Drypetes natalensis*	3	
551	MAJE	*Dyschoriste verticillaris*	1	1 or 2
531	MAJE	*Ehretia amoena*	1	
55	ITA-WTH	*Ehretia rigida*	1	
539	MAJE	*Ekebergia capensis*	3	
151	ITA-ALL	*Ekebergia pterophylla*	3	
172	MARAK	*Elaeodendron transvaalensis*	2	2 or 3
239	WPP-PL	*Elephantorrhiza elephantina*	2	
259	NL-Sanc	*Elephantorrhiza goetzei*	2	2 or 3
150	ITA-ALL	*Englerophytum magalismontanum*	3	
112	ITA-ALL	*Erythrina lysistemon*	1	
388	ESH-09	*Erythrococca berberidae*	2	1 or 2
76	ITA-ALL	*Euclea crispa*	3	
89	ITA-ALL	*Euclea natalensis*	2	2 or 3
493	TEMBE08	*Euclea natalensis*	2	2 or 3
63	ITA-WTH	*Euclea racemosa*	3	
149	ITA-ALL	*Euclea racemosa*	3	
331	NL-Sanc	*Euclea racemosa*	3	
148	ITA-ALL	*Euclea undulata*	2	2 or 3
192	WPP-R	*Euclea undulata*	2	2 or 3
240	WPP-PL	*Euclea undulata*	2	2 or 3
389	ESH-09	*Eugenia capensis*	3	
516	TEMBE08	*Eugenia capensis*	3	
48	ESH-R	*Eugenia natalita*	3	
390	ESH-09	*Eugenia natalitia*	3	
494	TEMBE08	*Euphorbia ingens*	1	
560	MAJE	*Euphorbia ingens*	1	*Not seen during*
472	TEMBE08	*Euphorbia sp*	1	
251	NL-Sanc	*Exoecaria bussei*		
332	NL-Sanc	*Fadogia ancylantha*		
333	NL-Sanc	*Faidherbia albida*		
566	MAJE	*Faidherbia albida*		
111	ITA-ALL	*Faurea saligna*	3	
248	NL-Sanc	*Feretia aeruginescens*		
38	ESH-R	*Ficus burt-davyi*	1	?
391	ESH-09	*Ficus cf. burtt-davyi*		
392	ESH-09	*Ficus cf. craterostoma*		
393	ESH-09	*Ficus cf. natalensis*		
210	WPP-R	*Ficus ilicina*	1	?
87	ITA-ALL	*Ficus sur*	1	?
277	NL-Sanc	*Flacourtia indica*		
270	NL-Sanc	*Flueggea virosa*	2	

303	NL-Sanc	*Friesodielsia obovata*			
334	NL-Sanc	*Garcinia livingstonii*			3
394	ESH-09	*Garcinia livingstonii*			3
335	NL-Sanc	*Garcinia sp.*			
573	MAJE	*Gardenia ternifolia*			3
336	NL-Sanc	*Gardenia volkensii*			3
467	TEMBE08	*Gomphrena celosiodes*			
473	TEMBE08	*Grass*			
178	WPP-R	*Grewia avellana*	1		
219	WPP-PL	*Grewia avellana*	1		
110	ITA-ALL	*Grewia bicolor*	1		
191	WPP-R	*Grewia bicolor*	1		
224	WPP-PL	*Grewia bicolor*	1		
286	NL-Sanc	*Grewia bicolor*	1		
522	MAJE	*Grewia bicolor*	1		
47	ESH-R	*Grewia caffra*	1		
395	ESH-09	*Grewia caffra*	1		
440	TEMBE08	*Grewia caffra*	1		
197	WPP-R	*Grewia flava*	1		
242	WPP-PL	*Grewia flava*	1		
13	ESH-R	*Grewia flavescens*	1		
209	WPP-R	*Grewia flavescens*	1		
228	WPP-PL	*Grewia flavescens*	1		
337	NL-Sanc	*Grewia flavescens*	1		
396	ESH-09	*Grewia flavescens*	1		
529	MAJE	*Grewia flavescens*	1		
574	MAJE	*Grewia forbesii*			
147	ITA-ALL	*Grewia microthyrsa*	3	2 or 3	
456	TEMBE08	*Grewia microthyrsa*	3	2 or 3	
319	NL-Sanc	*Grewia monticola*	1		
43	ESH-R	*Grewia occidentalis*	1		
66	ITA-WTH	*Grewia occidentalis*	1		
146	ITA-ALL	*Grewia occidentalis*	1		
397	ESH-09	*Grewia occidentalis*	1		
179	WPP-R	*Grewia retinervis*	1		
220	WPP-PL	*Grewia retinervis*	2	1 or 2	
557	MAJE	*Grewia villosa*	2	2 or 3	
535	MAJE	*Gymnosporia buxifolia*			
461	TEMBE08	*Gymnosporia heterophylla*			
81	ITA-ALL	*Gymnosporia heterophylla*	2		
344	NL-Sanc	*Gymnosporia heterophylla*	2		
57	ITA-WTH	*Gymnosporia maranguensis*	2	or 1	
88	ITA-ALL	*Gymnosporia maranguensis*	2	or 1	
108	ITA-ALL	*Gymnosporia mossambicensis*	2		
170	MARAK	*Gymnosporia polycantha*	2		
107	ITA-ALL	*Gymnosporia senegalensis*	3		
533	MAJE	*Gymnosporia senegalensis*	3		*Not seen du*
195	WPP-R	*Gymnosporia senegalensis*	3		
495	TEMBE08	*Heliotropium sp.*	3		
474	TEMBE08	*Hermannia sp*			
41	ESH-R	*Hippobromus pauciflorus*	2		
109	ITA-ALL	*Hippobromus pauciflorus*	2		

398	ESH-09	*Hippobromus pauciflorus*	*2*	
338	NL-Sanc	*Hippocratea indica*		
339	NL-Sanc	*Hippocratea parvifolia*		
304	NL-Sanc	*Holarrhena pubescens*		
554	MAJE	*Holarrhena pubescens*		*Not seen du*
340	NL-Sanc	*Hymenocardia acida*		
548	MAJE	*Hymenocardia acida*		
42	ESH-R	*Hymenocardia ulmoides*	3	
400	ESH-09	*Hymenocardia ulmoides*	*3*	
510	TEMBE08	*Hymenocardia ulmoides*	3	
341	NL-Sanc	*Hymenodictyon parvifolium*		
46	ESH-R	*Inhambanella herriquenzii*	2	?
402	ESH-09	*Inhambanella herriquenzii*		
20	ESH-R	*Isoglossa woodii*	2	
401	ESH-09	*Isoglossa woodii*	*2*	
443	TEMBE08	*Jasminum multipartitum*	2	1 or 2?
262	NL-Sanc	*Julbernardia globiflora*		
523	MAJE	*Karomia tettensis*		
315	NL-Sanc	*Keetia gueinzii*		
342	NL-Sanc	*Kigelia africana*		
576	MAJE	*Kigelia africana*		
40	ESH-R	*Kiggelaria africana*		?
404	ESH-09	*Kiggelaria africana*		
171	MARAK	*Kirkia wilmsii*	1	
403	ESH-09	*Kraussia floribunda*		
515	TEMBE08	*Landolphia kirkii*	3	
145	ITA-ALL	*Lannea discolor*	2	
279	NL-Sanc	*Lannea discolor*	2	
561	MAJE	*Lannea discolor*	2	
564	MAJE	*Lannea schweinfurthii*		*Not seen du*
405	ESH-09	*Laportea peduncularis*		
196	WPP-R	*Maerua*	1	
144	ITA-ALL	*Maesa lanceolata*	3	
184	WPP-R	*Malvaceae*	2	?
143	ITA-ALL	*Manilkara concolor*	3	
343	NL-Sanc	*Manilkara mochisia*	3	
263	NL-Sanc	*Markhamia obtusifolia*	3	
260	NL-Sanc	*Markhamia zanzibarica*		
106	ITA-ALL	*Maytenus undata*	2	
230	WPP-PL	*Melhania acuminata*	2	
469	TEMBE08	*Memecylon sousae*		
30	ESH-R	*Milettia grandis (CHK)*	2	?
406	ESH-09	*Milettia grandis (CHK)*		
407	ESH-09	*Mimusops caffra*		
169	MARAK	*Mimusops zeyheri*	2	
408	ESH-09	*Monanthotaxis caffra*	*3*	
513	TEMBE08	*Monanthotaxis caffra*	3	
345	NL-Sanc	*Monotes africanus*		
446	TEMBE08	*Mundulea sericea*		
24	ESH-R	*Ochna arborea*	3	
142	ITA-ALL	*Ochna natalitia*	3	
409	ESH-09	*Ochna natalitia*		

208	WPP-R	*Ochna pulchra*	3		
232	WPP-PL	*Ochna pulchra*			
141	ITA-ALL	*Ochna serrulata*	2		
168	MARAK	*Ochna serrulata*	2		
346	NL-Sanc	*Oncoba spinosa*		insuf	
10	ESH-R	*Oricia bachmannii*	3		
253	NL-Sanc	*Ormocarpum kirkii*	1		
524	MAJE	*Ormocarpum kirkii*	1		
64	ITA-WTH	*Ormocarpum trichocarpum*	1		
86	ITA-ALL	*Ormocarpum trichocarpum*	1		
238	WPP-PL	*Other Herbs*	2		
225	WPP-PL	*Others*			
207	WPP-R	*Otoptera burchellii*	3	?	
105	ITA-ALL	*Ozoroa mucronata*	2		
453	TEMBE08	*Ozoroa paniculosa*			
347	NL-Sanc	*Ozoroa pwetoensis*			
140	ITA-ALL	*Ozoroa sphaerocarpa*	3	?	
31	ESH-R	*Pachystigma bowkeri*	2	?	
413	ESH-09	*Pachystigma bowkeri*			
410	ESH-09	*Pancovia golungensis*	3		
23	ESH-R	*Pappea capensis*	2	or 1	
139	ITA-ALL	*Pappea capensis*	2	or 1	
414	ESH-09	*Pappea capensis*			
138	ITA-ALL	*Pavetta cooperi*	2		
137	ITA-ALL	*Pavetta edentula*	2		
348	NL-Sanc	*Pavetta eylessi*			3
349	NL-Sanc	*Pavetta schumanniana*			3
25	ESH-R	*Peddia africana*	2	?	
411	ESH-09	*Peddia africana*			
92	ITA-ALL	*Peltophorum africanum*	3		
206	WPP-R	*Peltophorum africanum*	3		
237	WPP-PL	*Peltophorum africanum*	3		
291	NL-Sanc	*Peltophorum africanum*	3		
350	NL-Sanc	*Pericopsis angolensis*			
308	NL-Sanc	*Philenoptera bussei*	3		
189	WPP-R	*Philenoptera nelsii*	3	?	
231	WPP-PL	*Philenoptera nelsii*	3		
256	NL-Sanc	*Philenoptera violacea*	3		
19	ESH-R	*Phyllanthus reticulatus*	2	?	
309	NL-Sanc	*Phyllanthus reticulatus*	2		
416	ESH-09	*Phyllanthus reticulatus*	2		
496	TEMBE08	*Phyllica cf. paniculata*			
351	NL-Sanc	*Piliostigma thonningii*			
412	ESH-09	*Pisonia aculeata*			
8	ESH-R	*Plectroniella armata*	2		
415	ESH-09	*Plectroniella armata*	2		
167	MARAK	*Plumbago auriculata*	1		
475	TEMBE08	*Pollichia campestris*			
182	WPP-R	*Polygala sp*	2		
568	MAJE	*Pouzolzia mixta*		Not seen during	
136	ITA-ALL	*Protea caffra*	3	?	
16	ESH-R	*Prothorus longifolia*	3	?	

417	ESH-09	*Prothorus longifolia*	3	
135	ITA-ALL	*Prunus africana*	2	
352	NL-Sanc	*Pseudolachnostylis maprouneifolia*		insuf
399	ESH-09	*Psidium guavum*		insuf
134	ITA-ALL	*Pterocarpus angolensis*	2	
353	NL-Sanc	*Pterocarpus chrysothrix*		insuf
538	MAJE	*Pterocarpus rotondifolius*	2	2 or 3
272	NL-Sanc	*Pterocarpus rotundifolius*	2	2 or 3
180	WPP-R	*Rhigozum brevispinosum*	1	
514	TEMBE08	*Rhoicissus revoilii*	3	
6	ESH-R	*Rhus chirindensis*	2	
133	ITA-ALL	*Rhus dentata*	2	
104	ITA-ALL	*Rhus gerrardii*	2	?
132	ITA-ALL	*Rhus grandidens*	2	?
62	ITA-WTH	*Rhus gueinzii*	1	or 2?
91	ITA-ALL	*Rhus gueinzii*	1	or 2?
462	TEMBE08	*Rhus gueinzii*	1	
70	ITA-WTH	*Rhus lucida*	3	
85	ITA-ALL	*Rhus lucida*	3	
181	WPP-R	*Rhus marlothii*	2	
131	ITA-ALL	*Rhus montana*	3	
418	ESH-09	*Rhus natalensis*	2	
542	MAJE	*Rhus natalensis*	2	Not seen during
419	ESH-09	*Rhus nebulosa*	2	
130	ITA-ALL	*Rhus pallens*	3	
129	ITA-ALL	*Rhus pyroides*	2	
83	ITA-ALL	*Rhus rehmanniana*	3	
128	ITA-ALL	*Rhus sp1*	2	
226	WPP-PL	*Rhus tenuinervis*	3	
292	NL-Sanc	*Rourea orientalis*		insuf
420	ESH-09	*Salacia leptoclada*		2 or 3
5	ESH-R	*Sapium integerrimum*	2	?
421	ESH-09	*Sapium integerrimum*	2	
457	TEMBE08	*Sapium integerrimum*	2	
127	ITA-ALL	*Schotia brachypetala*		2 or 3
497	TEMBE08	*Schotia brachypetala*		2 or 3
486	TEMBE08	*Schotia capitata*	3	
126	ITA-ALL	*Schotia latifolia*	2	
296	NL-Sanc	*Schrebera trichoclada*		insuf
577	MAJE	*Schrebera trichoclada*		Not seen du
37	ESH-R	*Sclerocarya birrea*	1	
84	ITA-ALL	*Sclerocarya birrea*	1	or 2?
281	NL-Sanc	*Sclerocarya birrea*	1	
422	ESH-09	*Sclerocarya birrea*	1	
530	MAJE	*Sclerocarya birrea*	1	
103	ITA-ALL	*Scolopia mundii*	2	
59	ITA-WTH	*Scolopia zeyheri*	2	
102	ITA-ALL	*Scolopia zeyheri*	2	
18	ESH-R	*Scutia myrtina*	2	or 3
423	ESH-09	*Scutia myrtina*	2	
508	TEMBE08	*Scutia myrtina*	2	
205	WPP-R	*Securidaca longipedunculata*	1	

