



PET-Livestock Sudan

A Pictorial Evaluation Tool for Body Condition Scoring Livestock in Sudan



PET-Livestock Sudan

A Pictorial Evaluation Tool (PET) for Body Condition Scoring of
Livestock in Sudan

Ian Robinson



Revised 2015

Robinson WI (2011) PET- Livestock Sudan: A Pictorial Evaluation Tool for Livestock Assessment in Sudan.

Acknowledgements;

Graphics – Lisa Osborne (AA International);

Fieldwork Coordination- Adil Farah

Published by AA International Ltd, Aberystwyth

ISBN 978-0-9931553-8-3

Contents:

What is PET-Livestock Sudan?	4
Before you start	6
Which animals do I condition score?	8
Target areas and features	9
Condition scoring your animal	12
Condition scoring a Herd/Flock	15
Accounting for Herd/Flock variability	19
Photographic guide	21
Camels CS1-CS5	22
Cattle CS1-CS5	28
Goats CS1-CS5	34
Sheep CS1-CS5	40
Annex 1 – Recording sheets	46
Annex 2 – Forage Assessments – Pasture	50
<i>PET-Forages Sudan</i>	53
Annex 3 – Forage Assessments – Browse	60

What is PET-Livestock Sudan?

PET-Livestock Sudan is a **Pictorial Evaluation Tool** that has been prepared:

- to help Sudan assessors¹ to estimate the most common body condition of groups of domestic animals seen on the ranges, in fields, in backyards, by the side of the road and in markets rapidly and *without touching* their bodies;
- to quantify/standardise evaluations of livestock body condition and monitor changes in the same herds and flocks over time; and between similar herds and flocks in different locations.

PET places sets of photographs of Sudanese camels, cattle, long-tailed sheep and smooth-haired goats in a range of body conditions scored from 1 (very thin) to 5 (very fat) in a progressive series for each species, following a grading system developed in Australia for domestic livestock 30 to 40 years ago².

The PET approach offers a simplified and modified version of the Australian condition scoring system based on the critical observation of *one* highly visible *target area or feature* of the body that can be accomplished by a quick look at the animal from the correct angle or approach.

PET is divided into three parts:-

- an explanatory section that tells you how to use the tool;
- a gallery of photographs of livestock providing a **guide** of clear examples of the condition scores CS 1 to CS 5 by which to judge/categorise the animals under observation;
- three annexes providing back-up information for livestock production assessors including examples of record sheets; and estimates of typical

¹ Livestock production planners and evaluators, food security assessors, field workers in agencies and NGOs; all persons conducting general rapid rural appraisals.

² The Australian practice, which has stood the test of time, involves both observation and palpation of flesh in key areas of the body for all stock except camels.

forage sources, grazing, crop by-products and browse found in Sudanese rangelands.

In the **PET**, each condition score of each species is portrayed by two annotated photographs of three carefully selected animals exhibiting the characteristics that define the given condition score. The two photographs are linked:-

- One photograph is taken approaching the chosen animal, while it is either standing alone or within a small group, from a direction that presents the *target area or feature* upon which the condition score is based, to best advantage.
- The second photograph is a close-up showing the detail of the same *target area or feature* to help decision making.

By comparing the *target area or feature* of each of the animals under observation with the photographs of condition-scored *target area or feature* of similar animals in *PET-Livestock Sudan*, assessors will be **able to select the photograph and, thereby, the condition score that most closely matches the condition of each animal in the group.**

BEFORE YOU START

It is important that you spend time reading this introduction. It explains how to use *PET-Livestock Sudan* to get the best return from the time you invest.

In **PET**, you will find sets of photographs of each familiar domestic species reared in Sudan. The sets are divided into grades or *condition scores* (CS) based on deposits of flesh, in the higher scores this is mostly fat, laid down in strategic locations or in an obvious features of the body that a) can be seen clearly from a short distance away; and, b) that change significantly enough because of nutritional and physiological changes for such changes to be noticed by a conscientious observer.

The set of two photographs of three different animals in each grade, each one different from the other - yet within the same score, provides the assessor with an indication of the variation that exists within the scores. However, as with most characteristics of animal indicators except for birth and death, nature rarely moves in exact steps, so grades merge into one another and scores become blurred around the edges.

Under **PET** it is individual animals that are observed and scored, but it is the *most common* or *mode* condition score of the herd/flock that is the indicator of importance under current levels of management and programme interventions.

The data for individuals are amalgamated to provide the indicators needed. After using **PET** for a short time, most assessors, with livestock production experience, will automatically recognise the most frequently occurring or mode CS of a group of livestock. It takes little time to record the score that immediately springs to mind in a suitable note-book, in an efficient, formalised way, ready for analysis later. Given access to range livestock and the time available for assessments, the *one-site, non-touch* condition scoring system presented in PET is very fit for purpose to assess the mode CS of Sudanese herds and flocks in present systems of intervention/ management to compare the body condition of similar livestock

in different places at the same time; and, the same livestock in different (or same) places at different times.

The body condition of an animal depends on its immediate past and contemporary level of nutrition and the simultaneous physiological demands placed on that animal, conditioned by its genetic make-up. Consequently, mature animals are the best indicators as their growing spurts are over³, but they will still lose and put on flesh. Therefore, to obtain general overall impressions of flock or herd condition, it is better to disregard young stock *when scoring*⁴ and concentrate your observations on the mature animals.

Within the mature sector, animals in early/middle lactation are under the heaviest demand so, given the same access to nutrition as non-lactating stock, milking females are most likely to be exhibiting lower condition scores as they 'milk off their backs'. **Therefore, when evaluating change in CS for management purposes:**

- it is important to compare *like with like*, so an overall identification of the class of mature livestock assessed in an obvious physiological state (milking or non-milking; fattening or store) is necessarily part of the procedure; and, if the group is mixed, a note of the proportions of each class in the herd/ flock under observation, is an important prerequisite for useful and enduring assessment.⁵

A further point to consider is the overall health of the group. Whereas injury will usually only seriously affect the condition of a single animal, metabolic disorders are likely to affect the condition of several head at the same time; and infectious diseases affect many animals simultaneously. Disorders and diseases will be invariably accompanied by other specific signs that are beyond the scope of **PET** to record, however, *absence* of the common non-specific signs of good health in several animals should always be noted on the record sheet *viz*:

- prominent, clear and placid eyes; moist nostrils, straight back and a stable confident posture should always be noted.

Similarly, also note the presence on non-specific signs of ill-health in several animals *viz*:

- mucus coming from nose/ eyes⁶; a *staring* or patchy coat; faecal stains from long-term scours; exaggerated up-and-down rocking of several heads when a group is walking past⁷; and an unthrifty appearance.

³ Except for compensatory growth of store stock.

⁴ Not when looking at general health.

⁵ Experienced livestock enumerators/ assessors count in clusters of heads –do the same thing and note the proportion of milkers.

⁶ Maybe caked in dust.

⁷ Rapid indicator of lameness.

STEP 1

Which animals do I condition score?

To begin the assessment you must first identify the *target area or feature* of the animals to be assessed. If the herd or flock is mixed, each species may have a different *target area or feature* to be scored.

Livestock are sometimes herded together in mixed groups. You must decide which animals you need or are able to score. This is most usually determined by:

- whether or not an indicator species has been selected;
- the amount of time you can spend with the herd/flock according to the schedule of the assessment;
- the level of access granted by the livestock keeper.

As a rule of thumb, the large domestic animals in this series (camels and cattle) are easier to score than the small ruminants (sheep and goats), the *target areas and features* are bigger and so, broadly speaking, the differences are easier to detect, so:

- if time is short or the assessment is being done mostly from a vehicle in a driven transect, **use camels and cattle as your indicators** as they will connect to the prevailing situation of access to both browse (camels) and grazing (cattle);
- If you have time and are stopping regularly on the ranges so you are scoring mostly on foot, **use sheep and goats as indicators**, the two species probably offer a much larger sample than camels and cattle as they graze (sheep)/ browse (goats) in greater concentrations, so more stock can be viewed with less effort and less risk (camels and cattle may usefully be scored at the same time if they are available in the same locations).
- In locations where the animals are held under control in confined spaces, with the permission of the livestock keepers **all livestock** may be easily scored but be careful not to impede the operations that confine the livestock in the first place (vaccinating, kraaling, releasing from kraal, watering, or selling).

STEP 2

What are the target areas and features?

PET photographs show estimated condition scores according to the amount of flesh (fat and muscle) deposited at single indicator sites, the chosen PET *target areas and features*, where shape changes reflect general changes in body condition. Such changes can be easily seen from a short distance away from the animal and are not masked by other physical changes to the animal's condition brought about by other factors (e.g. daily inflation of rumen).

Remember, *target areas and features* selected for PET-Livestock Sudan differ between domestic species. Some features are obvious choices; other areas connect to locations chosen because they are not influenced by breed changes.

- The chosen *target feature* for all camels is the *hump*, which has been used for condition scoring before by Australian assessors⁸.
- The chosen *target area* for all cattle breeds is the loin, more specifically the flesh cover over the *transverse and vertical processes of the lumbar vertebrae* on the *right side*⁹ of the animal.
- The chosen *target feature* for long-tailed sheep is the loin, more specifically the flesh cover over the *transverse and vertical processes of the lumbar vertebrae on the right side*⁹ of the animal and, in highest scores, how it sculpts the outline from pin bone to tail base.
- The chosen *target area* for all goat breeds is the loin, more specifically the flesh cover over the *transverse and vertical processes of the lumbar vertebrae on the right side*⁹ of the animal and, in highest scores, how it sculpts a rounded rump.

The following two charts provide line-drawings showing the features and the external changes to look for regarding camels (Chart 1), and a diagram (Chart 2) of the changes of flesh deposition around the lumbar (loin) vertebrae noted in the condition score photographs for long-tailed sheep, cattle and goats.

⁸ Crabb D, Manwaring J and Connor T (1990) Feeding Standards for Australian Livestock. Ruminants CSIRO, Australia; contains some of the history of condition scoring since Jefferies (1961) began the process with sheep.

⁹ NOT influenced by daily pressure changes in the rumen.