354	NL-Sanc	*Senna petersiana*		insuf
447	TEMBE08	*Senna petersiana*		?
305	NL-Sanc	*Sesamum angolensis*		insuf
7	ESH-R	*Sideroxylon inerme*	3	
125	ITA-ALL	*Sideroxylon inerme*	3	
424	ESH-09	*Sideroxylon inerme*	3	
49	ESH-R	*Solanum aculaetissimus*	2	
426	ESH-09	*Solanum aculaetissimus*		prob 2
463	TEMBE08	*Solanum cf. pandoriforme*		prob 2
425	ESH-09	*Solanum duplo-sinuatum*		prob 2
459	TEMBE08	*Solanum sp lite*		prob 2
166	MARAK	*Spirostachys africana*	1	
444	TEMBE08	*Spirostachys africana*	1	
569	MAJE	*Sterculia appendiculata*		insuf
278	NL-Sanc	*Stereospermum kunthianum*		
536	MAJE	*Stereospermum kunthianum*	2	insuf 2?
427	ESH-09	*Strychnos cf. gerrardii*		
17	ESH-R	*Strychnos madagascariensis*	2	
101	ITA-ALL	*Strychnos madagascariensis*	2	
165	MARAK	*Strychnos madagascariensis*	2	
452	TEMBE08	*Strychnos madagascariensis*	2	
355	NL-Sanc	*Strychnos potatorum*		
100	ITA-ALL	*Strychnos spinosa*	2	
306	NL-Sanc	*Strychnos spinosa*	2	
478	TEMBE08	*Strychnos spinosa*	2	
124	ITA-ALL	*Strychnos usambarensis*	2	
164	MARAK	*Strychnos usambarensis*	2	
22	ESH-R	*Syzygium cordatum*	3	
123	ITA-ALL	*Syzygium cordatum*	3	
428	ESH-09	*Syzygium cordatum*	3	
498	TEMBE08	*Syzygium cordatum*	3	
122	ITA-ALL	*Syzygium guineese*	3	
470	TEMBE08	*Tabernaemontana elegans*		
34	ESH-R	*Tarchonanthus camphoratus*	3	
204	WPP-R	*Tarchonanthus camphoratus*	3	
429	ESH-09	*Tarchonanthus camphoratus*	3	
430	ESH-09	*Teclea gerrardii*	3	
190	WPP-R	*Tephrosia sericea*	3	
33	ESH-R	*Terenna pavetoides*		
431	ESH-09	*Terenna pavetoides*		
575	MAJE	*Terminalia sambesiaca*		
194	WPP-R	*Terminalia sericea*	3	
221	WPP-PL	*Terminalia sericea*	3	
356	NL-Sanc	*Terminalia sericea*	3	
307	NL-Sanc	*Terminalia stenostachya*		
357	NL-Sanc	*Terminalia stuhlmanii*		
458	TEMBE08	*Toddaliopsis bremekampii*	3	
432	ESH-09	*Trichalysa sonderiana*	3	prob 3
358	NL-Sanc	*Trichelia emetica*		
565	MAJE	*Urena lobata*		Not seen during
511	TEMBE08	*Uvaria caffra*	3	
512	TEMBE08	*Uvarie lucens*	3	

121	ITA-ALL	*Vangueria infausta*	2	
267	NL-Sanc	*Vangueria infausta*	2	
120	ITA-ALL	*Vangueria randii*	2	
546	MAJE	*Vangueria randii*		*Not seen du*
578	MAJE	*Vitex buchananii*		*Not seen during*
504	TEMBE08	*Vitex ferruginea*		2 or 3
282	NL-Sanc	*Vitex mombassae*		2 or 3
252	NL-Sanc	*Vitex petersiana*		
119	ITA-ALL	*Vitex rehmannii*	3	2 or 3
269	NL-Sanc	*Xeroderris stuhlmannii*		
562	MAJE	*Xeroderris stuhlmannii*		
509	TEMBE08	*Xerroderis sp.*		
203	WPP-R	*Ximenia americana*	3	
271	NL-Sanc	*Ximenia americana*	3	
39	ESH-R	*Ximenia caffra*	3	
98	ITA-ALL	*Ximenia caffra*	3	
202	WPP-R	*Ximenia caffra*	3	
434	ESH-09	*Ximenia caffra*	*3*	
435	ESH-09	*Zanthoxylum capense*	*1*	almost always ea
293	NL-Sanc	*Ziziphus abyssinica*	3	
11	ESH-R	*Ziziphus mucronata*	2	
69	ITA-WTH	*Ziziphus mucronata*	2	
118	ITA-ALL	*Ziziphus mucronata*	2	
223	WPP-PL	*Ziziphus mucronata*	2	
359	NL-Sanc	*Ziziphus mucronata*	2	
436	ESH-09	*Ziziphus mucronata*	*2*	
455	TEMBE08	*Ziziphus mucronata*	2	
541	MAJE	*Ziziphus mucronata*	2	*Not seen during*
188	WPP-R	*Ziziphus mucronata*	2	

vailability in Habi	Importance in Diet	eference ra
AVAIL_1	**IMP_1**	**PREF_1**
	0.15%	
5.70%	**2.40%**	0.42
11.47%	**15.97%**	1.39
	7.71%	
	2.70%	3.00
	6.23%	
	20.29%	
(quite Low)	**50.2%**	
	2.89%	
0.30%	***insignificant***	
0.00%	0.10%	
0.20%	0.40%	2.00
0.33%	**5.40%**	16.37
	5.90%	11.00
	1.52%	
2.40%	3.50%	1.46
0.01%	0.01%	1.00
0.10%	0.10%	1.00
	10.50%	5.00
	7.14%	
	1.16%	
1.666%	0.52%	0.31
	1.43%	
	3.4%	
8.945%	2.75%	0.31
	18.40%	6.00
	21.12%	
0.90%	2.30%	2.56
	1.74%	
1.150%	4.42%	3.84
	0.13%	
	0.00%	
0.70%	1.40%	2.00
	2.74%	
ring sampling i	0.34%	
0.095%	0.23%	2.42
	7.47%	
	3.3%	
	0.98%	
0.10%	0.20%	2.00
	0.00%	
	0.76%	
0.00%	0.00%	
	0.5%	
ring sampling i	0.17%	
0.30%	0.30%	1.00
g sampling in th	0.40%	
	0.00%	
	2.0%	
1.415%	1.49%	1.05

	0.00%	
	0.5%	
0.00%	0.00%	
	0.25%	
	0.31%	
	0.16%	
	0.16%	
0.10%	0.00%	
	0.08%	
	2.1%	
0.40%	0.20%	0.50
	0.30%	
0.80%	0.00%	0.00
4.10%	***insignificant***	
0.20%	0.10%	0.50
	0.25%	
0.412%	0.98%	2.38
0.10%	0.10%	1.00
	4.60%	11.00
	0.30%	
0.10%	0.40%	4.00
	0.04%	
0.10%	0.00%	
	1.15%	
	2.3%	
	0.02%	
	0.15%	
0.30%	0.00%	
0.90%	1.00%	1.11
1.10%	0.10%	0.09
0.40%	0.00%	
1.40%	0.00%	0.00
4.20%	***insignificant***	
0.20%	0.00%	
ring sampling i	0.23%	
0.00%	0.00%	
1.50%	1.80%	1.20
	0.8%	
0.00%	0.00%	
0.12%	0.64%	5.33
	0.37%	
	0.13%	
0.00%	0.00%	
g sampling in th	0.69%	
	0.5%	
(quite abundant)	**1.88%**	
0.10%	0.00%	
	1.50%	13.00
	0.00%	
0.40%	0.10%	0.25

	1.30%	
6.60%	7.10%	1.08
	1.6%	
(quite abundant)	**22.86%**	
1.394%	0.92%	0.66
	0.14%	
0.50%	0.00%	
0.20%	0.00%	
	0.09%	
	0.15%	
0.10%	0.10%	1.00
	7.30%	6.00
	2.28%	
	4.89%	
9.80%	0.20%	0.02
ring sampling i	0.86%	
	0.30%	
3.60%	0.40%	0.11
11.004%	0.80%	0.07
2.90%	**4.80%**	1.66
1.54%	**2.98%**	1.94
5.20%	0.40%	0.08
3.86%	***insignificant***	
2.40%	0.10%	0.04
0.523%	0.29%	0.55
0.20%	0.10%	0.50
	2.5%	
1.50%	0.30%	0.20
0.59%	2.58%	4.37
	0.30%	
0.195%	0.92%	4.72
6.80%	0.00%	
	0.00%	
6.78%	**30.04%**	4.43
2.00%	**4.00%**	2.00
1.60%	0.60%	0.38
	0.00%	
0.368%	0.80%	2.17
0.10%	0.00%	0.00
0.70%	1.70%	2.43
0.524%	1.09%	2.08
0.20%	0.10%	0.50
0.20%	0.30%	1.50
0.50%	0.10%	0.20
here	0.19%	
here	**0.1%**	
here	**2.41%**	
0.10%	0.00%	
	0.04%	
0.00%	0.00%	
	0.15%	

0.80%	0.00%	
9.80%	**4.00%**	0.41
3.05%	***insignificant***	
0.022%	1.95%	88.64
(abundant)	**1.58%**	
	0.04%	
	0.00%	
	0.02%	
0.10%	0.10%	1.00
	0.07%	
	1.10%	6.00
	0.00%	
2.40%	5.50%	2.29
2.886%	4.93%	1.71
0.10%	0.00%	
	0.71%	
	0.30%	
(abundant)	0.31%	
	1.1%	
0.666%	0.57%	0.86
	0.22%	
	11.20%	5.00
	37.39%	
1.50%	0.80%	0.53
0.75%	**1.76%**	2.34
10.70%	29.40%	2.75
(quite abundant)	**7.48%**	
2.803%	13.54%	4.83
	4.73%	
	4.4%	
0.70%	0.00%	
	1.56%	
0.30%	0.10%	0.33
	0.52%	
	2.9%	
1.20%	2.10%	1.75
0.240%	1.78%	7.42
	0.46%	
0.60%	1.10%	1.83
	0.00%	
0.004%	0.40%	100.00
ring sampling i	0.63%	
	1.8%	
2.012%	3.73%	1.85
6.55%	32.20%	4.92
9.10%	13.50%	1.48
35.328%	13.08%	0.37
	1.80%	2.00

	3.04%	
1.12%	4.19%	3.74
0.01%	0.00%	0.00
	0.33%	
	0.15%	
	1.16%	
	0.3%	
	0.2%	
(abundant)	(insignificant)	
	0.28%	
	0.9%	
2.129%	0.75%	0.35
0.303%	2.07%	6.83
	7.60%	13.00
10.806%	1.15%	0.11
	0.00%	
1.15%	5.16%	4.49
0.51%	***insignificant***	
1.30%	1.50%	1.15
	0.00%	
	0.15%	
	0.2%	
	3.19%	
	0.46%	
	0.04%	
	2.40%	1.00
	0.00%	
0.00%	0.00%	
	0.00%	
1.40%	0.80%	0.57
0.49%	***insignificant***	
	0.3%	
(abundant)	(insignificant)	
	0.06%	
	0.5%	
	0.04%	
g sampling in th	0.40%	
	0.18%	
0.70%	3.20%	4.57
0.00%	0.00%	
0.00%	0.00%	
1.824%	0.29%	0.16
	0.15%	
3.60%	5.60%	1.56
	0.12%	
	1.0%	
	2.5%	
	4.2%	
0.10%	0.00%	0.00
	0.61%	
0.10%	0.20%	2.00
0.40%	0.40%	1.00

0.20%	0.10%	0.50
0.00%	0.00%	
	0.3%	
0.00%	0.00%	
ring sampling i	0.17%	
0.00%	0.00%	
	0.31%	
	0.18%	
6.70%	**21.50%**	3.21
4.55%	**9.23%**	2.03
	0.15%	
0.20%	0.80%	4.00
0.00%	**3.48%**	1250.99
0.20%	0.10%	0.50
1.272%	5.97%	4.69
	0.06%	
	2.1%	
	13.53%	
0.20%	0.40%	2.00
0.30%	***insignificant***	
	1.17%	
0.20%	0.00%	0.00
1.99%	**2.00%**	1.00
0.00%	0.00%	
1.810%	2.75%	1.52
0.001%	0.17%	170.00
	0.00%	
(abundant)	**1.34%**	
0.00%	0.00%	
	0.08%	
	1.70%	4.00
	0.00%	
10.60%	**18.70%**	1.76
9.26%	**7.70%**	0.83
g sampling in th	0.46%	
0.076%	1.66%	21.84
	0.42%	
	1.98%	
0.00%	0.00%	
	7.00%	8.00
	0.46%	
	0.15%	
4.89%	8.38%	1.71
	0.15%	
ring sampling i	1.89%	
2.00%	0.40%	0.20
	0.04%	
	0.18%	
	0.09%	
	0.15%	

0.00%	0.00%	
0.00%	0.00%	
0.10%	0.10%	1.00
ring sampling i	0.63%	
0.00%	0.00%	
0.428%	0.86%	2.01
	0.08%	
	0.5%	
(abundant)	(insignificant)	
0.10%	0.00%	
	0.06%	
	0.55%	
	5.2%	
	5.83%	
2.10%	1.30%	0.62
2.746%	5.91%	2.15
0.00%	0.00%	
0.00%	0.00%	
0.023%	0.11%	4.78
	0.11%	
2.12%	4.51%	2.13
	3.3%	
(abundant)	(insignificant)	
	0.00%	
0.10%	0.20%	2.00
0.136%	0.40%	2.94
ring sampling i	0.34%	
	1.5%	
0.20%	0.40%	2.00
	0.00%	
1.80%	**4.40%**	2.44
	0.00%	
0.00%	0.00%	
2.40%	1.20%	0.50
0.80%	1.50%	1.88
	0.15%	
0.57%	**1.70%**	2.98
	0.27%	
	0.23%	
	0.3%	
2.58%	11.90%	4.61
	0.2%	
(abundant)	(insignificant)	
0.40%	0.00%	
	2.33%	
	0.44%	
	0.00%	
	0.1%	

11.40%	0.00%	0.00
8.76%	**0.01%**	0.00
	0.00%	
0.12%	0.64%	5.33
0.00%	0.00%	
	1.39%	
1.30%	2.60%	2.00
4.383%	5.33%	1.22
	1.80%	3.00
	0.76%	
0.60%	***insignificant***	
2.46%	**3.28%**	1.33
0.20%	0.00%	0.00
	0.15%	
	0.82%	
0.10%	0.00%	
	0.00%	
	0.22%	
	0.8%	
	0.47%	
	0.00%	
	0.00%	
	0.00%	
0.90%	0.00%	
0.20%	0.00%	
	0.40%	
	1.3%	
	0.30%	
2.30%	0.00%	0.00
2.63%	***insignificant***	
0.20%	0.10%	0.50
0.00%	0.00%	
0.20%	0.00%	
6.50%	**2.00%**	0.31
4.83%	**1.01%**	0.21
3.80%	1.90%	0.50
	0.67%	
0.10%	0.00%	
	0.04%	
0.20%	0.00%	
	4.2%	
	1.43%	
	0.1%	
0.31%	3.22%	10.39
	0.18%	
1.70%	**6.40%**	3.76
g sampling in th	0.29%	
	0.00%	
	1.14%	

	0.00%	
0.60%	0.00%	
	0.5%	
	0.00%	
0.00%	0.00%	
0.851%	1.43%	1.68
0.50%	0.40%	0.80
8.90%	**16.30%**	1.83
(abundant)	(insignificant)	
	3.07%	
	0.00%	
	0.15%	
	0.00%	
	2.50%	12.00
	0.30%	
	0.40%	
	0.80%	0.50
	0.76%	
7.00%	**10.80%**	1.54
	0.00%	
	0.9%	
g sampling in th	1.03%	
	0.3%	
	0.00%	
	0.00%	
	1.06%	
	0.00%	
0.92%	**3.15%**	3.41
0.20%	0.10%	0.50
	0.3%	
	4.46%	
	0.58%	
	0.00%	
	0.04%	
	0.09%	
	0.00%	
0.30%	0.10%	0.33
ring sampling i	0.11%	
	0.13%	
	0.76%	
0.50%	0.20%	0.40
1.311%	2.41%	1.84
	0.15%	
	4.90%	8.00
	0.15%	
	0.77%	
	2.0%	
	0.71%	
0.20%	0.00%	0.00

0.30%	0.00%	
	1.51%	
0.00%	0.10%	
	1.48%	
	0.00%	L/R
	0.3%	
	0.05%	
	0.40%	
	2.3%	
	0.44%	
0.31%	3.22%	10.39
	4.94%	
g sampling in th	0.29%	
0.30%	0.20%	0.67
0.430%	1.55%	3.60
	1.8%	
	0.93%	
	0.15%	L
0.28%	1.29%	4.61
	3.75%	
0.00%	0.00%	
	0.15%	
0.00%	0.10%	
	0.16%	
	0.00%	
3.74%	8.38%	2.24
	0.48%	
	0.00%	
	0.04%	
	0.00%	
	0.27%	
	0.19%	
0.20%	0.00%	0.00
	0.6%	
2.70%	**1.20%**	0.44
	0.20%	
0.114%	0.17%	1.49
2.30%	0.40%	0.17
25.29%	**6.86%**	0.27
1.30%	0.00%	
0.40%	0.10%	0.25
0.00%	0.00%	
	0.49%	
	0.3%	
0.10%	0.00%	
g sampling in th	0.34%	
(abundant)	(insignificant)	
(abundant)	(insignificant)	

	0.00%	
0.40%	0.60%	1.50
	0.00%	
ring sampling i	0.92%	
g sampling in th	0.11%	
	0.04%	
0.30%	0.20%	0.67
1.10%	2.90%	2.64
	0.00%	R
0.70%	0.40%	0.57
0.251%	0.40%	1.59
	0.71%	
1.40%	0.00%	0.00
0.80%	0.40%	0.50
	0.11%	
	0.15%	L
0.60%	0.00%	0.00
	0.3%	
ten if found by	**0.0%**	
0.20%	0.10%	0.50
	1.32%	
	0.80%	5.00
	0.00%	L
0.46%	**5.34%**	11.51
0.00%	0.00%	
	0.8%	
	0.69%	
g sampling in th	1.09%	
1.30%	**2.00%**	1.54

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Majeti-Gyongyi
Majeti-Gyongyi
Tembe - Buk, Adcock
Brown and van der Westhuisen 2004
Brown and van der Westhuisen 2004
Wolfe
Brown and van der Westhuisen 2004
Majeti-Gyongyi
Tembe - Buk, Adcock
Peter Erb Aug/Sept 1992/1993; Rocky Community
Brown and van der Westhuisen 2004
Rossouw 1998
Wolfe
Peter Erb Aug/Sept 1992/1993; Rocky Community
ESH Buk, Adcock, Shaw
ESH Buk, Adcock, Shaw
Brown and van der Westhuisen 2004
Rossouw 1998
Kotze 1990
Wolfe
Helary 2005/ Adcock&Shaw 2009
Brown and van der Westhuisen 2004
ESH Buk, Adcock, Shaw
Tembe - Buk, Adcock
Majeti-Gyongyi
Peter Erb Aug/Sept 1992/1993; Rocky Community

Average of Suitability (for CC)	
SPECIES	Total
Acacia ataxacantha	1
Acacia burkei	1
Acacia caffra	1
Acacia cosiensis	1
Acacia davyi	1
Acacia erubescens	1
Acacia fleckii	1
Acacia gerrardii	1
Acacia hebeclada	3
Acacia hockii	1
Acacia karroo	1
Acacia kraussiana	1
Acacia nigrescens	1
Acacia nilotica	1
Acacia senegalensis	1
Acacia sieberiana	1
Acacia tortilis	1
Acacia xanthophloea	1
Acalypha glabrata	1
Acalypha ornata	
Acokanthera oppositifolia	3
Acridicarpus nataliatus	
Aeschynomene leptostachya	
Albizia adianthifolia	3
Albizia anthelmintica	3
Albizia harveyi	1
Albizia versicolor	3
Allophylus	3
Allophylus africanus	3
Aloe spectabilis	2
Ancylobathrys petersiana	
Antidesma venosum	3
Asclepias fruticosa	3
Asparagus sp 1	2
Asparagus sp 2	2
Azima tetracantha	2
Balanites aegyptiaca	2
Balanites maughamii	2
Baphia massaiensis	
Bauhinia galpinii	3
Bauhinia petersiana	3
Bauhinia tomentosa	3
Becium grandiflorum	2
Berchemia discolor	1
Berchemia zeyheri	1
Blepharis sp	2

Boscia albitrunca	2
Boscia angustifolia	2
Brachylaena discolor	3
Brachylaena ilicifolia	2
Brachystegia allenii	3
Brachystegia boehmii	3
Brachystegia stipulata	3
Bridelia cathartica	3
Burkea africana	3
Canthium crassum	2
Canthium glaucum	2
Canthium inerme	2
Canthium lactescens	2
Canthium sp	2
Canthium spinosum	2
Capparis sp	3
Capparis tomentosa	3
Cardiogyne africana	
Carissa bispinosa	3
Carissa tetramera	3
Cassia abbreviata	2
Cassine transvaalensis	2
Cassipourea mollis	
Catunaregam spinosa	1
Celtis africana	1
Cissus cornifolia	
Cissus integrifolia	
Cleome angustifolia	
Clerodendrum glabrum	2
Clerodendrum myricoides	
Coddia rudis	1
Colophospermum mopane	3
Combretum adenogonium	
Combretum apiculatum	3
Combretum apiculatum subsp. leutweinii	2
Combretum collinum	3
Combretum elaeagnoides	
Combretum erythrophyllum	2
Combretum fragrans	
Combretum hereroense	1
Combretum molle	2
Combretum mossambicense	
Combretum obovatum	
Combretum paniculatum	2
Combretum psidioides	1
Combretum psidioides	1
Combretum spp.	
Combretum zeyheri	2
Commiphora africana	2
Commiphora marlothii	2
Commiphora mollis	2
Commiphora mossambicensis	2

Commiphora neglecta	1
Commiphora pyracanthoides	3
Commiphora sp	2
Convolvulaceae sp.	
Cordia monoica	2
Crosopteryx febrifuga	
Croton gratissimus	3
Croton macrostachyus	
Croton pseudopulchellus	3
Croton steenkampensis	
Cussonia spicata	1
Cussonia zuluensis	1
Dalbergia arbutifolia	
Dalbergia armata	2
Dalbergia melanoxylon	1
Dalbergia nitidula	1
Dalbergia obovata	2
Dalium schlecteri	3
Deinbolla oblongifolia	3
Deinbollia nyikensis	3
Dialium schlechteri	3
Dichrostachys cinerea	1
Diospyros inhacaensis	3
Diospyros kirkii	
Diospyros lyciodes/ dichrophylla	3
Diospyros mespiliformis	
Diospyros natalensis	3
Diospyros quiloensis	2
Diospyros scabrida	3
Diospyros senensis	
Diospyros simii	3
Diospyros sinensis	
Diospyros squarrosa	
Diospyros whyteana	2
Diospyros zombensis	
Diplorhynchus condylocarpon	2
Dombeya rotundifolia	1
Dovyalis caffra	2
Dovyalis longispina	2
Dovyalis rhamnoides	3
Drypetes arguta	3
Drypetes natalensis	3
Dyschoriste verticillaris	1
Ehretia amoena	1
Ehretia rigida	1
Ekebergia capensis	3
Ekebergia pterophylla	3
Elaeodendron transvaalensis	2
Elephantorrhiza elephantina	2
Elephantorrhiza goetzei	2
Englerophytum magalismontanum	3
Erythrina lysistemon	1

Erythrococca berberidae	2
Euclea crispa	3
Euclea natalensis	2
Euclea racemosa	3
Euclea undulata	2
Eugenia capensis	3
Eugenia natalita	3
Eugenia natalitia	3
Euphorbia ingens	1
Euphorbia sp	1
Exoecaria bussei	
Fadogia ancylantha	
Faidherbia albida	
Faurea saligna	3
Feretia aeruginescens	
Ficus burt-davyi	1
Ficus cf. burtt-davyi	
Ficus cf. craterostoma	
Ficus cf. natalensis	
Ficus ilicina	1
Ficus sur	1
Flacourtia indica	
Flueggea virosa	2
Friesodielsia obovata	
Garcinia livingstonii	
Garcinia sp.	
Gardenia ternifolia	
Gardenia volkensii	
Gomphrena celosiodes	
Grass	
Grewia avellana	1
Grewia bicolor	1
Grewia caffra	1
Grewia flava	1
Grewia flavescens	1
Grewia forbesii	
Grewia microthyrsa	3
Grewia monticola	1
Grewia occidentalis	1
Grewia retinervis	1.5
Grewia villosa	2
Gymnosporia buxifolia	
Gymnosporia heterophylla	2
Gymnosporia maranguensis	2
Gymnosporia mossambicensis	2
Gymnosporia polycantha	2
Gymnosporia senegalensis	3
Heliotropium sp.	3
Hermannia sp	
Hippobromus pauciflorus	2
Hippocratea indica	

Hippocratea parvifolia	
Holarrhena pubescens	
Hymenocardia acida	
Hymenocardia ulmoides	3
Hymenodictyon parvifolium	
Inhambanella herriquenzii	2
Isoglossa woodii	2
Jasminum multipartitum	2
Julbernardia globiflora	
Karomia tettensis	
Keetia gueinzii	
Kigelia africana	
Kiggelaria africana	
Kirkia wilmsii	1
Kraussia floribunda	
Landolphia kirkii	3
Lannea discolor	2
Lannea schweinfurthii	
Laportea peduncularis	
Maerua	1
Maesa lanceolata	3
Malvaceae	2
Manilkara concolor	3
Manilkara mochisia	3
Markhamia obtusifolia	3
Markhamia zanzibarica	
Maytenus undata	2
Melhania acuminata	2
Memecylon sousae	
Milettia grandis (CHK)	2
Mimusops caffra	
Mimusops zeyheri	2
Monanthotaxis caffra	3
Monotes africanus	
Mundulea sericea	
Ochna arborea	3
Ochna natalitia	3
Ochna pulchra	3
Ochna serrulata	2
Oncoba spinosa	
Oricia bachmannii	3
Ormocarpum kirkii	1
Ormocarpum trichocarpum	1
Other Herbs	2
Others	
Otoptera burchellii	3
Ozoroa mucronata	2
Ozoroa paniculosa	
Ozoroa pwetoensis	
Ozoroa sphaerocarpa	3
Pachystigma bowkeri	2
Pancovia golungensis	3