Chart 1 Camels-Line drawings showing CS 1-5 based on the amount of fat in the hump

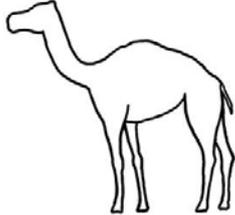
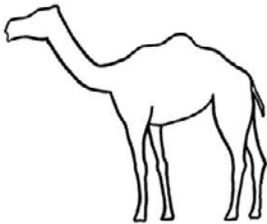
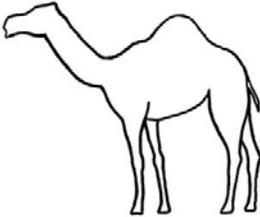
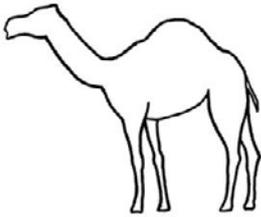
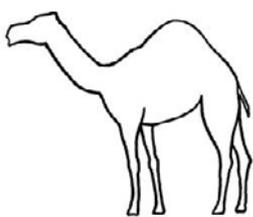
CS	Description	Illustration
1	The hump, though present, is indistinct; the hump sac contains little or no fat and, often, in the case of older stock, falls to one side.	
2	The hump is present and the hump sac contains enough fat to create a distinct shape that is 'hump like' and sits on a base 25-35% of the dorsal length. The height of the hump is 10-20% of the base.	
3	The hump sac contains enough fat to create a hump, characteristic of dromedaries that is swollen beyond the width of the transverse processes, sits on a base 35-50% of the dorsal length. The height of the hump is 10-20% of the base.	
4	The hump is the dominant feature extending beyond the width of the flanks and occupying 50-70% of the dorsal length of the body. The height of the hump is 10-30% of the base.	
5	The hump is extremely dominant extending beyond the width of the flanks and occupying 70% + of the dorsal length of the body. The height of the hump is 15-30% of the base.	

Chart 2 Line drawings showing internal deposition of flesh in loin area for CS 1-5 for cattle, sheep and goats.

CS	Description. Viewed from right side only.	Illustration of cross section of backbone in loin area
1	Severely concave between spine and ribs. The backbone is very noticeable, lateral processes of the lumbar vertebrae may be seen as individual bones like <i>piano-keys</i> .	
2	Slightly concave between vertical and lateral processes. Ends of the lateral processes of the lumbar vertebrae are seen as a sharpened edge - not individual bones forming a <i>knife-edge</i> .	
3	The flesh deposits have sculpted a smooth slope (c.45°) between the tips of vertical processes (spine) to the rounded end of the lateral processes forming a <i>slope</i> .	
4	Fat and muscle deposits between the spine and the end of the lateral processes have flattened the back in the lumbar (loin) area like a <i>table-top</i> .	
5	Further fat and muscle deposits have swollen the flat back area to the extent, in cattle only, that a groove is visible between the deposits on either side of the spine. Fat is deposited over the tail-head and wobbles. Long-tailed sheep and goats do NOT show the groove and the flesh cover is sculpted back covering the pin bone linking to a fat tail-head (sheep) or a rounded rump (goat).	

STEP 3

What is the condition score of my animal?

In PET, the photographs of livestock in what is termed 'good' condition have *red* backgrounds. The photographs of animals in 'medium' condition *yellow* backgrounds. The photographs of animals in 'poor' condition have *blue* backgrounds.

Remember, 'poor', 'medium' and 'good' are terms that subjective and connect to purpose¹⁰. **PET** condition scores from **CS 1** to **CS 5** provide you with a simple measure, like a ruler, that can be used for any animal at any time.

Turn to the section in *PET-Livestock Sudan* that contains the photographs. For each domestic species you will find five pages of photographs, one page for each condition score. Each page presents 6 photographs comprising 2 photographs of three examples of the same score, an **approach** shot and a **close-up** of the *target area or feature* that determines the score.

The '**Approach**': the photograph is taken from a distance of 3-5 metres from the animal. It presents the whole body from the angle that shows the *target area or feature* in context and to the best effect. In this regard each species has its own recommended **approach** angle which should be strictly adhered to.

- Camels - viewed from the side, either LEFT or RIGHT side may be used.
- Cattle - viewed from the side - RIGHT SIDE¹¹ only.
- Goats - viewed from the side - RIGHT SIDE¹¹ only.
- Long-tailed sheep - viewed from the side - RIGHT SIDE¹¹ only.

The '**Close-up**': These photographs show a closer view of *target area or feature* providing the detail missing in the **approach** shot.

CS 1 and **CS 2** have **blue** background; **CS 3** has a **yellow** background; and **CS 4** and **CS 5** have **red** backgrounds.

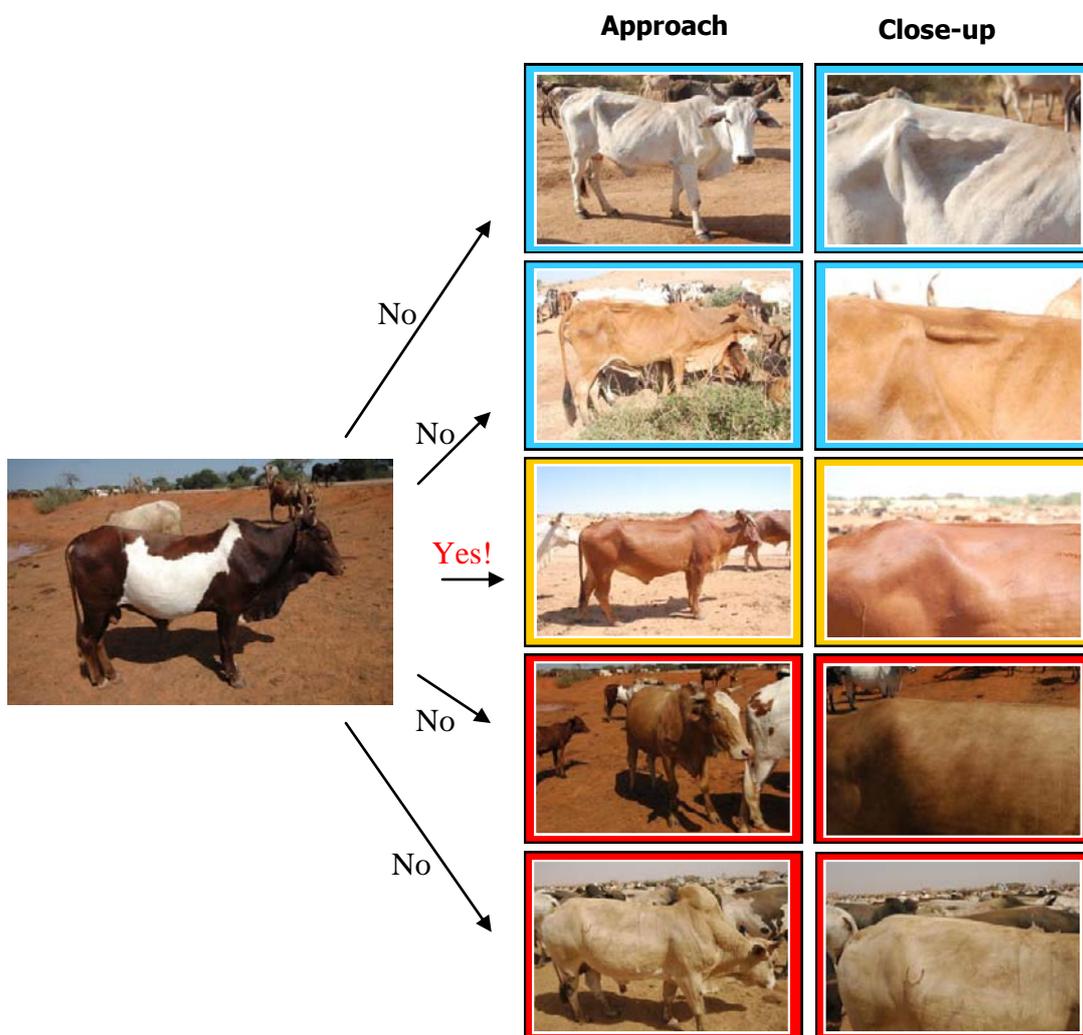
¹⁰ Breeding stock may not be required to go above CS 3; store stock for fattening may be preferred in CS 2.

¹¹ Inflated rumen after a few hours grazing, masks the bones and extends the flesh cover on the left side of a ruminant.

Look at the animals at a distance of 3-5 metres and compare the animals you are looking at with the photographs in **PET**.

- Select the photograph that most closely matches the animals you are studying.
- Study the *target area* or *feature* in **close-up** to confirm your choice.
- Where appropriate, information written on the photograph may help you to decide if you feel that the animal falls between two scores.

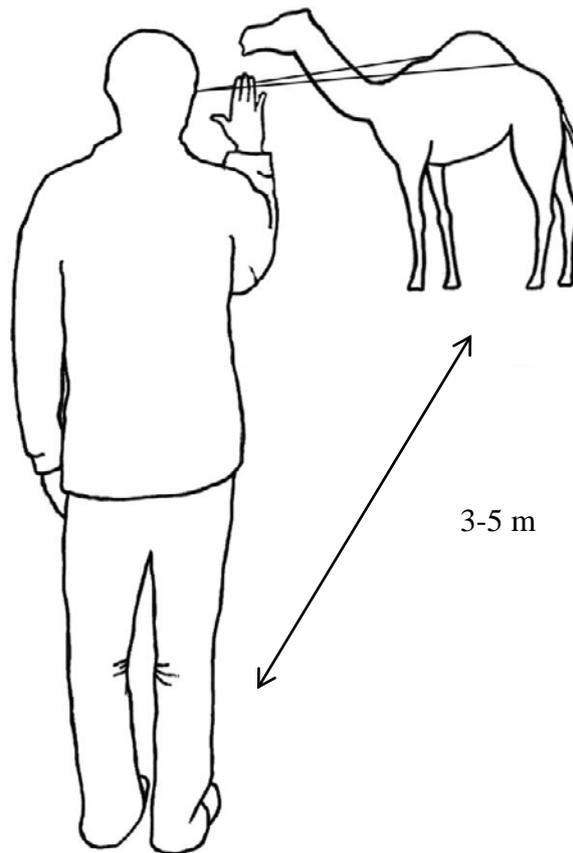
An example of how to use the '**Approach**' photographs in *PET-Livestock Sudan* is given below. The '**Close-up**' photographs should be used for confirmation.



In the above example, the cow is best described as a CS 3 – the photograph with a yellow background. Do not be afraid to change your mind when you take a closer look at the **Close-up**.

The cattle condition score range depends on changes of thickness of flesh cover in the same location.

The camel condition score depends on changes in the comparative size of the hump. To help you judge the proportions of the back occupied by the hump base – try using the simple technique described below:-



1. Stand 3-5 m from the camel.

2. Place your open hand, at arms length, palm forward in line between your eyes and the camel.

3. Close one eye and see how many fingers cover:-

a) the hump-base (Fingers H)

b) the back, from tail head to beginning of the neck (Fingers B)

4. Calculate percentage of Fingers H / Fingers B

eg. $3/4 = 75\%$: $2/4 = 50\%$: $1/4 = 25\%$

This may help you confirm the score you have in mind.

STEP 4

Condition Scoring a Herd/Flock

Condition scoring a herd or flock means repeating the exercise described in Step 3, with each accessible, healthy, adult member of the group. Here are some suggestions how to approach the herd/ flock to be scored.