Pappea capensis	2
Pavetta cooperi	2
Pavetta edentula	2
Pavetta eylessi	
Pavetta schumanniana	
Peddia africana	2
Peltophorum africanum	3
Pericopsis angolensis	
Philenoptera bussei	3
Philenoptera nelsii	3
Philenoptera violacea	3
Phyllanthus reticulatus	2
Phyllica cf. paniculata	
Piliostigma thonningii	
Pisonia aculeata	
Plectroniella armata	2
Plumbago auriculata	1
Pollichia campestris	
Polygala sp	2
Pouzolzia mixta	
Protea caffra	3
Prothorus longifolia	3
Prunus africana	2
Pseudolachnostylis maprouneifolia	
Psidium guavum	
Pterocarpus angolensis	2
Pterocarpus chrysothrix	
Pterocarpus rotondifolius	2
Pterocarpus rotundifolius	2
Rhigozum brevispinosum	1
Rhoicissus revoilii	3
Rhus chirindensis	2
Rhus dentata	2
Rhus gerrardii	2
Rhus grandidens	2
Rhus gueinzii	1
Rhus lucida	3
Rhus marlothii	2
Rhus montana	3
Rhus natalensis	2
Rhus nebulosa	2
Rhus pallens	3
Rhus pyroides	2
Rhus rehmanniana	3
Rhus sp1	2
Rhus tenuinervis	3
Rourea orientalis	
Salacia leptoclada	
Sapium integerrimum	2
Schotia brachypetala	
Schotia capitata	3
Schotia latifolia	2

Schrebera trichoclada	
Sclerocarya birrea	1
Scolopia mundii	2
Scolopia zeyheri	2
Scutia myrtina	2
Securidaca longipedunculata	1
Senna petersiana	
Sesamum angolensis	
Sideroxylon inerme	3
Solanum aculaetissimus	2
Solanum cf. pandoriforme	
Solanum duplo-sinuatum	
Solanum sp lite	
Spirostachys africana	1
Sterculia appendiculata	
Stereospermum kunthianum	2
Strychnos cf. gerrardii	
Strychnos madagascariensis	2
Strychnos potatorum	
Strychnos spinosa	2
Strychnos usambarensis	2
Syzygium cordatum	3
Syzygium guineese	3
Tabernaemontana elegans	
Tarchonanthus camphoratus	3
Teclea gerrardii	3
Tephrosia sericea	3
Terenna pavetoides	
Terminalia sambesiaca	
Terminalia sericea	3
Terminalia stenostachya	
Terminalia stuhlmanii	
Toddaliopsis bremekampii	3
Trichalysa sonderiana	3
Trichelia emetica	
Urena lobata	
Uvaria caffra	3
Uvarie lucens	3
Vangueria infausta	2
Vangueria randii	2
Vitex buchananii	
Vitex ferruginea	
Vitex mombassae	
Vitex petersiana	
Vitex rehmannii	3
Xeroderris stuhlmannii	
Xerroderis sp.	
Ximenia americana	3
Ximenia caffra	3
Zanthoxylum capense	1
Ziziphus abyssinica	3
Ziziphus mucronata	2

Ziziphus mucronata	2
Grand Total	2.016786571

THIS DATA COLLECTION IS DATA COMPILED BY KERYN ADE			% AVAILABLE BR(	% IN DIET
ROW ORDER	RESERVE	SPECIES	AVAIL_1	IMP_1
1				
2	ESH-R	**Acacia cosiensis**		20.29%
3	ESH-R	**Acalypha glabrata**		7.47%
4	ESH-R	**Diospyros inhacaensis**		4.73%
5	ESH-R	**Sapium integerrimum**		4.46%
6	ESH-R	**Rhus chirindensis**		3.07%
7	ESH-R	**Sideroxylon inerme**		1.48%
8	ESH-R	**Plectroniella armata**		1.43%
9	ESH-R	**Acacia kraussiana**		1.43%
10	ESH-R	**Oricia bachmannii**		1.39%
11	ESH-R	**Ziziphus mucronata**		1.32%
12	ESH-R	**Catunaregam spinosa**		1.30%
13	ESH-R	**Grewia flavescens**		1.17%
14	ESH-R	**Dovyalis longispina**		1.16%
15	ESH-R	**Brachylaena discolor**		1.15%
16	ESH-R	**Prothorus longifolia**		1.14%
17	ESH-R	**Strychnos madagascariensis**		0.93%
18	ESH-R	**Scutia myrtina**		0.77%
19	ESH-R	**Phyllanthus reticulatus**		0.67%
20	ESH-R	**Isoglossa woodii**		0.55%
21	ESH-R	**Diospyros natalensis**		0.52%
22	ESH-R	**Syzygium cordatum**		0.48%
23	ESH-R	**Pappea capensis**		0.47%
24	ESH-R	**Ochna arborea**		0.44%
25	ESH-R	**Peddia africana**		0.40%
26	ESH-R	**Canthium spinosum**		0.37%
27	ESH-R	**Drypetes natalensis**		0.28%
28	ESH-R	**Bauhinia tomentosa**		0.25%
29	ESH-R	**Asclepias fruticosa**		0.25%
30	ESH-R	**Milettia grandis (CHK)**		0.23%
31	ESH-R	**Pachystigma bowkeri**		0.22%
32	ESH-R	**Dialium schlechteri**		0.22%
33	ESH-R	**Terenna pavetoides**		0.20%
34	ESH-R	**Tarchonanthus camphoratus**		0.19%
35	ESH-R	**Commiphora neglecta**		0.19%
36	ESH-R	**Celtis africana**		0.14%
37	ESH-R	**Sclerocarya birrea**		0.13%
38	ESH-R	**Ficus burt-davyi**		0.12%
39	ESH-R	**Ximenia caffra**		0.11%
40	ESH-R	**Kiggelaria africana**		0.11%
41	ESH-R	**Hippobromus pauciflorus**		0.09%
42	ESH-R	**Hymenocardia ulmoides**		0.08%
43	ESH-R	**Grewia occidentalis**		0.08%
44	ESH-R	**Balanites maughamii**		0.08%
45	ESH-R	**Dalbergia armata**		0.07%
46	ESH-R	**Inhambanella herriquenzii**		0.06%
47	ESH-R	**Grewia caffra**		0.06%
48	ESH-R	**Eugenia natalita**		0.06%
49	ESH-R	**Solanum aculaetissimus**		0.05%
50	ESH-R	**Cussonia zuluensis**		0.02%
51	ITALA GAME RESERVE - ABOUT 25% SOURVELD			
52	ITA-WTH	**Acacia nilotica**		18.40%
53	ITA-WTH	**Dichrostachys cinerea**		11.20%
54	ITA-WTH	**Acacia karroo**		10.50%

55	ITA-WTH	**Ehretia rigida**		7.60%
56	ITA-WTH	**Coddia rudis**		7.30%
57	ITA-WTH	**Gymnosporia maranguensis**		7.00%
58	ITA-WTH	**Acacia gerrardii**		5.90%
59	ITA-WTH	**Scolopia zeyheri**		4.90%
60	ITA-WTH	**Berchemia zeyheri**		4.60%
61	ITA-WTH	**Acacia caffra**		2.70%
62	ITA-WTH	**Rhus gueinzii**		2.50%
63	ITA-WTH	**Euclea racemosa**		2.40%
64	ITA-WTH	**Ormocarpum trichocarpum**		1.80%
65	ITA-WTH	**Dombeya rotundifolia**		1.80%
66	ITA-WTH	**Grewia occidentalis**		1.70%
67	ITA-WTH	**Cassine transvaalensis**		1.50%
68	ITA-WTH	**Dalbergia armata**		1.10%
69	ITA-WTH	**Ziziphus mucronata**		0.80%
70	ITA-WTH	**Rhus lucida**		0.80%
71	**ITALA GAME RESERVE - ABOUT 25% SOURVELD**			
72	ITA-ALL	**Dichrostachys cinerea**		37.39%
73	ITA-ALL	**Acacia nilotica**		21.12%
74	ITA-ALL	**Acacia karroo**		7.14%
75	ITA-ALL	**Acacia caffra**		6.23%
76	ITA-ALL	**Euclea crispa**		3.19%
77	ITA-ALL	**Dombeya rotundifolia**		3.04%
78	ITA-ALL	**Acacia davyi**		2.89%
79	ITA-ALL	**Acacia tortilis**		2.74%
80	ITA-ALL	**Coddia rudis**		2.28%
81	ITA-ALL	**Gymnosporia heterophylla**		1.98%
82	ITA-ALL	**Acacia gerrardii**		1.52%
83	ITA-ALL	**Rhus rehmanniana**		1.06%
84	ITA-ALL	**Sclerocarya birrea**		0.76%
85	ITA-ALL	**Rhus lucida**		0.76%
86	ITA-ALL	**Ormocarpum trichocarpum**		0.76%
87	ITA-ALL	**Ficus sur**		0.61%
88	ITA-ALL	**Gymnosporia maranguensis**		0.46%
89	ITA-ALL	**Euclea natalensis**		0.46%
90	ITA-ALL	**Diospyros scabrida**		0.46%
91	ITA-ALL	**Rhus gueinzii**		0.30%
92	ITA-ALL	**Peltophorum africanum**		0.30%
93	ITA-ALL	**Dalbergia obovata**		0.30%
94	ITA-ALL	**Combretum molle**		0.30%
95	ITA-ALL	**Combretum apiculatum**		0.30%
96	ITA-ALL	**Bauhinia galpinii**		0.30%
97	ITA-ALL	**Berchemia zeyheri**		0.30%
98	ITA-ALL	**Ximenia caffra**		0.15%
99	ITA-ALL	**uk1**		0.15%
100	ITA-ALL	**Strychnos spinosa**		0.15%
101	ITA-ALL	**Strychnos madagascariensis**		0.15%
102	ITA-ALL	**Scolopia zeyheri**		0.15%
103	ITA-ALL	**Scolopia mundii**		0.15%
104	ITA-ALL	**Rhus gerrardii**		0.15%
105	ITA-ALL	**Ozoroa mucronata**		0.15%
106	ITA-ALL	**Maytenus undata**		0.15%
107	ITA-ALL	**Gymnosporia senegalensis**		0.15%
108	ITA-ALL	**Gymnosporia mossambicensis**		0.15%
109	ITA-ALL	**Hippobromus pauciflorus**		0.15%
110	ITA-ALL	**Grewia bicolor**		0.15%

111	ITA-ALL	**Faurea saligna**		0.15%
112	ITA-ALL	**Erythrina lysistemon**		0.15%
113	ITA-ALL	**Dovyalis caffra**		0.15%
114	ITA-ALL	**Cordia monoica**		0.15%
115	ITA-ALL	**Clerodendrum glabrum**		0.15%
116	ITA-ALL	**Brachylaena ilicifolia**		0.15%
117	ITA-ALL	**Acacia ataxacantha**		0.15%
118	ITA-ALL	**Ziziphus mucronata**		0.00%
119	ITA-ALL	**Vitex rehmannii**		0.00%
120	ITA-ALL	**Vangueria randii**		0.00%
121	ITA-ALL	**Vangueria infausta**		0.00%
122	ITA-ALL	**Syzygium guineese**		0.00%
123	ITA-ALL	**Syzygium cordatum**		0.00%
124	ITA-ALL	**Strychnos usambarensis**		0.00%
125	ITA-ALL	**Sideroxylon inerme**		0.00%
126	ITA-ALL	**Schotia latifolia**		0.00%
127	ITA-ALL	**Schotia brachypetala**		0.00%
128	ITA-ALL	**Rhus sp1**		0.00%
129	ITA-ALL	**Rhus pyroides**		0.00%
130	ITA-ALL	**Rhus pallens**		0.00%
131	ITA-ALL	**Rhus montana**		0.00%
132	ITA-ALL	**Rhus grandidens**		0.00%
133	ITA-ALL	**Rhus dentata**		0.00%
134	ITA-ALL	**Pterocarpus angolensis**		0.00%
135	ITA-ALL	**Prunus africana**		0.00%
136	ITA-ALL	**Protea caffra**		0.00%
137	ITA-ALL	**Pavetta edentula**		0.00%
138	ITA-ALL	**Pavetta cooperi**		0.00%
139	ITA-ALL	**Pappea capensis**		0.00%
140	ITA-ALL	**Ozoroa sphaerocarpa**		0.00%
141	ITA-ALL	**Ochna serrulata**		0.00%
142	ITA-ALL	**Ochna natalitia**		0.00%
143	ITA-ALL	**Manilkara concolor**		0.00%
144	ITA-ALL	**Maesa lanceolata**		0.00%
145	ITA-ALL	**Lannea discolor**		0.00%
146	ITA-ALL	**Grewia occidentalis**		0.00%
147	ITA-ALL	**Grewia microthyrsa**		0.00%
148	ITA-ALL	**Euclea undulata**		0.00%
149	ITA-ALL	**Euclea racemosa**		0.00%
150	ITA-ALL	**Englerophytum magalismontanum**		0.00%
151	ITA-ALL	**Ekebergia pterophylla**		0.00%
152	ITA-ALL	**Diospyros simii**		0.00%
153	ITA-ALL	**Dalbergia armata**		0.00%
154	ITA-ALL	**Cussonia spicata**		0.00%
155	ITA-ALL	**Combretum zeyheri**		0.00%
156	ITA-ALL	**Combretum paniculatum**		0.00%
157	ITA-ALL	**Cassine transvaalensis**		0.00%
158	ITA-ALL	**Aloe spectabilis**		0.00%
159	ITA-ALL	**Albizia versicolor**		0.00%
160	ITA-ALL	**Acokanthera oppositifolia**		0.00%
161	ITA-ALL	**Acacia sieberiana**		0.00%
162				
163	MARAK	**Marakele National Park**	**% of Avail (SBVs**	**%Diet (SBVs)**
174	MARAK	**Diplorhynchus condylocarpon**	6.55%	32.20%
169	MARAK	**Mimusops zeyheri**	2.58%	11.90%
164	MARAK	**Strychnos usambarensis**	3.74%	8.38%