1. Considering animals grazing at pasture, **in the herder's presence and with the herder's permission:**
 - Try to approach the grazing/**browsing cluster from the animals' right side;** *i.e.* in clock face or military terms looking at the animals head-on, the observers should approach from nine-o'clock.
 - Walk towards the animal/s with PET open at the correct section in a confident manner - as if you are very familiar with this group of stock;
 - **Walk at a steady, even pace, don't run and do not approach jerkily or waving your arms about** - unless you are trying to drive the animal/s away from you or to prevent them from moving towards/around you.
 - When you are about 3-5 metres from the animal/s, slow down and wait for the animals to lift their heads, as a *standard operating procedure* try to score the animal/s when they are standing with their heads in the *at rest/ walking slowly* position.
 - **If the animals move away from you, don't chase after them, outflank** them by walking quickly away from them to the right, at an angle that enables you to continue in an arc that will bring you back on the right side of them as they settle down in their new position.
2. Considering animals moving slowly at pasture in ranks or in single file, along **a track or out of/into a collecting pen, in the herder's presence and with the herder's permission:**
 - Position yourself **ahead** of the lead animal some 5 metres to the right of the intended path; approach the position, with PET already open at the correct section, at a decreasing speed so that stopping is the most natural thing to do, *i.e.* do not move quickly approaching the moving group and do not stop abruptly.

- Making no sudden movements or noises, allow the animals to file past *at their own speed* while you record the scores on the record sheet - this may be easily achieved by putting ticks in a series of columns as noted in Annex 1.
 - With a large group in movement, for most general assessing purposes **don't worry about missing the odd adult that may sneak past or that is hidden by another**. Trying to chase down an escapee in an open area is likely to disturb the whole group so is not *effort-effective*. Remember it is the mode score of the herd/flock that you are trying to record.¹²
3. Considering animals that you pass when you are in a vehicle during a driven transect:
- Explain your task carefully to the driver.
 - Ask the driver to pass the animals:
 - On the right side if they walking in the same direction as you are travelling.
 - On the left if they are walking towards you.
 - If time allows, stop the vehicle and allow the animals to file past the vehicle at their own speed.
 - Record the scores on the record sheet as you pass them or *vice versa*.
4. Considering animals at a watering point:
- Watering points are *often* a place of tension for herders and animals.
 - Obtain permission to remain at the site from the senior herder and/or water point organiser, but negotiate access politely with each livestock keeper.
 - Stay out of the way of animals arriving or departing.
 - Rather than scoring the animal at the source of water and in the action of drinking, position yourself near the route in/ out, close to the source and behave as in paragraph 2 above.
5. Considering animals in a kraal/ homestead:
- An uninvited cold call at a kraal or homestead should be conducted tactfully and with respect, such areas are private and are often jealously guarded.

¹² When scoring for managerial purposes such as adjusting the feeding regime; or splitting the herd/flock for mating, selecting for sale or culling - each animal must be scored so the group should be channelled through a temporary race that will allow you to see each adult animal for long enough to be assessed.

- An initial approach should be made by a local-language speaking team member, preferably a member of the same clan.
- Permission should be sought to observe the animals, if possible when leaving the kraal in a slow and orderly fashion.
- Position yourself- looking at the kraal:
 - stand 5m or so away from the kraal on the left side of the exit, facing the track leading out of the kraal so you can see the **right** flanks and rears of the animals leaving the kraal;
 - **don't block the exit, or stand so close you cause the animals to scamper** past you when leaving; stand still, keep quiet and go about the business of looking at PET and recording scores smoothly *i.e.* with no jerky movements.

The five situations described above cover most circumstances. Recording scores should not be seen as a contentious activity, however, when doing a general assessment, if note taking is likely to be too intrusive for the circumstances prevailing, trust your own capacity to recognise- in a very short time- the *mode* (most common) condition score of the group of livestock under observation and record it later in the summary sheet. (Annex 1)

After using PET a few times you should find that scoring becomes *intuitive*:

- you will automatically look at the *target areas and features*;
- automatically assign a score; and
- with only a little thought, easily be aware of the most common score in the group;
- a little more organised thinking will also give you the range of scores available and the class of animals under scrutiny (*e.g.* milkers, followers, culls, store stock, fat stock, and draught animals).

These points can be stored mentally and a) noted later if walking; b) noted immediately if passing a small group of livestock in a vehicle.

Remember, although a single set of condition scores provides useful insight into prevailing conditions at the time of collection, the lasting value of condition scoring lies in the comparison of condition scores of the same livestock over time allowing;

- the comparison of contemporary scores of similar livestock between locations;
- the regular adjusting and re-planning of management decisions using the improved levels of knowledge.

STEP 5

Accounting for Herd/Flock Variability

When you have become confident in using PET-Livestock Sudan to condition-score livestock under any circumstances, you can supplement your records by including more details regarding the animals scored and the factors determining the score.

A single species, owner-managed, breeding herd or flock is likely to contain animals in different physiological states. The condition score mode of sub-groups may differ from one another, according to the demands placed on the members of that group; therefore, as noted earlier during detailed herd/flock assessments, the mode score of each group should be noted separately.

Given herding practices common in Sudan, sub-groups of herds and flocks are regularly grazed separately. Consequently, more often than not, a cluster of animals seen together will belong to such a sub-group, which makes scoring of the animals in view at any one time easier than when all the animals of the herd or flock are grazed together. The most likely times to see diverse groups of livestock are a) during seasonal migrations; b) when village herders collect the animals from all households and take them to pasture; or c) in a lairage awaiting slaughter.

Also, livestock traders tend to buy similar animals which they move together; each trader specialising in a particular class such as fat cattle for sale to butchers in a larger town, store cattle for fattening elsewhere, or cull cows for sale in a market place; plus a similar range of options for goats and sheep. Again this sub-grouping of animals on the move simplifies condition scoring for general assessors.

Animals with condition scores that differ widely from the norm or mode value in such sub-groups are most likely to be *enigmas* e.g. one or two barren cows in a group of milkers that missed a pregnancy, aging animals in a breeding herd/flock that have lost their teeth and are no longer able to graze marginal pastures; animals suffering from a temporary disability (injury) or a disease (footrot). If

there are several such animals standing out from what should be the norm, try to find out the cause. Perhaps they are new arrivals, purchased from other more marginal locations; perhaps their signs are indications of a metabolic disorder in the area (*e.g.* a mineral deficiency); or perhaps they are showing early signs of an infectious disease or a widespread parasitic infection. In any event, it is worth questioning the herder to find out why such variability exists; and noting the response.

Photographs 1 and 2 shown below show two clusters of animals in similar condition, typical of groups met *in transit* at pasture. For comparison purposes, Photographs 3 and 4 show typical mixed groups of camels in a municipal lairage awaiting slaughter; and cattle at a weekly market.



Photograph 1: CS2 Sheep, breeding ewes



Photograph 2: CS2 breeding goats with offspring



Photograph 3: A mixed group of camels at market



Photograph 4: Different groups of cattle in market

PET-Livestock Sudan

Photo-Indicator Pages

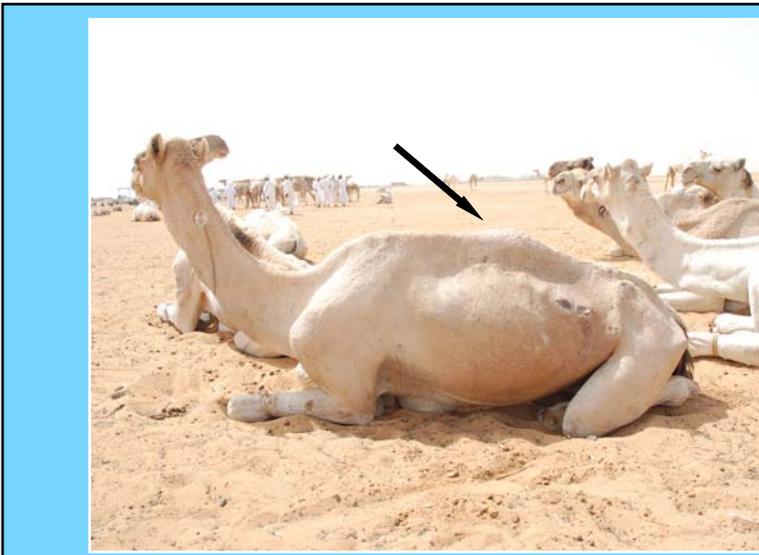
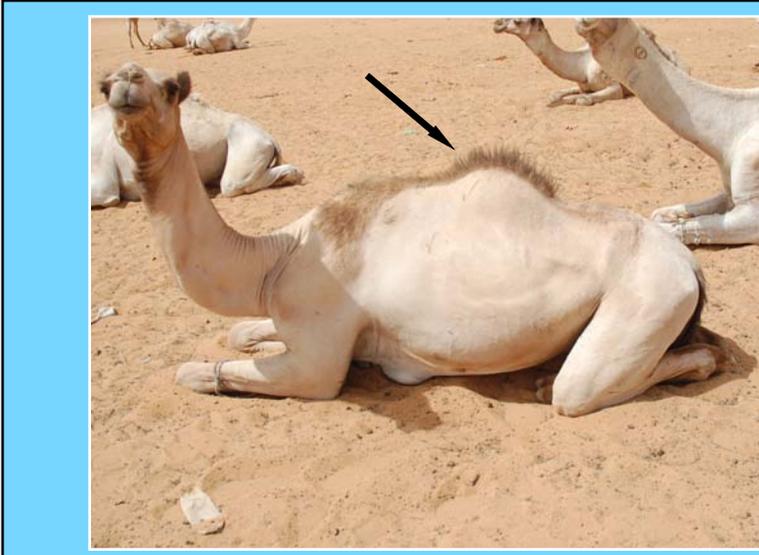
Camels

CS1 – CS5

Camels - CS1

Approach

Close-up

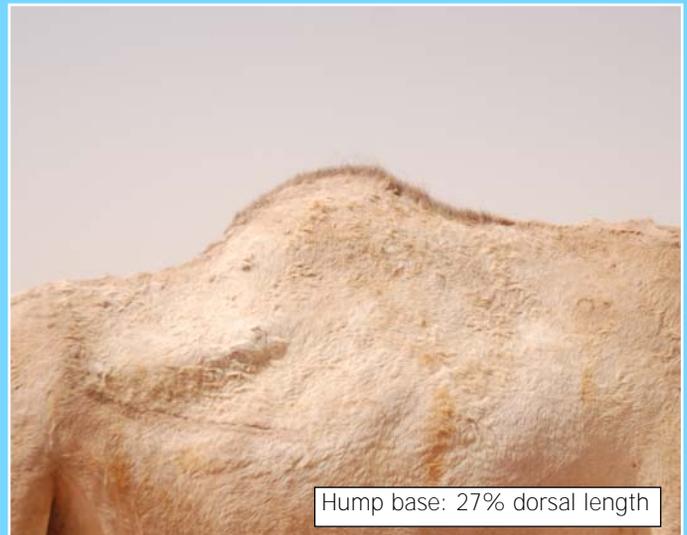
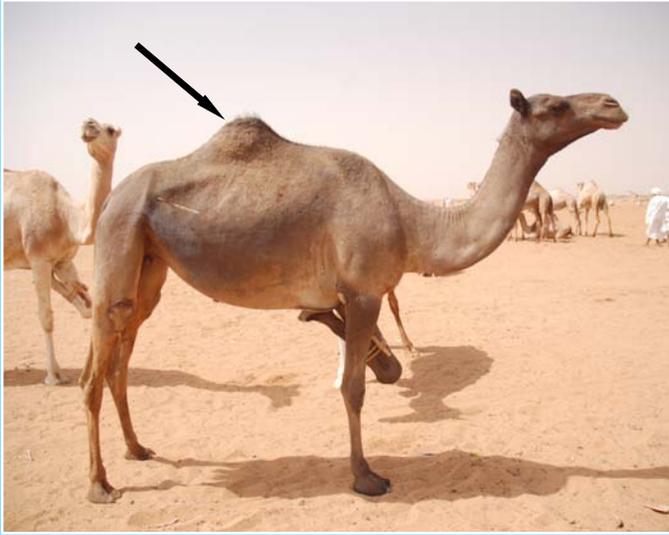


Note: CS1. The hump, though present, is indistinct. The hump sac contains little or no fat and, in the case of older stock falls to one side.

Camels - CS2

Approach

Close-up

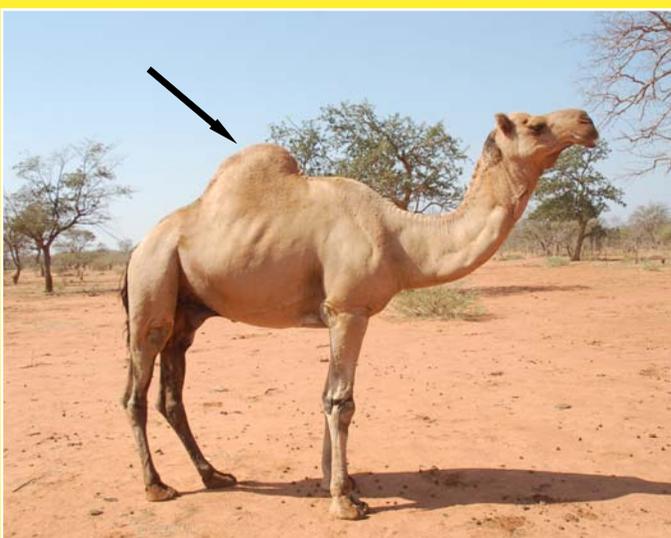
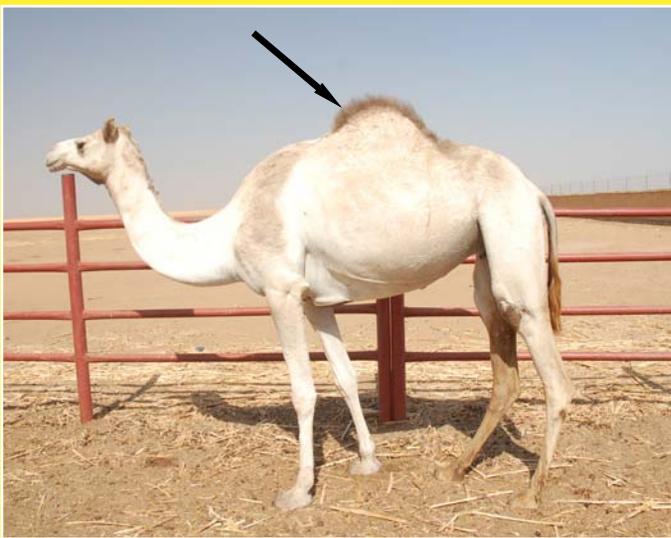
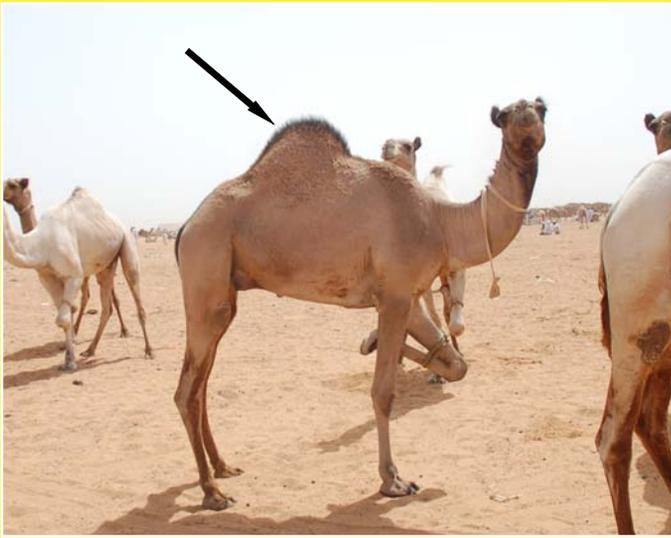


Note: CS2. The hump is present and the hump sac contains enough fat to create a distinct shape that is 'hump like' with vertical growth and sitting on a base 25-30% of the thoracic and abdominal vertebrae.

Camels - CS3

Approach

Close-up

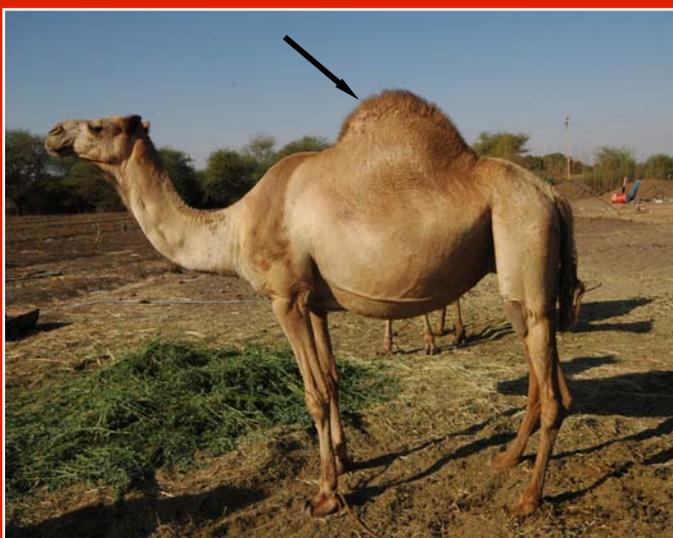
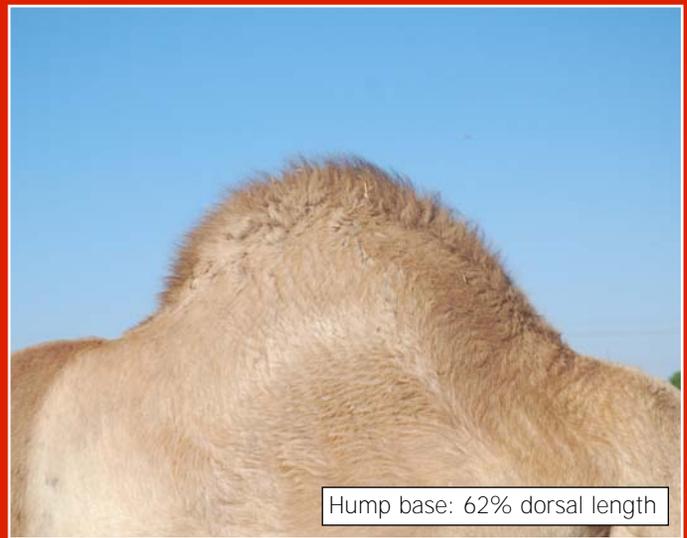


Note: CS3. The hump sac contains enough fat to create a hump, characteristic of dromedaries that is swollen beyond the width of the transverse processes of the backbone and fits on a base of 35-45% of the dorsal length comprising the thoracic and lumbar vertebrae.

Camels - CS4

Approach

Close-up

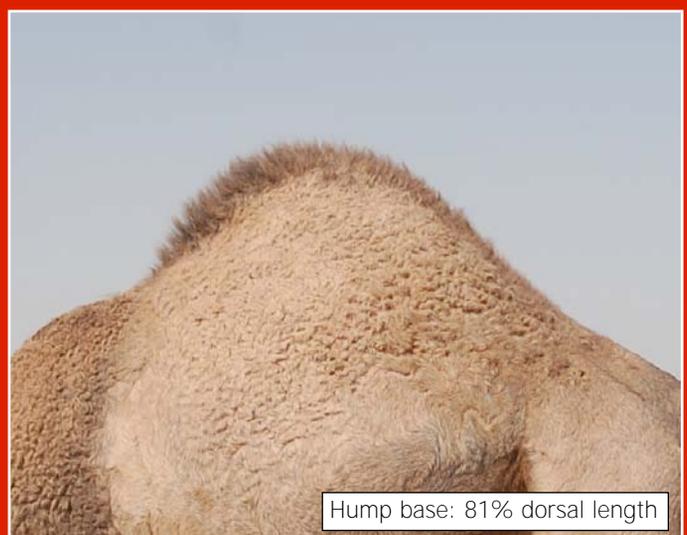


Note: CS4. The hump is a major dominant feature extending beyond the width of the flanks and occupying 50-70% of the dorsal length of the body.

Camels - CS5

Approach

Close-up



Note: CS5. The hump dominates the body; the hump sac rises from the tail-head and progresses further than the middle of the chest (thoracic) vertebrae towards the neck (cervical) vertebrae; extending as it does so, beyond the flanks. The hump base occupies more than 70% of the dorsal length, comprising the thoracic and abdominal vertebrae.

Cattle

CS1 – CS5

Cattle - CS1

Approach

Close-up

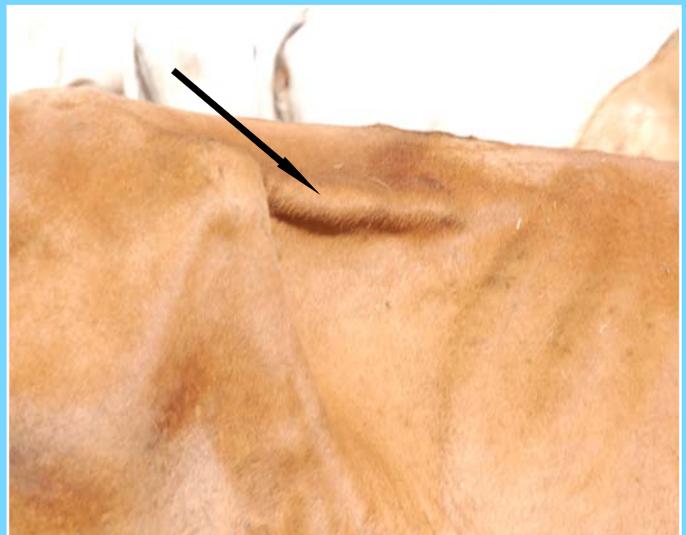


Note: CS1. Viewed from the right hand side of the body of the mature animal, standing at rest or in slow movement with head held in a horizontal position; the ends of lateral processes of the lumbar vertebrae are easily observed as separate protusions, reminiscent of piano keys.

Cattle - CS2

Approach

Close-up



Note: CS2. Viewed from the right hand side of the body the ends of lateral processes of the lumbar vertebrae are seen as a straight line.