170	MARAK	**Gymnosporia polycantha**	4.89%	8.38%
172	MARAK	**Elaeodendron transvaalensis**	1.15%	5.16%
171	MARAK	**Kirkia wilmsii**	2.12%	4.51%
173	MARAK	**Dombeya rotundifolia**	1.12%	4.19%
166	MARAK	**Spirostachys africana**	0.31%	3.22%
167	MARAK	**Plumbago auriculata**	0.31%	3.22%
175	MARAK	**Combretum hereroense**	0.59%	2.58%
165	MARAK	**Strychnos madagascariensis**	0.28%	1.29%
168	MARAK	**Ochna serrulata**	0.12%	0.64%
176	MARAK	**Canthium sp**	0.12%	0.64%
184	**WATERBERG PLATEAU NP-Rocky**			
178	WPP-R	**Grewia avellana**	6.70%	**21.50%**
179	WPP-R	**Grewia retinervis**	10.60%	**18.70%**
180	WPP-R	**Rhigozum brevispinosum**	8.90%	**16.30%**
181	WPP-R	**Rhus marlothii**	7.00%	**10.80%**
182	WPP-R	**Polygala sp**	1.70%	**6.40%**
183	WPP-R	**Combretum apiculatum subsp. leu**	2.90%	**4.80%**
184	WPP-R	**Malvaceae**	1.80%	**4.40%**
185	WPP-R	**Croton gratissimus**	9.80%	**4.00%**
186	WPP-R	**Combretum psidioides**	2.00%	**4.00%**
187	WPP-R	**Acacia ataxacantha**	5.70%	**2.40%**
188	WPP-R	**Ziziphus mucronata**	1.30%	**2.00%**
189	WPP-R	**Philenoptera nelsii**	6.50%	**2.00%**
190	WPP-R	**Tephrosia sericea**	2.70%	**1.20%**
191	WPP-R	**Grewia bicolor**	0.20%	0.80%
192	WPP-R	**Euclea undulata**	1.40%	0.80%
193	WPP-R	**Dichrostachys cinerea**	1.50%	0.80%
194	WPP-R	**Terminalia sericea**	2.30%	0.40%
195	WPP-R	**Gymnosporia senegalensis**	2.00%	0.40%
196	WPP-R	**Maerua**	0.20%	0.40%
197	WPP-R	**Grewia flava**	0.20%	0.40%
198	WPP-R	**Combretum collinum**	5.20%	0.40%
199	WPP-R	**Blepharis sp**	0.10%	0.40%
200	WPP-R	**Acacia fleckii**	0.20%	0.40%
201	WPP-R	**Acacia hebeclada**	0.01%	0.01%
202	WPP-R	**Ximenia caffra**	0.60%	0.00%
203	WPP-R	**Ximenia americana**	1.40%	0.00%
204	WPP-R	**Tarchonanthus camphoratus**	0.20%	0.00%
205	WPP-R	**Securidaca longipedunculata**	0.20%	0.00%
206	WPP-R	**Peltophorum africanum**	2.30%	0.00%
207	WPP-R	**Otoptera burchellii**	0.20%	0.00%
208	WPP-R	**Ochna pulchra**	11.40%	0.00%
209	WPP-R	**Grewia flavescens**	0.20%	0.00%
210	WPP-R	**Ficus ilicina**	0.10%	0.00%
211	WPP-R	**Dombeya rotundifolia**	0.01%	0.00%
212	WPP-R	**Commiphora africana**	0.10%	0.00%
213	WPP-R	**Burkea africana**	1.40%	0.00%
214	WPP-R	**Bauhinia petersiana**	0.80%	0.00%
215		**WATERBERG PLATEAU NP-Rocky**		
216	**WPP-PL**	**AAA-Species**	**% of Available**	**% in Diet May to C**
217	**WPP-PL**	**Combretum psidioides**	**6.78%**	**30.04%**
218	**WPP-PL**	**Acacia ataxacantha**	**11.47%**	**15.97%**
219	**WPP-PL**	**Grewia avellana**	**4.55%**	**9.23%**
220	**WPP-PL**	**Grewia retinervis**	**9.26%**	**7.70%**
221	**WPP-PL**	**Terminalia sericea**	**25.29%**	**6.86%**
222	**WPP-PL**	**Acacia fleckii**	**0.33%**	**5.40%**

223	WPP-PL	Ziziphus mucronata	0.46%	5.34%
224	WPP-PL	Grewia bicolor	0.00%	3.48%
225	WPP-PL	Others	2.46%	3.28%
226	WPP-PL	Rhus tenuinervis	0.92%	3.15%
227	WPP-PL	Combretum apiculatum subsp. leu	1.54%	2.98%
228	WPP-PL	Grewia flavescens	1.99%	2.00%
229	WPP-PL	Dichrostachys cinerea	0.75%	1.76%
230	WPP-PL	Melhania acuminata	0.57%	1.70%
231	WPP-PL	Philenoptera nelsii	4.83%	1.01%
232	WPP-PL	Ochna pulchra	8.76%	0.01%
233	WPP-PL	Burkea africana	4.20%	*insignificant*
234	WPP-PL	Bauhinia petersiana	4.10%	*insignificant*
235	WPP-PL	Combretum collinum	3.86%	*insignificant*
236	WPP-PL	Croton gratissimus	3.05%	*insignificant*
237	WPP-PL	Peltophorum africanum	2.63%	*insignificant*
238	WPP-PL	Other Herbs	0.60%	*insignificant*
239	WPP-PL	Elephantorrhiza elephantina	0.51%	*insignificant*
240	WPP-PL	Euclea undulata	0.49%	*insignificant*
241	WPP-PL	Acacia erubescens	0.30%	*insignificant*
242	WPP-PL	Grewia flava	0.30%	*insignificant*
243		**NORTH LUANGWA**		
244	NL-Sanc	**AAA-Species**	% of Avail	**% In Diet**
245	NL-Sanc	***Dichrostachys cinerea***	10.70%	29.40%
246	NL-Sanc	***Diplorhynchus condylocarpon***	9.10%	13.50%
247	NL-Sanc	***Catunaregam spinosa***	6.60%	7.10%
248	NL-Sanc	***Feretia aeruginescens***	3.60%	5.60%
249	NL-Sanc	***Dalbergia melanoxylon***	2.40%	5.50%
250	NL-Sanc	***Acacia gerrardii***	2.40%	3.50%
251	NL-Sanc	***Exoecaria bussei***	0.70%	3.20%
252	NL-Sanc	***Vitex petersiana***	1.10%	2.90%
253	NL-Sanc	***Ormocarpum kirkii***	1.30%	2.60%
254	NL-Sanc	***Acacia nilotica***	0.90%	2.30%
255	NL-Sanc	***Diospyros quiloensis***	1.20%	2.10%
256	NL-Sanc	***Philenoptera violacea***	3.80%	1.90%
257	NL-Sanc	***Canthium glaucum***	1.50%	1.80%
258	NL-Sanc	***Commiphora africana***	0.70%	1.70%
259	NL-Sanc	***Elephantorrhiza goetzei***	1.30%	1.50%
260	NL-Sanc	***Markhamia zanzibarica***	0.80%	1.50%
261	NL-Sanc	***Acacia sieberiana***	0.70%	1.40%
262	NL-Sanc	***Julbernardia globiflora***	2.10%	1.30%
263	NL-Sanc	***Markhamia obtusifolia***	2.40%	1.20%
264	NL-Sanc	***Diospyros senensis***	0.60%	1.10%
265	NL-Sanc	***Brachystegia boehmii***	0.90%	1.00%
266	NL-Sanc	***Combretum* spp.**	1.60%	0.60%
267	NL-Sanc	***Vangueria infausta***	0.40%	0.60%
268	NL-Sanc	***Combretum apiculatum***	3.60%	0.40%
269	NL-Sanc	***Xeroderris stuhlmannii***	0.70%	0.40%
270	NL-Sanc	***Flueggea virosa***	0.40%	0.40%
271	NL-Sanc	***Ximenia americana***	0.80%	0.40%
272	NL-Sanc	***Pterocarpus rotundifolius***	0.50%	0.40%
273	NL-Sanc	***Combretum fragrans***	1.50%	0.30%
274	NL-Sanc	***Commiphora mollis***	0.20%	0.30%
275	NL-Sanc	***Albizia harveyi***	0.30%	0.30%
276	NL-Sanc	***Baphia massaiensis***	0.40%	0.20%
277	NL-Sanc	***Flacourtia indica***	0.10%	0.20%
278	NL-Sanc	***Stereospermum kunthianum***	0.30%	0.20%

279	NL-Sanc	*Lannea discolor*	0.10%	0.20%
280	NL-Sanc	*Colophospermum mopane*	9.80%	0.20%
281	NL-Sanc	*Sclerocarya birrea*	0.50%	0.20%
282	NL-Sanc	*Vitex mombassae*	0.30%	0.20%
283	NL-Sanc	*Acalypha ornata*	0.10%	0.20%
284	NL-Sanc	*Cassipourea mollis*	0.40%	0.10%
285	NL-Sanc	*Diospyros mespiliformis*	0.30%	0.10%
286	NL-Sanc	*Grewia bicolor*	0.20%	0.10%
287	NL-Sanc	*Clerodendrum myricoides*	0.10%	0.10%
288	NL-Sanc	*Dalbergia arbutifolia*	0.10%	0.10%
289	NL-Sanc	Unknown spp.	0.30%	0.10%
290	NL-Sanc	*Acacia hockii*	0.10%	0.10%
291	NL-Sanc	*Peltophorum africanum*	0.20%	0.10%
292	NL-Sanc	*Rourea orientalis*	0.20%	0.10%
293	NL-Sanc	*Ziziphus abyssinica*	0.20%	0.10%
294	NL-Sanc	*Bauhinia petersiana*	0.20%	0.10%
295	NL-Sanc	*Commiphora marlothii*	0.20%	0.10%
296	NL-Sanc	*Schrebera trichoclada*	0.30%	0.10%
297	NL-Sanc	*Acacia erubescens*	0.00%	0.10%
298	NL-Sanc	*Berchemia discolor*	0.10%	0.10%
299	NL-Sanc	*Brachystegia stipulata*	1.10%	0.10%
300	NL-Sanc	*Combretum collinum*	2.40%	0.10%
301	NL-Sanc	*Combretum elaeagnoides*	0.20%	0.10%
302	NL-Sanc	*Commiphora mossambicensis*	0.50%	0.10%
303	NL-Sanc	*Friesodielsia obovata*	0.20%	0.10%
304	NL-Sanc	*Holarrhena pubescens*	0.10%	0.10%
305	NL-Sanc	*Sesamum angolensis*	0.00%	0.10%
306	NL-Sanc	*Strychnos spinosa*	0.00%	0.10%
307	NL-Sanc	*Terminalia stenostachya*	0.40%	0.10%
308	NL-Sanc	*Philenoptera bussei*	0.20%	0.00%
309	NL-Sanc	*Phyllanthus reticulatus*	0.10%	0.00%
310	NL-Sanc	*Antidesma venosum*	0.00%	0.00%
311	NL-Sanc	*Balanites aegyptiaca*	0.10%	0.00%
312	NL-Sanc	*Boscia angustifolia*	0.10%	0.00%
313	NL-Sanc	*Brachystegia allenii*	0.30%	0.00%
314	NL-Sanc	*Bridelia cathartica*	0.40%	0.00%
315	NL-Sanc	*Keetia gueinzii*	0.00%	0.00%
316	NL-Sanc	*Canthium lactescens*	0.00%	0.00%
317	NL-Sanc	*Cassia abbreviata*	0.10%	0.00%
318	NL-Sanc	*Diospyros kirkii*	0.70%	0.00%
319	NL-Sanc	*Grewia monticola*	0.00%	0.00%
320	NL-Sanc	*Aeschynomene leptostachya*	0.00%	0.00%
321	NL-Sanc	*Burkea africana*	0.20%	0.00%
322	NL-Sanc	*Canthium crassum*	0.00%	0.00%
323	NL-Sanc	*Capparis tomentosa*	0.00%	0.00%
324	NL-Sanc	*Cissus cornifolia*	0.50%	0.00%
325	NL-Sanc	*Cissus integrifolia*	0.20%	0.00%
326	NL-Sanc	*Combretum obovatum*	6.80%	0.00%
327	NL-Sanc	*Commiphora pyracanthoides*	0.10%	0.00%
328	NL-Sanc	*Convolvulaceae* sp.	0.00%	0.00%
329	NL-Sanc	*Crosopteryx febrifuga*	0.80%	0.00%
330	NL-Sanc	*Dalbergia nitidula*	0.10%	0.00%
331	NL-Sanc	*Euclea racemosa*	0.00%	0.00%
332	NL-Sanc	*Fadogia ancylantha*	0.00%	0.00%
333	NL-Sanc	*Faidherbia albida*	0.00%	0.00%
334	NL-Sanc	*Garcinia livingstonii*	0.00%	0.00%

335	NL-Sanc	*Garcinia* sp.	0.00%	0.00%
336	NL-Sanc	*Gardenia volkensii*	0.00%	0.00%
337	NL-Sanc	*Grewia flavescens*	0.00%	0.00%
338	NL-Sanc	*Hippocratea indica*	0.00%	0.00%
339	NL-Sanc	*Hippocratea parvifolia*	0.00%	0.00%
340	NL-Sanc	*Hymenocardia acida*	0.00%	0.00%
341	NL-Sanc	*Hymenodictyon parvifolium*	0.10%	0.00%
342	NL-Sanc	*Kigelia africana*	0.00%	0.00%
343	NL-Sanc	*Manilkara mochisia*	0.00%	0.00%
344	NL-Sanc	*Gymnosporia heterophylla*	0.00%	0.00%
345	NL-Sanc	*Monotes africanus*	0.40%	0.00%
346	NL-Sanc	*Oncoba spinosa*	0.00%	0.00%
347	NL-Sanc	*Ozoroa pwetoensis*	0.10%	0.00%
348	NL-Sanc	*Pavetta eylessi*	0.90%	0.00%
349	NL-Sanc	*Pavetta schumanniana*	0.20%	0.00%
350	NL-Sanc	*Pericopsis angolensis*	0.00%	0.00%
351	NL-Sanc	*Piliostigma thonningii*	0.20%	0.00%
352	NL-Sanc	*Pseudolachnostylis maprouneifoli*	0.60%	0.00%
353	NL-Sanc	*Pterocarpus chrysothrix*	0.00%	0.00%
354	NL-Sanc	*Senna petersiana*	0.30%	0.00%
355	NL-Sanc	*Strychnos potatorum*	0.00%	0.00%
356	NL-Sanc	*Terminalia sericea*	1.30%	0.00%
357	NL-Sanc	*Terminalia stuhlmanii*	0.00%	0.00%
358	NL-Sanc	*Trichelia emetica*	0.10%	0.00%
359	NL-Sanc	*Ziziphus mucronata*	0.00%	0.00%
360		**EASTERN SHORES**		
361	ESH-09	**AAA-Species**	**% Avail**	**% of Diet**
362	ESH-09	*Acacia cosiensis*	(quite Low)	**50.2%**
363	ESH-09	*Acacia kraussiana*		**3.4%**
364	ESH-09	*Acalypha glabrata*		**3.3%**
365	ESH-09	*Albizia adianthifolia*		**0.5%**
366	ESH-09	*Allophylus*		**2.0%**
367	ESH-09	*Ancylobathrys petersiana*		**0.5%**
368	ESH-09	Asclepias fruticosa		
369	ESH-09	*Balanites maughamii*		**2.1%**
370	ESH-09	Bauhinia tomentosa		
371	ESH-09	*Brachylaena discolor*		**2.3%**
372	ESH-09	*Canthium inerme*		**0.8%**
373	ESH-09	*Carissa bispinosa*		**0.5%**
374	ESH-09	*Catunaregam spinosa*		**1.6%**
375	ESH-09	*Combretum erythrophyllum*		**2.5%**
376	ESH-09	*Commiphora neglecta*		**0.1%**
377	ESH-09	Celtis africana		
378	ESH-09	Cussonia zuluensis		
379	ESH-09	*Deinbolla oblongifolia*		**1.1%**
380	ESH-09	Dalbergia armata		
381	ESH-09	Dialium schlechteri		
382	ESH-09	*Diospyros inhacaensis*		**4.4%**
383	ESH-09	*Diospyros natalensis*		**2.9%**
384	ESH-09	*Diospyros whyteana*		**1.8%**
385	ESH-09	*Dovyalis longispina*		**0.3%**
386	ESH-09	*Dovyalis rhamnoides*		**0.2%**
387	ESH-09	*Drypetes natalensis*		**0.9%**
388	ESH-09	*Erythrococca berberidae*		**0.2%**
389	ESH-09	*Eugenia capensis*		**0.3%**
390	ESH-09	*Eugenia natalitia*		**0.5%**

391	ESH-09	*Ficus cf. burtt-davyi*		1.0%
392	ESH-09	*Ficus cf. craterostoma*		2.5%
393	ESH-09	*Ficus cf. natalensis*		4.2%
394	ESH-09	*Garcinia livingstonii*		0.3%
395	ESH-09	*Grewia caffra*		2.1%
396	ESH-09	Grewia flavescens		
397	ESH-09	Grewia occidentalis		
398	ESH-09	*Hippobromus pauciflorus*		
399	ESH-09	*Psidium guavum*		0.5%
400	ESH-09	*Hymenocardia ulmoides*		0.5%
401	ESH-09	*Isoglossa woodii*		5.2%
402	ESH-09	*Inhambanella herriquenzii*		
403	ESH-09	*Kraussia floribunda*		3.3%
404	ESH-09	*Kiggelaria africana*		
405	ESH-09	*Laportea peduncularis*		1.5%
406	ESH-09	*Milettia grandis (CHK)*		
407	ESH-09	*Mimusops caffra*		0.3%
408	ESH-09	*Monanthotaxis caffra*		0.2%
409	ESH-09	*Ochna natalitia*		0.1%
410	ESH-09	*Pancovia golungensis*		0.8%
411	ESH-09	*Peddia africana*		1.3%
412	ESH-09	*Pisonia aculeata*		4.2%
413	ESH-09	*Pachystigma bowkeri*		
414	ESH-09	*Pappea capensis*		
415	ESH-09	*Plectroniella armata*		0.1%
416	ESH-09	*Phyllanthus reticulatus*		
417	ESH-09	*Prothorus longifolia*		
418	ESH-09	*Rhus natalensis*		0.9%
419	ESH-09	*Rhus nebulosa*		0.3%
420	ESH-09	*Salacia leptoclada*		0.3%
421	ESH-09	*Sapium integerrimum*		
422	ESH-09	*Sclerocarya birrea*		
423	ESH-09	*Scutia myrtina*		2.0%
424	ESH-09	*Sideroxylon inerme*		0.3%
425	ESH-09	*Solanum duplo-sinuatum*		2.3%
426	ESH-09	*Solanum aculaetissimus*		
427	ESH-09	*Strychnos cf. gerrardii*		1.8%
428	ESH-09	*Syzygium cordatum*		
429	ESH-09	*Tarchonanthus camphoratus*		
430	ESH-09	*Teclea gerrardii*		0.6%
431	ESH-09	*Terenna pavetoides*		
432	ESH-09	*Trichalysa sonderiana*		0.3%
433	ESH-09	*unknown x*		0.3%
434	ESH-09	*Ximenia caffra*		0.3%
435	ESH-09	*Zanthoxylum capense*		0.0%
436	ESH-09	*Ziziphus mucronata*		0.8%
437		TEMBE ELEPHANT PARK		
438	TEMBE08	AAA-Species	%in Habitat	% in Diet
439	TEMBE08	Catunaregam spinosa	(quite abundant)	22.86%
440	TEMBE08	Grewia caffra		13.53%
441	TEMBE08	Acacia burkei		7.71%
442	TEMBE08	Dichrostachys cinerea	(quite abundant)	7.48%
443	TEMBE08	Jasminum multipartitum		5.83%
444	TEMBE08	Spirostachys africana		4.94%
445	TEMBE08	Coddia rudis		4.89%
446	TEMBE08	Mundulea sericea		2.33%

447	TEMBE08	Senna petersiana		1.51%
448	TEMBE08	Carissa tetramera	(quite abundant)	1.88%
449	TEMBE08	Acacia karroo		1.16%
450	TEMBE08	Acalypha glabrata		0.98%
451	TEMBE08	Commiphora neglecta		2.41%
452	TEMBE08	Strychnos madagascariensis		3.75%
453	TEMBE08	Ozoroa paniculosa		0.82%
454	TEMBE08	Croton pseudopulchellus	(abundant)	1.58%
455	TEMBE08	Ziziphus mucronata		0.69%
456	TEMBE08	Grewia microthyrsa	(abundant)	1.34%
457	TEMBE08	Sapium integerrimum		0.58%
458	TEMBE08	Toddaliopsis bremekampii		0.49%
459	TEMBE08	Solanum sp lite		0.44%
460	TEMBE08	Unidentified 13		0.44%
461	TEMBE08	Gymnosporia heterophylla		0.42%
462	TEMBE08	Rhus guenzii		0.40%
463	TEMBE08	Solanum cf. pandoriforme		0.40%
464	TEMBE08	Dombeya rotundifolia		0.33%
465	TEMBE08	Acacia nilotica		1.74%
466	TEMBE08	Asparagus sp 1		0.31%
467	TEMBE08	Gomphrena celosiodes		0.31%
468	TEMBE08	Dalium schlecteri	(abundant)	0.31%
469	TEMBE08	Memecylon sousae		0.27%
470	TEMBE08	Tabernaemontana elegans		0.27%
471	TEMBE08	Unidentified 8		0.22%
472	TEMBE08	Euphorbia sp		0.18%
473	TEMBE08	Grass		0.18%
474	TEMBE08	Hermannia sp		0.18%
475	TEMBE08	Pollichia campestris		0.18%
476	TEMBE08	Asparagus sp 2		0.16%
477	TEMBE08	Azima tetracantha		0.16%
478	TEMBE08	Strychnos spinosa		0.16%
479	TEMBE08	Acacia senegalensis		0.13%
480	TEMBE08	Capparis sp		0.13%
481	TEMBE08	Diospyros lyciodes/ dichrophylla		1.56%
482	TEMBE08	Unidentified 1		0.13%
483	TEMBE08	Unidentified 11		0.13%
484	TEMBE08	Unidentified 3		0.13%
485	TEMBE08	Cleome angustifolia		0.09%
486	TEMBE08	Schotia capitata		0.09%
487	TEMBE08	Unidentified 4		0.09%
488	TEMBE08	Unidentified 9		0.09%
489	TEMBE08	Acridicarpus nataliatus		0.76%
490	TEMBE08	Boscia albitrunca		0.04%
491	TEMBE08	Commiphora sp		0.04%
492	TEMBE08	Croton steenkampensis		0.04%
493	TEMBE08	Euclea natalensis		0.04%
494	TEMBE08	Euphorbia ingens		0.04%
495	TEMBE08	Heliotropium sp.		0.04%
496	TEMBE08	Phyllica cf. paniculata		0.04%
497	TEMBE08	Schotia brachypetala		0.04%
498	TEMBE08	Syzygium cordatum		0.04%
499	TEMBE08	Unidentified 10		0.04%
500	TEMBE08	Unidentified 12		0.04%
501	TEMBE08	Unidentified 2		0.04%

502	TEMBE08	**Unidentified 6**		0.04%
503	TEMBE08	**Unidentified 7**		0.04%
504	TEMBE08	**Vitex ferruginea**		0.04%
505	TEMBE08	**Brachylaena discolor**		0.02%
506	TEMBE08	**Unidentified 5**		0.02%
507	TEMBE08	**Dalbergia nitidula**		0.71%
508	TEMBE08	**Scutia myrtina**		0.71%
509	TEMBE08	**Xerroderis sp.**		0.71%
510	TEMBE08	**Hymenocardia ulmoides**	(abundant)	(insignificant)
511	TEMBE08	**Uvaria caffra**	(abundant)	(insignificant)
512	TEMBE08	**Uvarie lucens**	(abundant)	(insignificant)
513	TEMBE08	**Monanthotaxis caffra**	(abundant)	(insignificant)
514	TEMBE08	**Rhoicissus revoilii**	(abundant)	(insignificant)
515	TEMBE08	**Landolphia kirkii**	(abundant)	(insignificant)
516	TEMBE08	**Eugenia capensis**	(abundant)	(insignificant)
517	TEMBE08	**Drypetes arguta**	(abundant)	(insignificant)
518		**MAJETI**		
			% contribution to total BA in Sanctuary	**% Importance (feeding rates recorded in Sanctuary)**
519	MAJE	**AAA-Species**		
520	MAJE	Dichrostachys cinerea	2.803%	13.54%
521	MAJE	Diplorhynchus condylocarpon	35.328%	13.08%
522	MAJE	Grewia bicolor	1.272%	5.97%
523	MAJE	Karomia tettensis	2.746%	5.91%
524	MAJE	Ormocarpum kirkii	4.383%	5.33%
525	MAJE	Dalbergia melanoxylon	2.886%	4.93%
526	MAJE	Acacia nilotica	1.150%	4.42%
527	MAJE	Diospyros zombensis	2.012%	3.73%
528	MAJE	Acacia nigrescens	8.945%	2.75%
529	MAJE	Grewia flavescens	1.810%	2.75%
530	MAJE	Sclerocarya birrea	1.311%	2.41%
531	MAJE	Ehretia amoena	0.303%	2.07%
532	MAJE	Croton macrostachyus	0.022%	1.95%
533	MAJE	Gymnosporia senegalensis	*ring sampling i*	1.89%
534	MAJE	Diospyros quiloensis	0.240%	1.78%
535	MAJE	Gymnosporia buxifolia	0.076%	1.66%
536	MAJE	Stereospermum kunthianum	0.430%	1.55%
537	MAJE	Allophylus africanus	1.415%	1.49%
538	MAJE	Pterocarpus rotondifolius	0.851%	1.43%
539	MAJE	Ekebergia capensis	10.806%	1.15%
540	MAJE	Commiphora africana	0.524%	1.09%
541	MAJE	Ziziphus mucronata	*g sampling in th*	1.09%
542	MAJE	Rhus natalensis	*g sampling in th*	1.03%
543	MAJE	Becium grandiflorum	0.412%	0.98%
544	MAJE	Catunaregam spinosa	1.394%	0.92%
545	MAJE	Combretum mossambicense	0.195%	0.92%
546	MAJE	Vangueria randii	*ring sampling i*	0.92%
547	MAJE	Combretum adenogonium	*ring sampling i*	0.86%
548	MAJE	Hymenocardia acida	0.428%	0.86%
549	MAJE	Combretum apiculatum	11.004%	0.80%
550	MAJE	Combretum zeyheri	0.368%	0.80%
551	MAJE	Dyschoriste verticillaris	2.129%	0.75%
552	MAJE	Cardiogyne africana	*g sampling in th*	0.69%
553	MAJE	Diospyros squarrosa	*ring sampling i*	0.63%
554	MAJE	Holarrhena pubescens	*ring sampling i*	0.63%