Cattle - CS3

Approach

Close-up



Note: CS3. Viewed from the right hand side of the body, the straight line noted in CS2 has disappeared under the fuller cover of flesh between the vertical processes and the ends of the lateral processes of the lumbar vertebrae, forming a filled triangle or wedge of muscle.

Cattle - CS4

Approach

Close-up

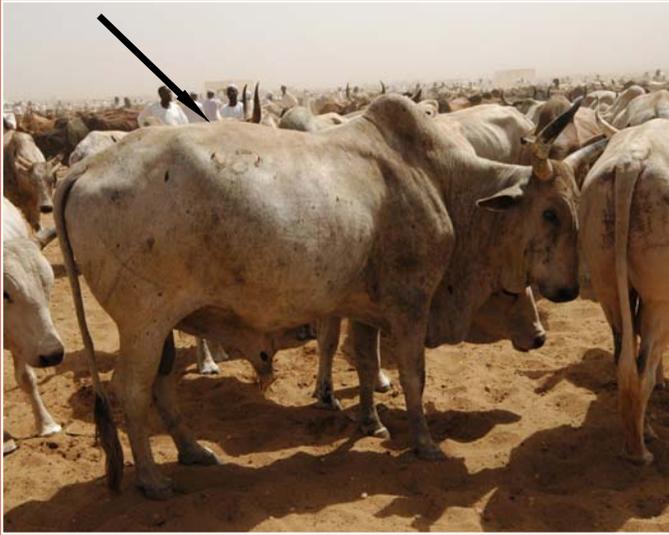


Note: CS4. Viewed from the right hand side of the body, the filling triangle of muscle and fat noted in CS3 has developed to form a flat surface between the top of vertical processes and the ends of the lateral processes of the lumbar vertebrae like a table top.

Cattle - CS5

Approach

Close-up



Note: CS5. Viewed from the right hand side of the body, the CS4 table top have developed a groove in the centre as fat and muscle tissues are deposited either side of the back bone. Fat is also noticed in deposits over the tail head and extending the rump in a distal distortion.

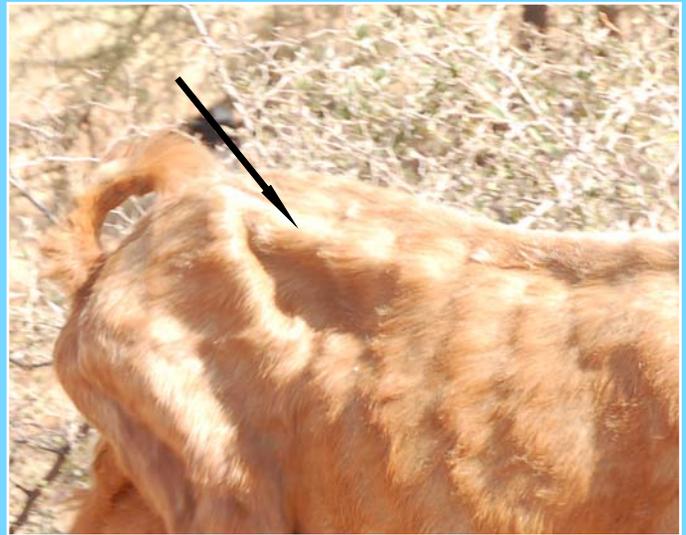
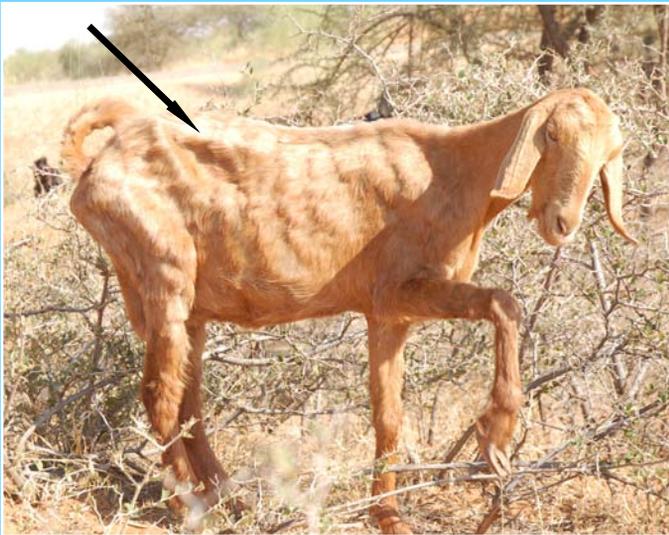
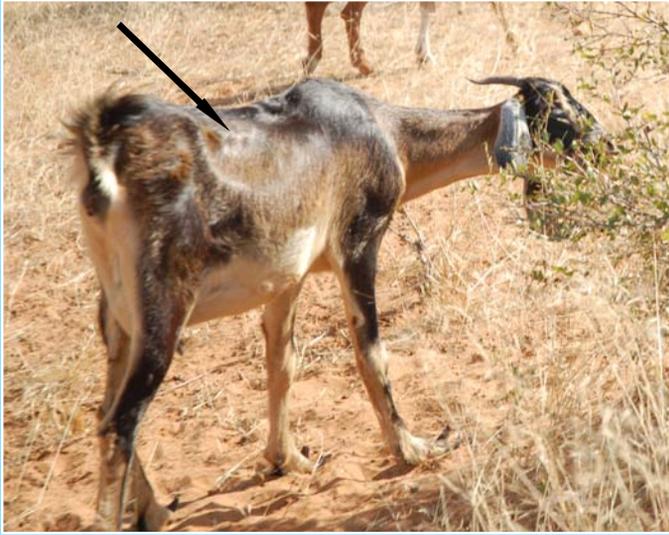
Goats

CS1 – CS5

Goats - CS1

Approach

Close-up

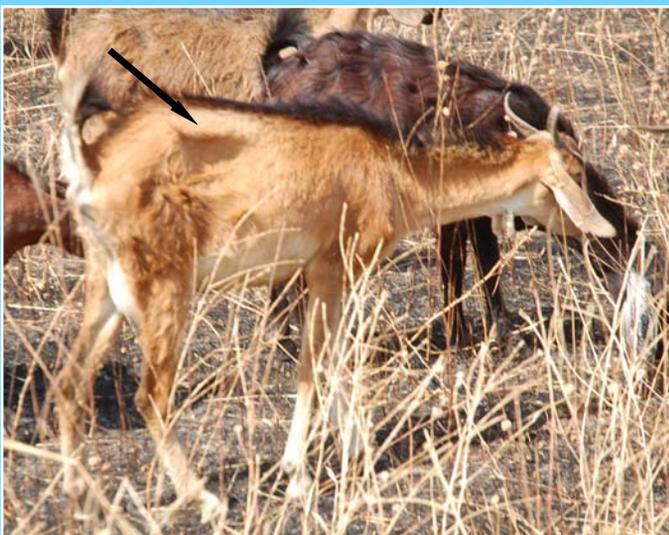
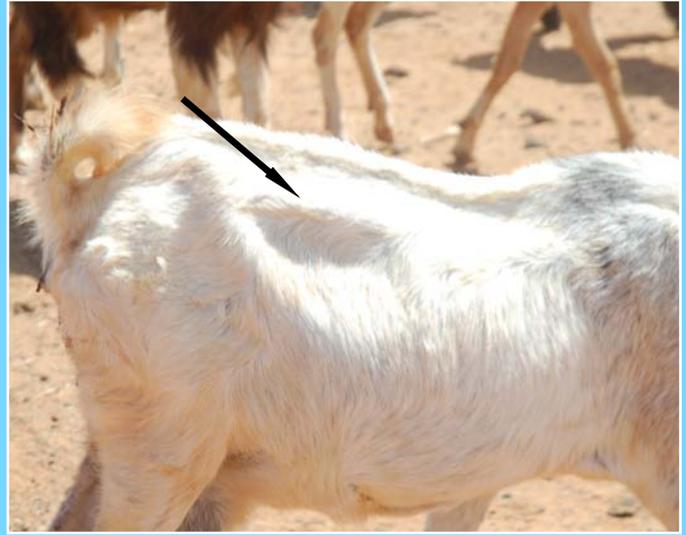


Note: CS1. Viewed from the right hand side when at rest or moving slowly with head in a horizontal position; the ends of the lateral processes of the lumbar vertebrae are visible. These appear as a series of bumps rather like piano keys. Pin bone is sharply prominent.

Goats - CS2

Approach

Close-up

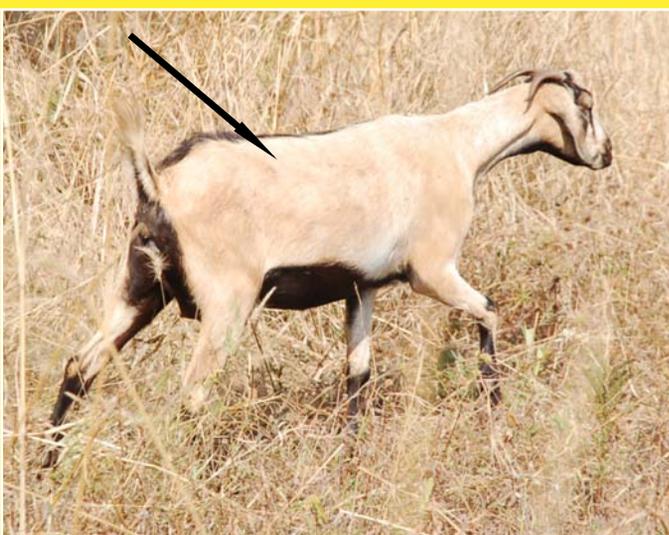


Note: CS2. Viewed from the right hand side; the ends of the lateral processes of the lumbar vertebrae are seen as a straight line - the bumps are no longer visible.

Goats - CS3

Approach

Close-up



Note: CS3. Viewed from the right hand side of the body; the straight line noted in CS2 is no longer visible. It has disappeared under a wedge of flesh in a filled triangle between the vertical processes and ends of the lateral processes of the lumbar vertebrae.

Goats - CS4

Approach

Close-up

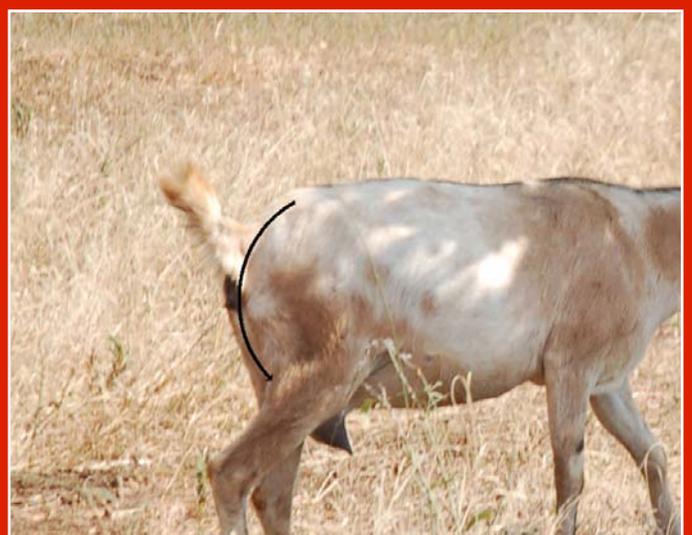
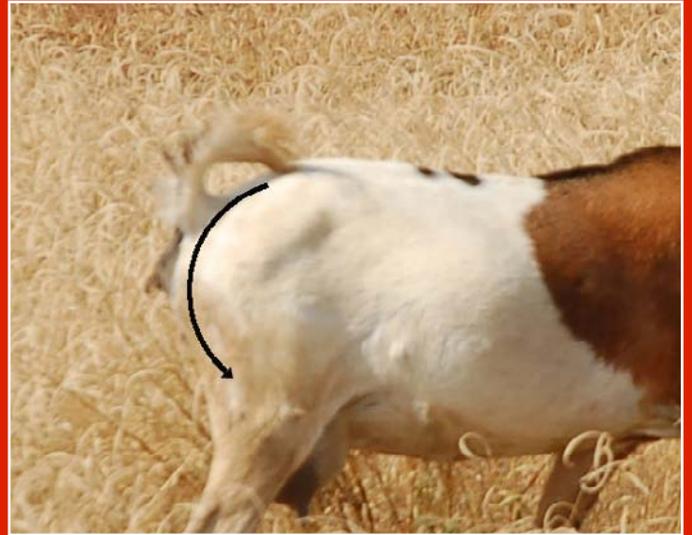


Note: CS4. Viewed from the right hand side; the filled triangle noted in CS3 has developed into a flat surface between the top of the vertical processes and the ends of the lateral processes of the lumbar vertebrae, rather like a table top.

Goats - CS5

Approach

Close-up



Note: CS5. Viewed from the right hand side; the flat back of CS4 is reinforced and sculpted by muscle deposits into a convex shape extending from the lumbar processes, incorporating the tail head and covering over a rounded rump.

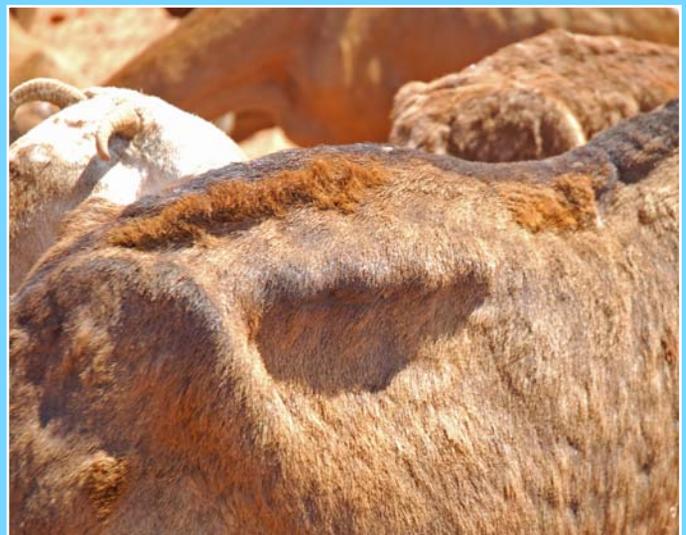
Sheep

CS1-CS5

Sheep - CS1

Approach

Close-up

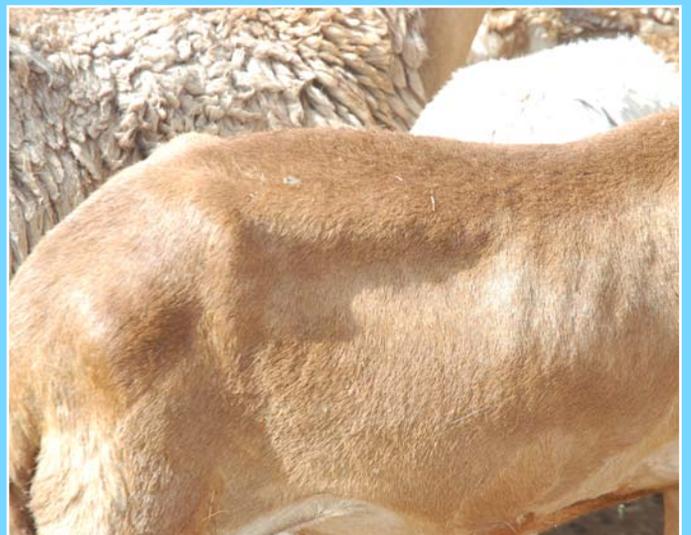
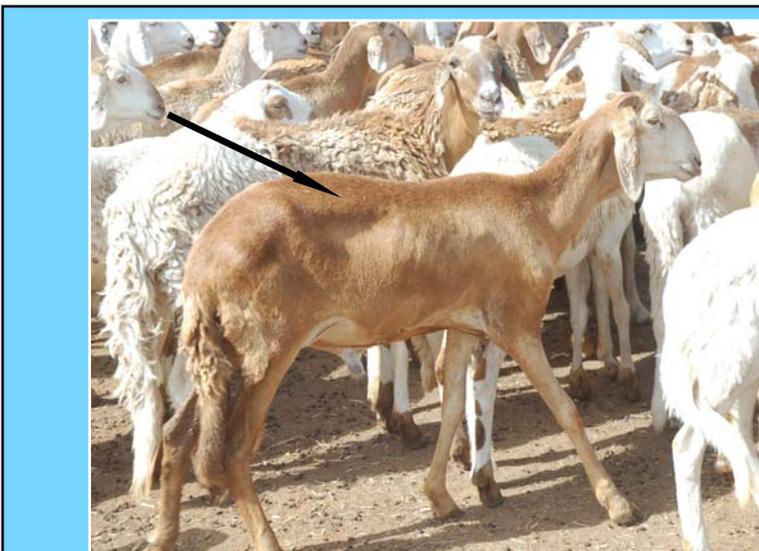
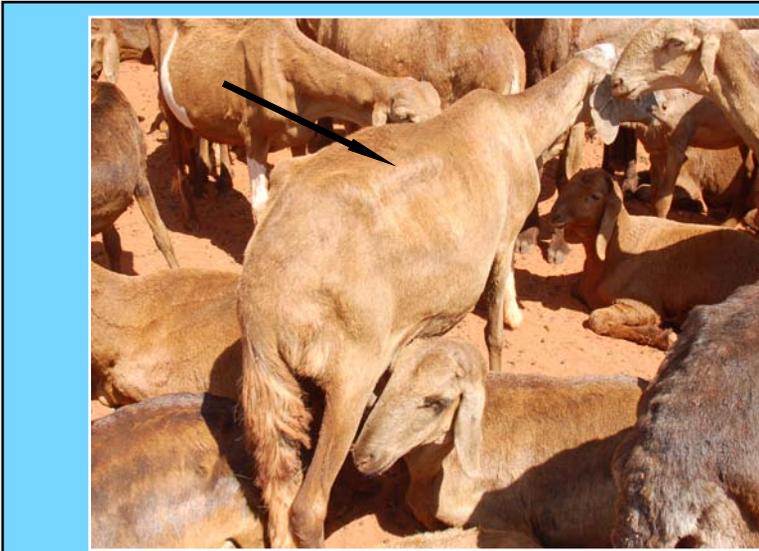


Note: CS1. Viewed from the right hand side of the body, of the mature animal, standing still or moving slowly with the head held horizontally, the ends of the lateral processes of the lumbar vertebrae are protruding, stretching the skin and may be viewed as separate bones. At the same time the vertical processes are noticeable and the pin bone is sharply prominent.

Sheep - CS2

Approach

Close-up

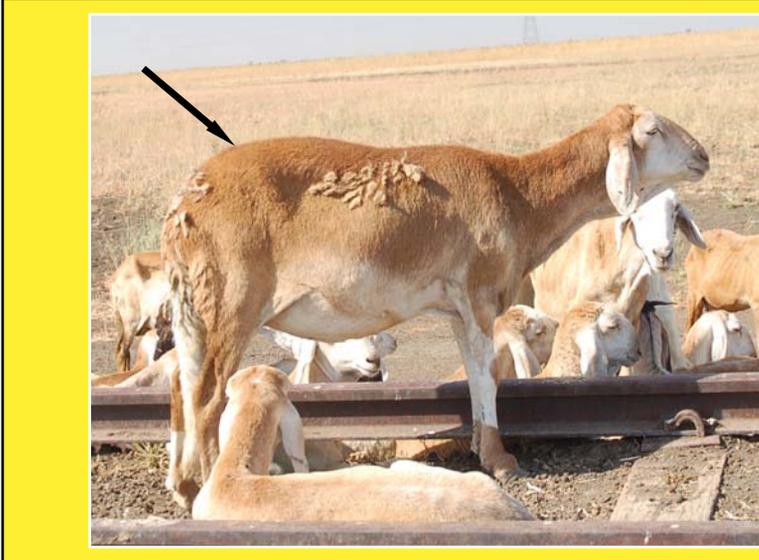


Note: CS2. Viewed from the right hand side, the ends of the lateral processes of the lumbar vertebrae are seen as a contiguous line with a noticeable covering of flesh, creating a 'straight line' parallel to the vertical column and ending at a prominent pin bone.

Sheep - CS3

Approach

Close-up



Note: CS3. Viewed from the right hand side the edges of the vertical and lateral processes of the lumbar vertebrae are linked by a wedge/triangle of flesh forming a sloping profile ending at a discernable but not prominent pin bone.

Sheep - CS4

Approach

Close-up

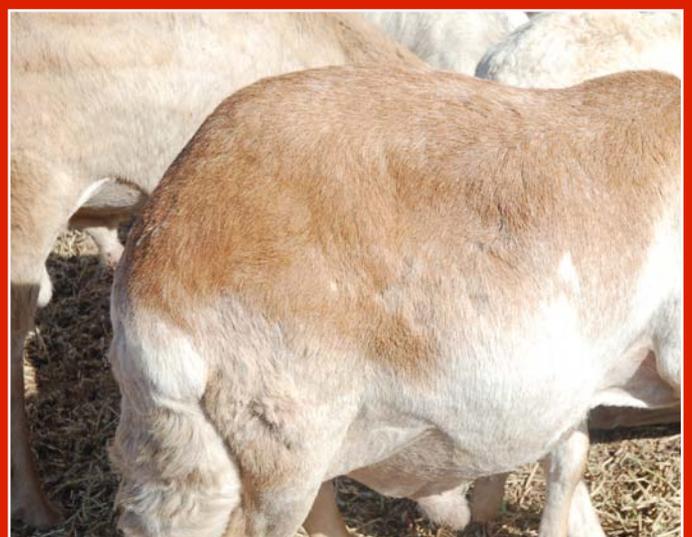
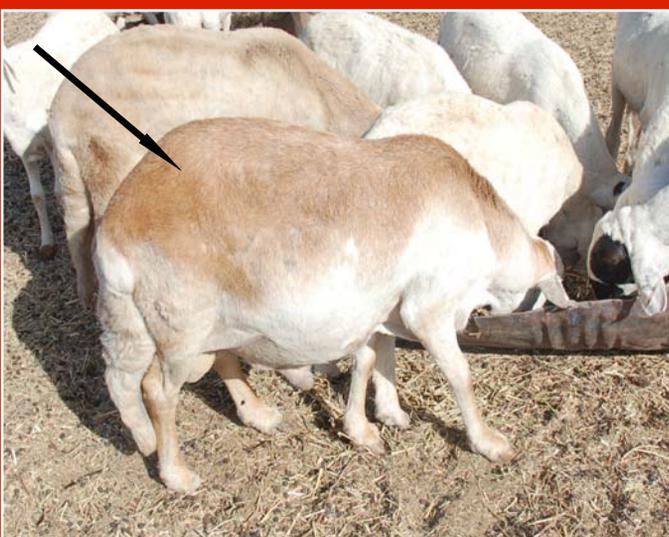


Note: CS4. Viewed from the right hand side, the lateral processes and vertical processes are covered by layers of flesh and fat, presenting a flat back that extends laterally to the ends of the lateral processes and the pin bone.

Sheep - CS5

Approach

Close-up



Note: CS5. Viewed from the right hand side from the beginnings of the lumbar region, the vertebrae and pin bone are covered with flesh extending longitudinally beyond the pin bone, rounding and widening the tail head, and laterally, beyond the ends of the lateral processes and down the flank and top thigh.

ANNEX 1

Recording Sheets

A recording sheet is simply a form prepared to enable data collectors to standardise operations in such a way that everyone assessing collects similar data in the same way.

Rapid appraisals, by definition, are time-bound, therefore, any methods that help speed up operations without risking data loss, misreading and misinterpretation have to be appreciated when the teams are:

- collecting data;
- transcribing from local languages and units to international languages and international units;
- collating data from various sources;
- storing data prior to analysis;
- analysing data.

Recording sheets for use in the field should ensure that:

- the correct data are collected,¹³
- data are quick and easy to enter into the tables,
- records are easy to understand by persons other than the assessor.¹⁴

In the case of recording sheets for PET condition scoring, the example given below may be used for any livestock species being scored for managerial purposes.

Under the recommended PET *standing operating procedures*, the hard copy recording sheets used in the field should be entered into the computer spread sheets at the **end of each working day**; and filed for safe keeping in case they are needed later.

- Style: - daily, portrait-orientated, A4 sized sheets that may be used with an A4 clipboard that can also accommodate PET when walking, are recommended.

¹³ In this sense they jog the memory of the assessor.

¹⁴ In the event of a separation of recorder and sheet, other people may read and interpret data collected accurately

- Format: - assessor name, day, sheet number and location should be recorded in the banner of every sheet; these facts may be entered before **the day's** scoring starts.

Thereafter,

- Input columns: - should be filled with a series of common marks (ticks, crosses or dashes) or standard letter codes designed for speed of entry.
- The condition score: - CS1 to CS5 input cells should be filled-up with 5 marks in each cell, for easy addition later.

The Grand Totals in the field sheet may be used for a general statement of condition in any one location. However, for more meaningful analyses, Recording Sheet 2 has **to be completed at the end of each day's field work**; this sheet provides a format for a summary of *mode* (most common) condition scores by species and by class.

ANNEX 2

Forage Assessments – Pasture and Stover

Under prevailing systems of management, forage supplies for the Sudanese livestock featured in PET come from grazing pasture - grasses and forbs; browsing bushes and trees - predominantly acacia species; grazing straws and stovers from cereals and pulses and from eating *cut and carried* forage from all sources.

Estimating forage availability may be seen both: -

- as an *art* inasmuch as pastoralists and settled livestock herders use traditional methods of estimation, often based on memory, and the use of indicator plants eg. the browsing of plants of last resort such as *Calatropis procera*; and the interpretation of behavioural tendencies of key animals in the flock/ herd;
- as a *science*, connecting to visual and physical examination of forage availability.

Considering the latter and regarding grazing available on a range:

- Spot checks¹⁵ from stratified samples taken during walking or vehicle-driven transects, will provide an estimate of grazing available on that range, at the time of the transect.
- Spot checks involve cutting a known area of grass, drying and *weighing to constant weight*.
 - The size of the sampled plot and frequency of sampling depend on the variability of the pasture, the density of the grasses or forbs; and the time/ resources available.
 - Usually, 1 square metre of pasture is sampled at random within the range area of interest.

¹⁵ In the absence of long term (seasonal) investigations using *exclusion cages*, ie. small controlled areas where grass growth may be measured accurately over a known period of time - spot checks on conserved areas are a valuable indication of forage availability.

A more rapid method than described above is to compare areas of the pasture under observation with **photographs** of known levels of production - in the manner of *PET-Crops Sudan*. Consequently:- **Photo-indicators** have been prepared for six areas of pasture, comprising indigenous annual (3) and perennial (3) meadow grasses *set-aside* for cutting for sale (hay or roofing) or for grazing. A similar exercise has been conducted 3 levels of standing stover from rainfed sorghum crops. In all 9 cases, samples of 1 square metre were identified as being representative of the sites, photographed, harvested by cutting, the fresh product weighed and the sample dried to *constant weight*.

The **photo-indicators** arranged in colour-coded rows of red, yellow and blue signifying high, medium and low performance are included in *PET- Forages Sudan* included below.

The actual levels of production are recorded in grams (g/ sq m) fresh weight and final dry weight; % dry matter (DM) of the sample at cutting is noted. The total weight of DM in tonnes per ha (kg per feddan) is extrapolated from the sample and noted at the end of the row.

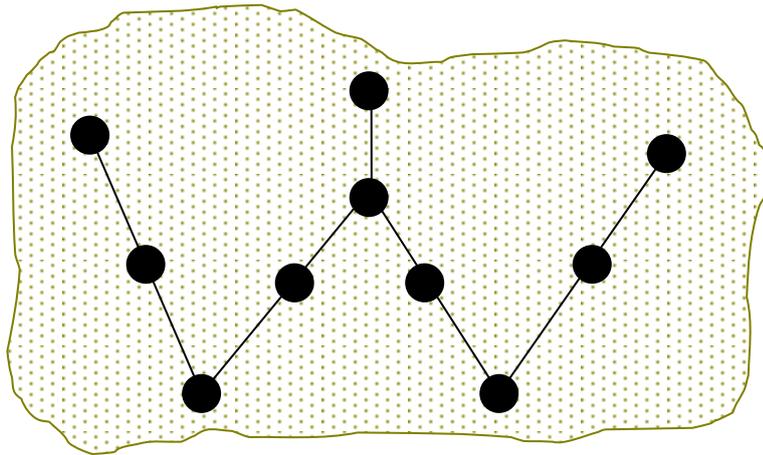
The photographs offer a very rapid way of estimating dry matter (DM) by comparing the photographs with the range in view.

The assessor should: -

- *look at the range - look at the photos*
 - from a distance,
 - from a close –up of 1 square metre,
 - select the photographs that most closely resemble the quantity of grass available.
 - read-off the estimated DM production in t/ha or kg/feddan.

Transect walking across the field will allow the level of variability to be judged by stopping and noting the production, using *PET- Forages Sudan*.

If the transect is conducted as shown in the diagram below, moving in a **W** shape across the field and estimating production at 10 points spaced at regular intervals, the yield of the whole field/ range may be calculated by adding the estimates together and dividing by ten.



It is preferable to check your interpretation of the photographs regularly. Box 1 contains an outline of how to do this.

Box 1. Cross-Checking PET Forage estimates.

1. Select an area of range that is uniform.
2. Use PET photographs to estimate the production of DM per ha.
3. Select 1 square metre of pasture you consider to represent that location using a PET quadrat.
4. Harvest the 1 square metre using a sickle.
5. Weigh the grass immediately after cutting.

This gives an immediate indication of grass available but as water content of cut grass varies with age and the time of day of the cut, the dry matter content (DM) of the grass available is a far better indicator of value and should be estimated by weighing the cut sample over and over again until constant (air-dried) weight is reached. This may be done by:-

- a. After the first weighing, place a sub-sample in a tray, in a sunny, protected area for 5 or 6 hours
- b. Turn the drying grass every hour or so.
- c. Weigh again and again, repeating the process until the same weight is recorded at two consecutive weighings. (A micro-wave may be used to speed process -with care, dry sub-sample for 2 minute sessions at medium strength, weighing after each session; until constant weight is reached.)

$$\text{DM \%} = \frac{\text{sub-sample (constant weight)}}{\text{sub-sample fresh weight}} \times 100\%$$

$$\text{DM t/ha} = \frac{\text{weight (g) from 1 sq m} \times 10,000}{1,000,000} = \frac{\text{weight (g)}}{100} = \text{t/ha}$$

PET-Forages

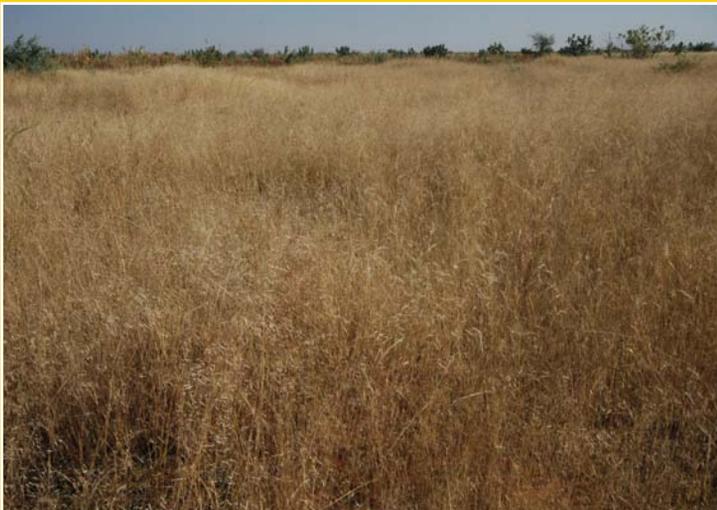
Sudan

A Pictorial Evaluation Tool (PET) for Forage Assessment
in Sudan

Annual Grasses

From-a-distance

Close-up



Annual Grasses

Harvest from 1m²

Yield



Harvested weight
365g/m²

Dry matter
100%

Dry Matter
3.65 t/ha
1533 kg/f



Harvested weight
205g/m²

Dry matter
100%

Dry Matter
2.05 t/ha
861 kg/f



Harvested weight
120g/m²

Dry matter
90%

Dry Matter
1.08 t/ha
453 kg/f

Perennial Grasses

From-a-distance

Close-up



Perennial Grasses

Harvest from 1m²

Yield



Harvested weight
1020 g/m²

Dry matter
50%

Dry Matter
5.10 t/ha
2142 kg/f



Harvested weight
735g/m²

Dry matter
50%

Dry Matter
3.70 t/ha
1554 kg/f



Harvested weight
310g/m²

Dry matter
80%

Dry Matter
2.48 t/ha
1041 kg/f

Stover Sorghum

From-a-distance

Close-up



Stover Sorghum

Harvest from 1m²

Yield



Harvested weight
575g/m²

Dry matter
70%

Dry Matter
4.00 t/ha
1680 kg/f



Harvested weight
313g/m²

Dry matter
75%

Dry Matter
2.35 t/ha
987 kg/f



Harvested weight
75g/m²

Dry matter
100%

Dry Matter
0.75 t/ha
315 kg/f

ANNEX 3

Forage Assessments - Browse

The high level of the contribution to diet of browse as the main forage of *browsers* and a significant supplementary/occasional feed of grazers makes the lack of information on the production of browsing species both surprising and unhelpful when assessing ranges.

Trees, especially thorny acacias, do not lend themselves to rapid assessment¹⁶ and it is the thorny acacias that dominate browsing ranges in Sudan. These most important species are well understood by pastoralists. Although the local names of the trees and bushes may change from place-to-place, the same important set of trees and bushes are found throughout Sudan, varying in degree of importance according to altitude, rainfall and soil type.

For animal production purposes, levels of biomass per hectare from browse depend on the type of tree, density of plants, age of tree, the way in which the trees have been formed (crown size/ shape), palatability of parts and access of stock to edible parts and actions of the herders (lopping, pollarding, shaking branches to harvest dry leaves and fruits).

The most important browse trees noted in transects walked or driven when producing *PET-Livestock Sudan* comprise the acacias such as *-kitir*, (*A.mellifera*); *suffer abyad* (*A.seyal*); *arrad* (*A.etbaica*); *talh* (*A.tortillis*); *hashab* (*A. Senegal*) and *sunt* (*A.nilotica*). In the absence of any production estimates, information from a variety of sources, collected 30 years ago elsewhere,¹⁷ suggest that forage production per annum varies enormously from 100 g to 4 kg per tree including leaves, small twigs, sprouts and pods depending on conditions.

¹⁶ Or even long term assessment judging by the research in this domain, too much compositional analysis of leaves in the laboratory – and not enough time spent in the field to provide a useful guide to all browse trees in any semi-arid area regarding production norms/ factors affecting production.

¹⁷ Mali, South Africa, Sudan, Kenya

Regarding density, a simple technique to estimate tree density per hectare called *point-to-plant*, is described below and shown in Figure 1. As with most rapid assessment exercises, frequency of sampling will determine level of accuracy; therefore, using the technique on a regular basis and in different places in the same ranges, will lead to a build-up of basic information regarding potential range availability in every location.

Point - to - Plant

The assessors walk through the range at the site of interest or at regular intervals e.g. every 1000 ha or 10 sq km, observing the types of trees and their dominance. List the trees in order of dominance/importance as a forage source at that time of the year and determine a) their density and b) crown size mode by judging the length of the radius of the crown.

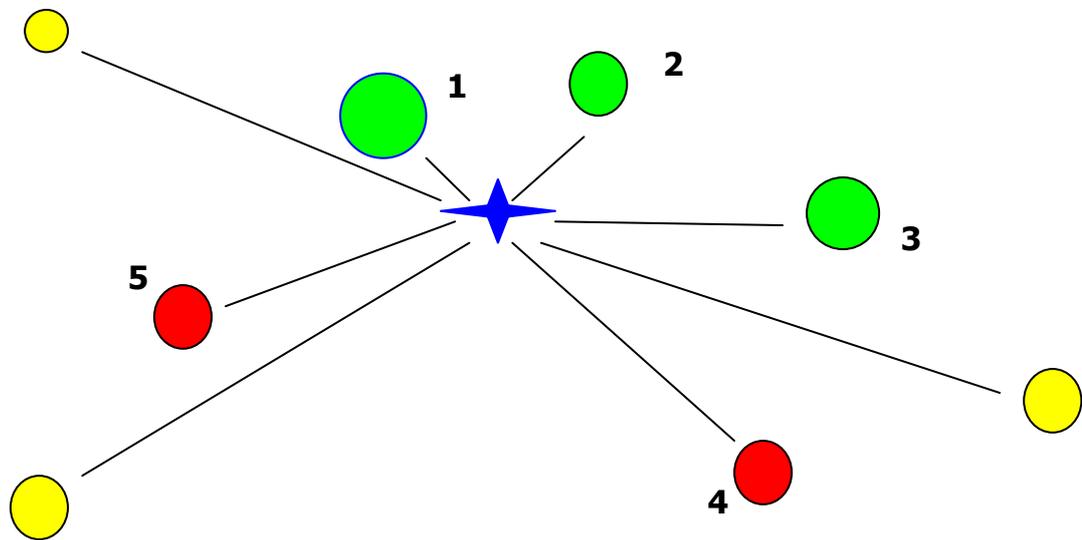
Choose the dominant tree species, then:-

- select a *point* in the range that seems to represent the prevailing density of the tree species chosen in that area;
- mark the *point* (blue star in Figure 1);
- measure the distance, by pacing in metres, from the *point* to the fourth and fifth nearest trees of interest to that *point*;¹⁸
- add the two distances together, then divide by two;
- the sum of the two distances divided by two gives a radius (r) of a circle within which you have identified 4 trees;
- area taken up by 4 trees is πr^2 square metres;
- **area taken up by one tree is $\pi r^2 / 4$ sq m= A;**
- number of trees per ha is 10,000/A

In Figure 1, the chosen species are marked green and red; the radius within which to find 4 trees is 20 m; area for one tree is 1257/4 sq m or 314 sq m. Therefore, the number of trees in one ha is 32. If each tree has full crown producing 4 kg of leaves over a season, the browse/ ha will be in the order of 4 x 32 = 128 kg. More dense savannahs and semi-arid forests may be producing 2 t/ha of high quality browse depending on the size of the crown and the accessibility of the browse.

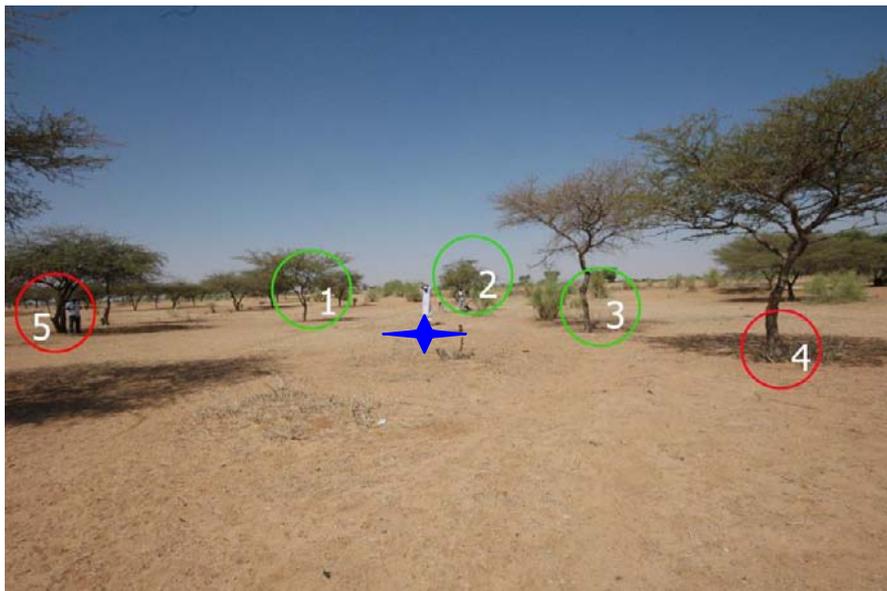
¹⁸ If in doubt, measure all 5 nearest trees.

Figure 1 "Point - to - Plant" Plant Density Estimate.



"Point- to- Plant" Process: -

- Identify nearest plants (green and red circles) to point (blue star).
- Distances from point to 4th and 5th plants (red circles) are 18 and 22 metres.
- Add distances together and divide by 2 = 20 metres



Trees are often pollarded by herders (growing points cut) - offering a lower, thicker crown for access. Browsing animals also shape the bushes and trees by returning to the same access points and keeping them trimmed of leaves and twigs. Notwithstanding the very real differences within and between species regarding *crown* shape and availability, the crown of most acacias of forage interest would be best described as *hemi-spherical*; consequently, the size of the accessible location of the tree containing the edible parts may be estimated using the formulae for a Curved Surface Area (CSA)¹⁹ of a *hemisphere* = $2\pi r^2$. By combining density of trees per ha (determined using Point-to-Plant) with potential CSA for browsing per tree for a series of common crown radius values (0.5 metres to 2.5 metres), it is possible to create a *ready reckoner* that will provide assessors with a table to estimate browse given a known production of browse per square metre of *crown surface area* for such trees.

The table on the following page provides such a *ready reckoner* that may be used for browse trees with *theoretical values* of 10g, 20g and 30g per square metre of *crown surface area*.

In the fullness of time, assessors should replace the theoretical values with empirical values collected in Sudanese ranges from the different tree species.

¹⁹ For animals that reach well into the bushes this will be an underestimate as *Volume of Hemisphere* = $(2/3) \pi r^3$ would be more appropriate in their case.

PET Livestock, Sudan
Browse- Simple Ready Reckoner

Tree	Crown Factor Multiplier ($2\pi r^2$)					Potential Tree Production estimate in Dry Matter														
						At 10g/ sq metre of crown surface					At 20g/ sq metre of crown surface					At 30g/ sq metre of crown surface				
Radius (m)	0.5	1	1.5	2	2.5	kg leaf per hectare					kg leaf per hectare					kg leaf per hectare				
Factor	2	6	14	25	39															
trees/ha																				
10	16	63	141	251	393	0	1	1	3	4	0	1	3	5	8	1	2	4	8	12
100	157	628	1414	2514	3928	2	6	14	25	39	3	13	28	50	79	5	19	42	75	118
250	393	1571	3535	6284	9819	4	16	35	63	98	8	31	71	126	196	12	47	106	189	295
500	786	3142	7070	12568	19638	8	31	71	126	196	16	63	141	251	393	24	94	212	377	589
750	1178	4713	10604	18852	29456	12	47	106	189	295	24	94	212	377	589	35	141	318	566	884
1000	1571	6284	14139	25136	39275	16	63	141	251	393	31	126	283	503	786	47	189	424	754	1178
1250	1964	7855	17674	31420	49094	20	79	177	314	491	39	157	353	628	982	59	236	530	943	1473
1500	2357	9426	21209	37704	58913	24	94	212	377	589	47	189	424	754	1178	71	283	636	1131	1767
1750	2749	10997	24743	43988	68731	27	110	247	440	687	55	220	495	880	1375	82	330	742	1320	2062
2000	3142	12568	28278	50272	78550	31	126	283	503	786	63	251	566	1005	1571	94	377	848	1508	2357
2250	3535	14139	31813	56556	88369	35	141	318	566	884	71	283	636	1131	1767	106	424	954	1697	2651
3000	4713	18852	42417	75408	117825	47	189	424	754	1178	94	377	848	1508	2357	141	566	1273	2262	3535



ISBN 978-0-9931553-8-3