555	MAJE	Deinbollia nyikensis	0.666%	0.57%
556	MAJE	Acacia karroo	1.666%	0.52%
557	MAJE	Grewia villosa	g sampling in th	0.46%
558	MAJE	Albizia harveyi	g sampling in th	0.40%
559	MAJE	Diospyros sinensis	0.004%	0.40%
560	MAJE	Euphorbia ingens	g sampling in th	0.40%
561	MAJE	Lannea discolor	0.136%	0.40%
562	MAJE	Xeroderris stuhlmannii	0.251%	0.40%
563	MAJE	Acacia tortilis	ring sampling i	0.34%
564	MAJE	Lannea schweinfurthii	ring sampling i	0.34%
565	MAJE	Urena lobata	g sampling in th	0.34%
566	MAJE	Acacia albida	1.824%	0.29%
567	MAJE	Combretum collinum	0.523%	0.29%
568	MAJE	Pouzolzia mixta	g sampling in th	0.29%
569	MAJE	Sterculia appendiculata	g sampling in th	0.29%
570	MAJE	Acacia xanthophloea	0.095%	0.23%
571	MAJE	Burkea africana	ring sampling i	0.23%
572	MAJE	Albizia anthelmintica	ring sampling i	0.17%
573	MAJE	Gardenia ternifolia	ring sampling i	0.17%
574	MAJE	Grewia forbesii	0.001%	0.17%
575	MAJE	Terminalia sambesiaca	0.114%	0.17%
576	MAJE	Kigelia africana	0.023%	0.11%
577	MAJE	Schrebera trichoclada	ring sampling i	0.11%
578	MAJE	Vitex buchananii	g sampling in th	0.11%
579				

Preference Index		
PREF_1	REFERENCE CODE	We will be abel to get Browse Availability data
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4.37	Smidt EF (2002)
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1.76	Peter Erb Aug/Sept 1992/1993; Rocky Community
1.83	Peter Erb Aug/Sept 1992/1993; Rocky Community
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3.76	Peter Erb Aug/Sept 1992/1993; Rocky Community
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4.43	Helary 2005/ Adcock&Shaw 2009
1.39	Helary 2005/ Adcock&Shaw 2009
2.03	Helary 2005/ Adcock&Shaw 2009
0.83	Helary 2005/ Adcock&Shaw 2009
0.27	Helary 2005/ Adcock&Shaw 2009
16.37	Helary 2005/ Adcock&Shaw 2009

11.51	Helary 2005/ Adcock&Shaw 2009
1250.99	Helary 2005/ Adcock&Shaw 2009
1.33	Helary 2005/ Adcock&Shaw 2009
3.41	Helary 2005/ Adcock&Shaw 2009
1.94	Helary 2005/ Adcock&Shaw 2009
1.00	Helary 2005/ Adcock&Shaw 2009
2.34	Helary 2005/ Adcock&Shaw 2009
2.98	Helary 2005/ Adcock&Shaw 2009
0.21	Helary 2005/ Adcock&Shaw 2009
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1.84	Majeti-Gyongyi
6.83	Majeti-Gyongyi
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7.42	Majeti-Gyongyi
21.84	Majeti-Gyongyi
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1.68	Majeti-Gyongyi
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0.55	Majeti-Gyongyi
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ι for some outstanding areas soon.

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DIET IPORTANCE PER ARE : NOTE that the absolute importance obviously partly depends on th

Sum of IMP_1	RESERVE				
SPECIES	ESH-09	ESH-R	ITA-ALL	ITA-WTH	MAJE
Acacia ataxacantha			0.15%		
Acacia burkei					
Acacia caffra			6.23%	2.70%	
Acacia cosiensis	50.18%	20.29%			
Acacia davyi			2.89%		
Acacia erubescens					
Acacia fleckii					
Acacia gerrardii			1.52%	5.90%	
Acacia hebeclada					
Acacia hockii					
Acacia karroo			7.14%	10.50%	0.52%
Acacia kraussiana	3.42%	1.43%			
Acacia nigrescens					2.75%
Acacia nilotica			21.12%	18.40%	4.42%
Acacia senegalensis					
Acacia sieberiana			0.00%		
Acacia tortilis			2.74%		0.34%
Acacia xanthophloea					0.23%
Acalypha glabrata	3.27%	7.47%			
Acalypha ornata					
Acokanthera oppositifolia			0.00%		
Acridicarpus nataliatus					
Aeschynomene leptostachya					
Albizia adianthifolia	0.48%				
Albizia anthelmintica					0.17%
Albizia harveyi					0.40%
Albizia versicolor			0.00%		
Allophylus	2.02%				
Allophylus africanus					1.49%
Aloe spectabilis			0.00%		
Ancylobathrys petersiana	0.51%				
Antidesma venosum					
Asclepias fruticosa		0.25%			
Asparagus sp 1					
Asparagus sp 2					
Azima tetracantha					
Balanites aegyptiaca					
Balanites maughamii	2.13%	0.08%			
Baphia massaiensis					
Bauhinia galpinii			0.30%		
Bauhinia petersiana					
Bauhinia tomentosa		0.25%			
Becium grandiflorum					0.98%
Berchemia discolor					
Berchemia zeyheri			0.30%	4.60%	
Blepharis sp					
Boscia albitrunca					

Boscia angustifolia					
Brachylaena discolor	2.28%	1.15%			
Brachylaena ilicifolia			0.15%		
Brachystegia allenii					
Brachystegia boehmii					
Brachystegia stipulata					
Bridelia cathartica					
Burkea africana					0.23%
Canthium crassum					
Canthium glaucum					
Canthium inerme	0.76%				
Canthium lactescens					
Canthium sp					
Canthium spinosum		0.37%			
Capparis sp					
Capparis tomentosa					
Cardiogyne africana					0.69%
Carissa bispinosa	0.50%				
Carissa tetramera					
Cassia abbreviata					
Cassine transvaalensis			0.00%	1.50%	
Cassipourea mollis					
Catunaregam spinosa	1.62%	1.30%			0.92%
Celtis africana		0.14%			
Cissus cornifolia					
Cissus integrifolia					
Cleome angustifolia					
Clerodendrum glabrum			0.15%		
Clerodendrum myricoides					
Coddia rudis			2.28%	7.30%	
Colophospermum mopane					
Combretum adenogonium					0.86%
Combretum apiculatum			0.30%		0.80%
Combretum apiculatum subsp. leutweinii					
Combretum collinum					0.29%
Combretum elaeagnoides					
Combretum erythrophyllum	2.52%				
Combretum fragrans					
Combretum hereroense					
Combretum molle			0.30%		
Combretum mossambicense					0.92%
Combretum obovatum					
Combretum paniculatum			0.00%		
Combretum psidioides					
Combretum psidioides					
Combretum spp.					
Combretum zeyheri			0.00%		0.80%
Commiphora africana					1.09%
Commiphora marlothii					
Commiphora mollis					
Commiphora mossambicensis					
Commiphora neglecta	0.14%	0.19%			

Commiphora pyracanthoides					
Commiphora sp					
Convolvulaceae sp.					
Cordia monoica			0.15%		
Crosopteryx febrifuga					
Croton gratissimus					
Croton macrostachyus					1.95%
Croton pseudopulchellus					
Croton steenkampensis					
Cussonia spicata			0.00%		
Cussonia zuluensis		0.02%			
Dalbergia arbutifolia					
Dalbergia armata		0.07%	0.00%	1.10%	
Dalbergia melanoxylon					4.93%
Dalbergia nitidula					
Dalbergia obovata			0.30%		
Dalium schlecteri					
Deinbolla oblongifolia	1.12%				
Deinbollia nyikensis					0.57%
Dialium schlechteri		0.22%			
Dichrostachys cinerea			37.39%	11.20%	13.54%
Diospyros inhacaensis	4.40%	4.73%			
Diospyros kirkii					
Diospyros lyciodes/ dichrophylla					
Diospyros mespiliformis					
Diospyros natalensis	2.95%	0.52%			
Diospyros quiloensis					1.78%
Diospyros scabrida			0.46%		
Diospyros senensis					
Diospyros simii			0.00%		
Diospyros sinensis					0.40%
Diospyros squarrosa					0.63%
Diospyros whyteana	1.76%				
Diospyros zombensis					3.73%
Diplorhynchus condylocarpon					13.08%
Dombeya rotundifolia			3.04%	1.80%	
Dovyalis caffra			0.15%		
Dovyalis longispina	0.25%	1.16%			
Dovyalis rhamnoides	0.16%				
Drypetes arguta					
Drypetes natalensis	0.91%	0.28%			
Dyschoriste verticillaris					0.75%
Ehretia amoena					2.07%
Ehretia rigida				7.60%	
Ekebergia capensis					1.15%
Ekebergia pterophylla			0.00%		
Elaeodendron transvaalensis					
Elephantorrhiza elephantina					
Elephantorrhiza goetzei					
Englerophytum magalismontanum			0.00%		
Erythrina lysistemon			0.15%		
Erythrococca berberidae	0.17%				

Euclea crispa			3.19%		
Euclea natalensis			0.46%		
Euclea racemosa			0.00%	2.40%	
Euclea undulata			0.00%		
Eugenia capensis	0.25%				
Eugenia natalita		0.06%			
Eugenia natalitia	0.50%				
Euphorbia ingens					0.40%
Euphorbia sp					
Exoecaria bussei					
Fadogia ancylantha					
Faidherbia albida					0.29%
Faurea saligna			0.15%		
Feretia aeruginescens					
Ficus burt-davyi		0.12%			
Ficus cf. burtt-davyi	1.02%				
Ficus cf. craterostoma	2.55%				
Ficus cf. natalensis	4.19%				
Ficus ilicina					
Ficus sur			0.61%		
Flacourtia indica					
Flueggea virosa					
Friesodielsia obovata					
Garcinia livingstonii	0.25%				
Garcinia sp.					
Gardenia ternifolia					0.17%
Gardenia volkensii					
Gomphrena celosiodes					
Grass					
Grewia avellana					
Grewia bicolor			0.15%		5.97%
Grewia caffra	2.10%	0.06%			
Grewia flava					
Grewia flavescens		1.17%			2.75%
Grewia forbesii					0.17%
Grewia microthyrsa			0.00%		
Grewia monticola					
Grewia occidentalis		0.08%	0.00%	1.70%	
Grewia retinervis					
Grewia villosa					0.46%
Gymnosporia buxifolia					1.66%
Gymnosporia heterophylla			1.98%		
Gymnosporia maranguensis			0.46%	7.00%	
Gymnosporia mossambicensis			0.15%		
Gymnosporia polycantha					
Gymnosporia senegalensis			0.15%		1.89%
Heliotropium sp.					
Hermannia sp					
Hippobromus pauciflorus		0.09%	0.15%		
Hippocratea indica					
Hippocratea parvifolia					
Holarrhena pubescens					0.63%

Hymenocardia acida					0.86%
Hymenocardia ulmoides	0.50%	0.08%			
Hymenodictyon parvifolium					
Inhambanella herriquenzii		0.06%			
Isoglossa woodii	5.18%	0.55%			
Jasminum multipartitum					
Julbernardia globiflora					
Karomia tettensis					5.91%
Keetia gueinzii					
Kigelia africana					0.11%
Kiggelaria africana		0.11%			
Kirkia wilmsii					
Kraussia floribunda	3.27%				
Landolphia kirkii					
Lannea discolor			0.00%		0.40%
Lannea schweinfurthii					0.34%
Laportea peduncularis	1.52%				
Maerua					
Maesa lanceolata			0.00%		
Malvaceae					
Manilkara concolor			0.00%		
Manilkara mochisia					
Markhamia obtusifolia					
Markhamia zanzibarica					
Maytenus undata			0.15%		
Melhania acuminata					
Memecylon sousae					
Milettia grandis (CHK)		0.23%			
Mimusops caffra	0.25%				
Mimusops zeyheri					
Monanthotaxis caffra	0.19%				
Monotes africanus					
Mundulea sericea					
Ochna arborea		0.44%			
Ochna natalitia	0.11%		0.00%		
Ochna pulchra					
Ochna serrulata			0.00%		
Oncoba spinosa					
Oricia bachmannii		1.39%			
Ormocarpum kirkii					5.33%
Ormocarpum trichocarpum			0.76%	1.80%	
Other Herbs					
Others					
Otoptera burchellii					
Ozoroa mucronata			0.15%		
Ozoroa paniculosa					
Ozoroa pwetoensis					
Ozoroa sphaerocarpa			0.00%		
Pachystigma bowkeri		0.22%			
Pancovia golungensis	0.76%				
Pappea capensis		0.47%	0.00%		
Pavetta cooperi			0.00%		

Pavetta edentula			0.00%		
Pavetta eylessi					
Pavetta schumanniana					
Peddia africana	1.26%	0.40%			
Peltophorum africanum			0.30%		
Pericopsis angolensis					
Philenoptera bussei					
Philenoptera nelsii					
Philenoptera violacea					
Phyllanthus reticulatus		0.67%			
Phyllica cf. paniculata					
Piliostigma thonningii					
Pisonia aculeata	4.22%				
Plectroniella armata	0.08%	1.43%			
Plumbago auriculata					
Pollichia campestris					
Polygala sp					
Pouzolzia mixta					0.29%
Protea caffra			0.00%		
Prothorus longifolia		1.14%			
Prunus africana			0.00%		
Pseudolachnostylis maprouneifolia					
Psidium guavum	0.50%				
Pterocarpus angolensis			0.00%		
Pterocarpus chrysothrix					
Pterocarpus rotondifolius					1.43%
Pterocarpus rotundifolius					
Rhigozum brevispinosum					
Rhoicissus revoilii					
Rhus chirindensis		3.07%			
Rhus dentata			0.00%		
Rhus gerrardii			0.15%		
Rhus grandidens			0.00%		
Rhus gueinzii			0.30%	2.50%	
Rhus lucida			0.76%	0.80%	
Rhus marlothii					
Rhus montana			0.00%		
Rhus natalensis	0.87%				1.03%
Rhus nebulosa	0.33%				
Rhus pallens			0.00%		
Rhus pyroides			0.00%		
Rhus rehmanniana			1.06%		
Rhus sp1			0.00%		
Rhus tenuinervis					
Rourea orientalis					
Salacia leptoclada	0.32%				
Sapium integerrimum		4.46%			
Schotia brachypetala			0.00%		
Schotia capitata					
Schotia latifolia			0.00%		
Schrebera trichoclada					0.11%
Sclerocarya birrea		0.13%	0.76%		2.41%

Scolopia mundii			0.15%		
Scolopia zeyheri			0.15%	4.90%	
Scutia myrtina	2.02%	0.77%			
Securidaca longipedunculata					
Senna petersiana					
Sesamum angolensis					
Sideroxylon inerme	0.25%	1.48%	0.00%		
Solanum aculaetissimus		0.05%			
Solanum cf. pandoriforme					
Solanum duplo-sinuatum	2.31%				
Solanum sp lite					
Spirostachys africana					
Sterculia appendiculata					0.29%
Stereospermum kunthianum					1.55%
Strychnos cf. gerrardii	1.78%				
Strychnos madagascariensis		0.93%	0.15%		
Strychnos potatorum					
Strychnos spinosa			0.15%		
Strychnos usambarensis			0.00%		
Syzygium cordatum		0.48%	0.00%		
Syzygium guineese			0.00%		
Tabernaemontana elegans					
Tarchonanthus camphoratus		0.19%			
Teclea gerrardii	0.63%				
Tephrosia sericea					
Terenna pavetoides		0.20%			
Terminalia sambesiaca					0.17%
Terminalia sericea					
Terminalia stenostachya					
Terminalia stuhlmanii					
Toddaliopsis bremekampii					
Trichalysa sonderiana	0.25%				
Trichelia emetica					
Urena lobata					0.34%
Uvaria caffra					
Uvarie lucens					
Vangueria infausta			0.00%		
Vangueria randii			0.00%		0.92%
Vitex buchananii					0.11%
Vitex ferruginea					
Vitex mombassae					
Vitex petersiana					
Vitex rehmannii			0.00%		
Xeroderris stuhlmannii					0.40%
Xerroderis sp.					
Ximenia americana					
Ximenia caffra	0.25%	0.11%	0.15%		
Zanthoxylum capense	0.04%				
Ziziphus abyssinica					
Ziziphus mucronata	0.80%	1.32%	0.00%	0.80%	1.09%
Ziziphus mucronata					
Grand Total	120.09%	61.83%	99.84%	94.50%	99.96%

ıe actual availability of the plant species in each habitat, along with the rhino diet choices

MARAK	NL-Sanc	TEMBE08	WPP-PL	WPP-R	Grand Total
			15.97%	2.40%	18.52%
		7.71%			7.71%
					8.93%
					70.47%
					2.89%
	0.10%		0.00%		0.10%
			5.40%	0.40%	5.80%
	3.50%				10.92%
				0.01%	0.01%
	0.10%				0.10%
		1.16%			19.32%
					4.85%
					2.75%
	2.30%	1.74%			47.98%
		0.13%			0.13%
	1.40%				1.40%
					3.08%
					0.23%
		0.98%			11.72%
	0.20%				0.20%
					0.00%
		0.76%			0.76%
	0.00%				0.00%
					0.48%
					0.17%
	0.30%				0.70%
					0.00%
					2.02%
					1.49%
					0.00%
					0.51%
	0.00%				0.00%
					0.25%
		0.31%			0.31%
		0.16%			0.16%
		0.16%			0.16%
	0.00%				0.00%
					2.21%
	0.20%				0.20%
					0.30%
	0.10%		0.00%	0.00%	0.10%
					0.25%
					0.98%
	0.10%				0.10%
					4.90%
				0.40%	0.40%
		0.04%			0.04%

	0.00%				0.00%
		0.02%			3.45%
					0.15%
	0.00%				0.00%
	1.00%				1.00%
	0.10%				0.10%
	0.00%				0.00%
	0.00%		0.00%	0.00%	0.23%
	0.00%				0.00%
	1.80%				1.80%
					0.76%
	0.00%				0.00%
0.64%					0.64%
					0.37%
		0.13%			0.13%
	0.00%				0.00%
					0.69%
					0.50%
		1.88%			1.88%
	0.00%				0.00%
					1.50%
	0.10%				0.10%
	7.10%	22.86%			33.79%
					0.14%
	0.00%				0.00%
	0.00%				0.00%
		0.09%			0.09%
					0.15%
	0.10%				0.10%
		4.89%			14.47%
	0.20%				0.20%
					0.86%
	0.40%				1.50%
			2.98%	4.80%	7.78%
	0.10%		0.00%	0.40%	0.79%
	0.10%				0.10%
					2.52%
	0.30%				0.30%
2.58%					2.58%
					0.30%
					0.92%
	0.00%				0.00%
					0.00%
			30.04%		30.04%
				4.00%	4.00%
	0.60%				0.60%
					0.80%
	1.70%			0.00%	2.79%
	0.10%				0.10%
	0.30%				0.30%
	0.10%				0.10%
		2.41%			2.73%

	0.00%				0.00%
		0.04%			0.04%
	0.00%				0.00%
					0.15%
	0.00%				0.00%
			0.00%	4.00%	4.00%
					1.95%
		1.58%			1.58%
		0.04%			0.04%
					0.00%
					0.02%
	0.10%				0.10%
					1.17%
	5.50%				10.43%
	0.00%	0.71%			0.71%
					0.30%
		0.31%			0.31%
					1.12%
					0.57%
					0.22%
	29.40%	7.48%	1.76%	0.80%	101.56%
					9.12%
	0.00%				0.00%
		1.56%			1.56%
	0.10%				0.10%
					3.46%
	2.10%				3.88%
					0.46%
	1.10%				1.10%
					0.00%
					0.40%
					0.63%
					1.76%
					3.73%
32.20%	13.50%				58.78%
4.19%		0.33%		0.00%	9.36%
					0.15%
					1.41%
					0.16%
		0.00%			0.00%
					1.19%
					0.75%
					2.07%
					7.60%
					1.15%
					0.00%
5.16%					5.16%
			0.00%		0.00%
	1.50%				1.50%
					0.00%
					0.15%
					0.17%

					3.19%
		0.04%			0.50%
	0.00%				2.40%
			0.00%	0.80%	0.80%
		0.00%			0.25%
					0.06%
					0.50%
		0.04%			0.44%
		0.18%			0.18%
	3.20%				3.20%
	0.00%				0.00%
	0.00%				0.29%
					0.15%
	5.60%				5.60%
					0.12%
					1.02%
					2.55%
					4.19%
				0.00%	0.00%
					0.61%
	0.20%				0.20%
	0.40%				0.40%
	0.10%				0.10%
	0.00%				0.25%
	0.00%				0.00%
					0.17%
	0.00%				0.00%
		0.31%			0.31%
		0.18%			0.18%
			9.23%	21.50%	30.73%
	0.10%		3.48%	0.80%	10.50%
		13.53%			15.69%
			0.00%	0.40%	0.40%
	0.00%		2.00%	0.00%	5.92%
					0.17%
		1.34%			1.34%
	0.00%				0.00%
					1.78%
			7.70%	18.70%	26.40%
					0.46%
					1.66%
	0.00%	0.42%			2.40%
					7.46%
					0.15%
8.38%					8.38%
				0.40%	2.44%
		0.04%			0.04%
		0.18%			0.18%
					0.25%
	0.00%				0.00%
	0.00%				0.00%
	0.10%				0.73%

	0.00%				0.86%
		0.00%			0.59%
	0.00%				0.00%
					0.06%
					5.73%
		5.83%			5.83%
	1.30%				1.30%
					5.91%
	0.00%				0.00%
	0.00%				0.11%
					0.11%
4.51%					4.51%
					3.27%
		0.00%			0.00%
	0.20%				0.60%
					0.34%
					1.52%
				0.40%	0.40%
					0.00%
				4.40%	4.40%
					0.00%
	0.00%				0.00%
	1.20%				1.20%
	1.50%				1.50%
					0.15%
			1.70%		1.70%
		0.27%			0.27%
					0.23%
					0.25%
11.90%					11.90%
		0.00%			0.19%
	0.00%				0.00%
		2.33%			2.33%
					0.44%
					0.11%
			0.01%	0.00%	0.01%
0.64%					0.64%
	0.00%				0.00%
					1.39%
	2.60%				7.93%
					2.56%
			0.00%		0.00%
			3.28%		3.28%
				0.00%	0.00%
					0.15%
		0.82%			0.82%
	0.00%				0.00%
					0.00%
					0.22%
					0.76%
					0.47%
					0.00%

					0.00%
	0.00%				0.00%
	0.00%				0.00%
					1.66%
	0.10%		0.00%	0.00%	0.40%
	0.00%				0.00%
	0.00%				0.00%
			1.01%	2.00%	3.01%
	1.90%				1.90%
	0.00%				0.67%
		0.04%			0.04%
	0.00%				0.00%
					4.22%
					1.51%
3.22%					3.22%
		0.18%			0.18%
				6.40%	6.40%
					0.29%
					0.00%
					1.14%
					0.00%
	0.00%				0.00%
					0.50%
					0.00%
	0.00%				0.00%
					1.43%
	0.40%				0.40%
				16.30%	16.30%
		0.00%			0.00%
					3.07%
					0.00%
					0.15%
					0.00%
		0.40%			3.20%
					1.56%
				10.80%	10.80%
					0.00%
					1.90%
					0.33%
					0.00%
					0.00%
					1.06%
					0.00%
			3.15%		3.15%
	0.10%				0.10%
					0.32%
		0.58%			5.04%
		0.04%			0.04%
		0.09%			0.09%
					0.00%
	0.10%				0.21%
	0.20%				3.50%

					0.15%
					5.05%
		0.71%			3.50%
				0.00%	0.00%
	0.00%	1.51%			1.51%
	0.10%				0.10%
					1.73%
					0.05%
		0.40%			0.40%
					2.31%
		0.44%			0.44%
3.22%		4.94%			8.16%
					0.29%
	0.20%				1.75%
					1.78%
1.29%		3.75%			6.11%
	0.00%				0.00%
	0.10%	0.16%			0.41%
8.38%					8.38%
		0.04%			0.52%
					0.00%
		0.27%			0.27%
				0.00%	0.19%
					0.63%
				1.20%	1.20%
					0.20%
					0.17%
	0.00%		6.86%	0.40%	7.26%
	0.10%				0.10%
	0.00%				0.00%
		0.49%			0.49%
					0.25%
	0.00%				0.00%
					0.34%
		0.00%			0.00%
		0.00%			0.00%
	0.60%				0.60%
					0.92%
					0.11%
		0.04%			0.04%
	0.20%				0.20%
	2.90%				2.90%
					0.00%
	0.40%				0.80%
		0.71%			0.71%
	0.40%			0.00%	0.40%
				0.00%	0.51%
					0.04%
	0.10%				0.10%
	0.00%	0.69%	5.34%		10.05%
				2.00%	2.00%
86.31%	100.10%	98.51%	99.89%	103.71%	964.74%

	AREA	
MARAK	**Marakele National Park**	
ESH-R	**Eastern Shores of St Lucia, from Lake Bangazi**	Rossouw 1998
ITA-WTH	**Ithala Game Reserve Valley Bushveld area (we**	Kotze 1990
ITA-ALL	**Ithala Game Reserve Valley (all)**	**Wolf**
WPP-R	**Waterberg Plateau National Park- Rocky Areas**	Peter Erb Aug/Sept 1992/1993; Rocky Com
WPP-PL	**Waterberg Plateau National Park-Central Plains**	Helary 2005/ Adcock&Shaw 2009
NL-Sanc	**North Luangwa, First Rhino Sanctuary**	**Brown and van der Westhuisen (2004)**
ESH-09	**Eastern Shores of St Lucia, from Lake Bangazi**	ESH Buk, Adcock, Shaw
TEMBE08	**Tembe Elephant Park 2008**	Tembe - Buk, Adcock
MAJE	**Majeti Game Reserve Rhino Sanctuary area, Ma**	Majeti-Gyongyi

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ıo browse availability and dry season diet survey 2009. EASA/NRF

ıilability and dry season diet survey May 2008. EASA/NRF

Plot	GPS Waypoint# or Latitude & Longitude	Photo #'s	Vegetation & terrain type	Date

Plant Size / Group Type	Species	No. Of Plants	Depth	Diame-ter	Canopy Cover	Rank	-Cover Adjut-ment%	Notes

Plant Size / Group Type	Species	No. Of Plants	Depth	Diame-ter	Canopy Cover	Rank	-Cover Adjut-ment%	Notes

WEIGHTED AVERAGE CANOPY DEPTH CALCULATOR

CANOPY DEPTH (meters)	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	<- Sum Divide by 100
2											
1.9											
1.8											
1.7											
1.6											
1.5											
1.4											
1.3											
1.2											
1.1											
1											
0.9											
0.8											
0.7											
0.6											
0.5											
0.4											
0.3											
0.2											
0.1											
0											

% OF TOTAL CANOPY COVER

Avg. Canopy Depth (m) ->: