LIVESTOCK BREEDING:

THE CASE FOR COMMUNITY BREEDING

Courtesy:

Food and Agriculture Organization of the United Nations

Pwani UNIVERSITY

Rewe, Thomas ***(Dr. sci. agr.)***
International Consultant
Community Based Breeding Programme
CBBP, Liberia, October 2016

“Economic growth alone does not solve the problem of hunger”

- José Graziano da Silva, FAO Director General

"Hardly a pure science, history is closer to animal husbandry than it is to mathematics in that it involves selective breeding. The principal difference between the husbandryman and the historian is that the former breeds sheep or cows or such and the latter breeds (assumed) facts. The husbandryman uses his skills to enrich the future, the historian uses his to enrich the past”.

- Author: Tom Robbins

CBBP - Training Handbook
Outline

- My Goat and I…
- Goat industry matters…
- Breeding is not mating!
- Where do we want to go?
- How do we get there?
- Structure of our Goat Breeding Programme
- Supporting structures to our Goat Breeding Programmes

Livestock Breeds, Mosby, 1992

My Goat and I…

"21,000 goats restocked for commercial production by 2017"

- *LandoLakes FFP Project, Liberia*

The flamboyant colours of “my Goat”

- The Dwarf Goat of west Africa
- Widely distributed across the rainforest belt
- Untapped resource for poverty reduction

Oseni, 2006

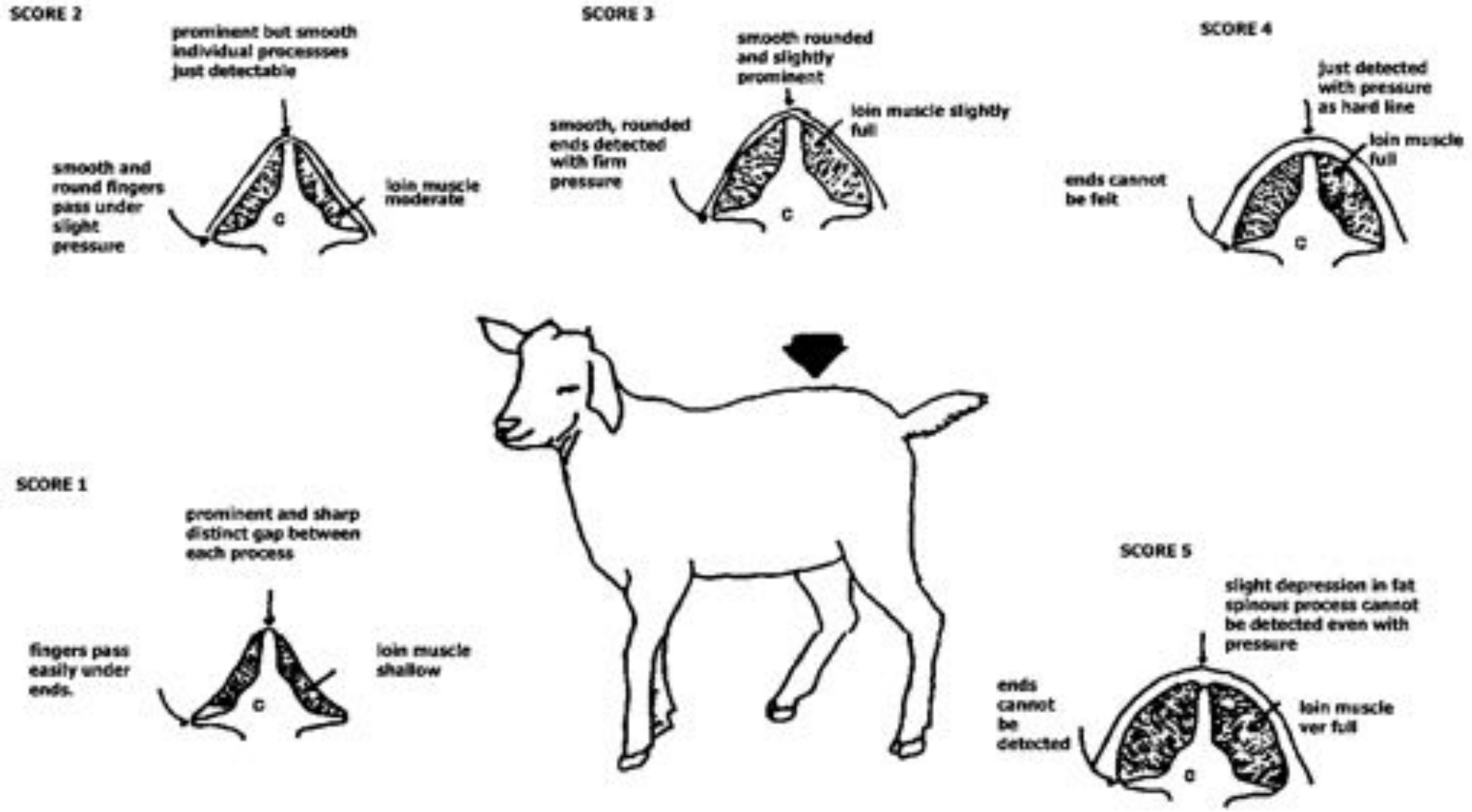
Do I know my Goat?

Courtesy: Mdukatshani, 2015

Goat Facts

- Move towards light than darkness
- Prefer to stay within a herd, distressed when separated
- Hierarchical - Follow the leader
- Easily distracted by Noise
- Seasonal breeders
- Exhibit twinning
- Hardy…

Body Condition Scoring …

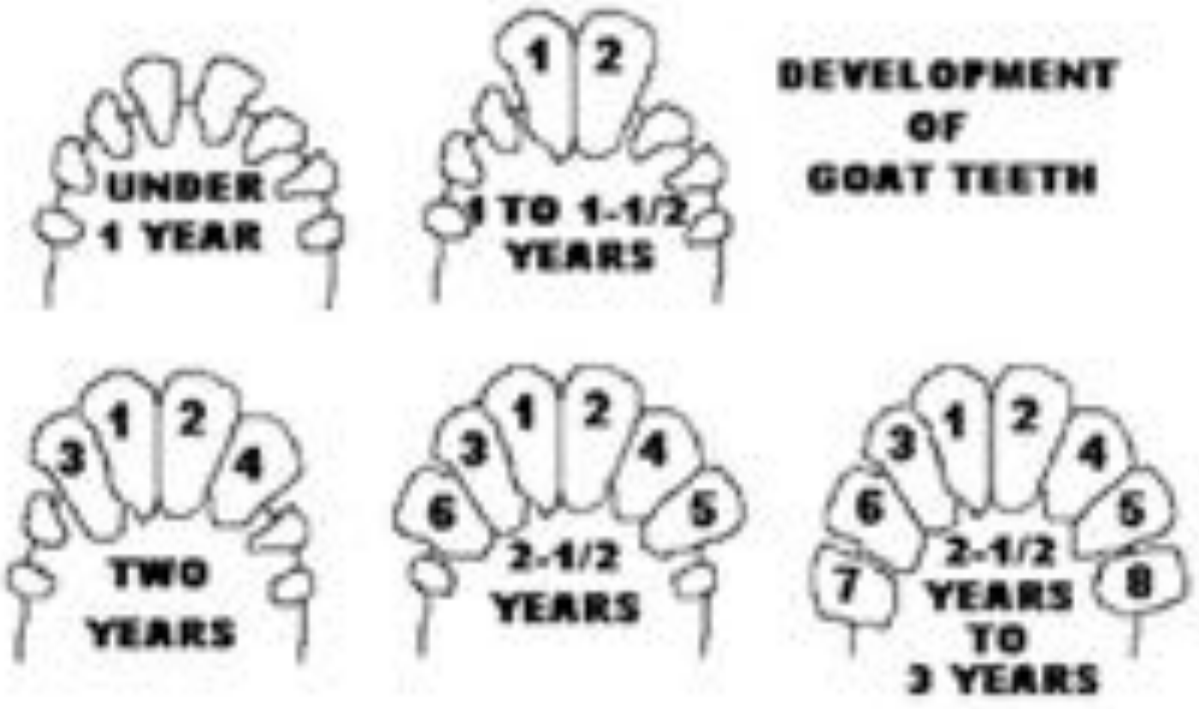


Mdukatshani, 2015

Scoring continued…

Score	Condition	Backbone	Rib cage	Loin eye area
1	Very thin	Stick out sharply (can even see), can feel individual vertebrae	Can feel each rib sharply	No fat covering
2	Thin	Can feel vertebrae but smooth	Smooth, need slight pressure to feel ribs	Smooth even fat cover
3	Good condition	Smooth and rounded	Smooth and well covered	Smooth even fat cover
4	Fat	Can feel with firm pressure	Cannot feel individual ribs, but can feel indent between ribs	Thick fat cover
5	Obese	Cannot feel individual vertebrae	Cannot feel individual ribs or indent between them	Fat accumulated around the tail area

How old is my Goat?



The first permanent approx. at 15 months of age – 2 permanent teeth

The next two incisors at 21-24 months of age - 4 permanent teeth

The next two incisors at 30 months of age – 6 permanent teeth

The last two teeth at 36 months of age –8 teeth (full-mouthed).

Why house my Goat?

- To provide shelter from bad weather
- To prevent theft
- To prevent predation.

Goat maternity shelter at Zoedo Goat Farmer Association, Nimba County, Liberia

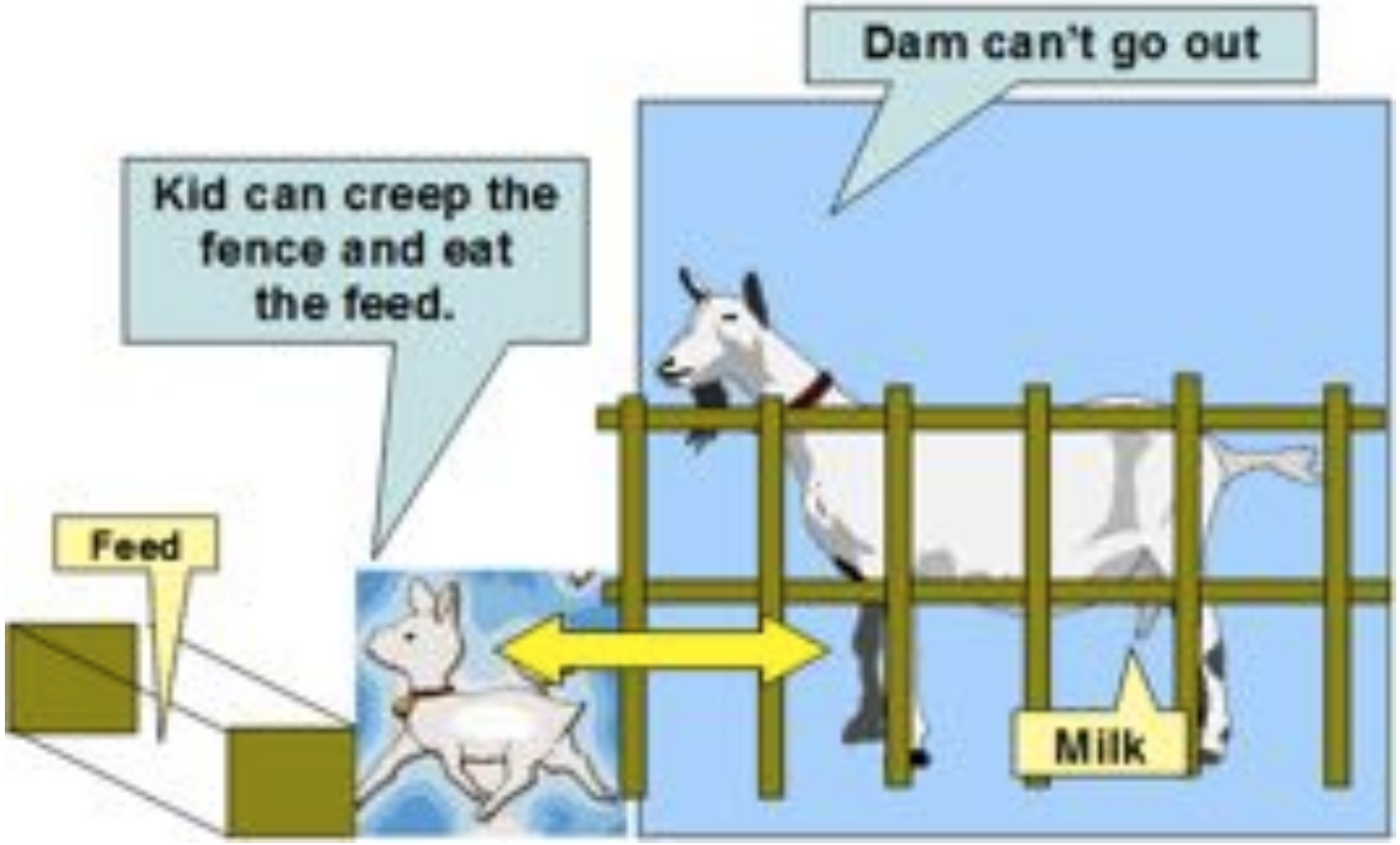
Courtesy: USAID, 2014

Feeding my Goat…

Critical feeding times

- Before mating (ewes and rams)
- Late pregnancy (last 6-8 weeks)
  - Save from small, weak kids
  - Overfeeding leads to kidding difficulties due to large kids
- Early lactation (bank ewe milk for her kids).
- Remember: **Creep feeding…**
  - Essential for rumen development
  - Danger if not given: Kids will lose condition or even die at weaning.
  - Introduce solid food at about 2 weeks of age.
- **Know your poisonous plants!**

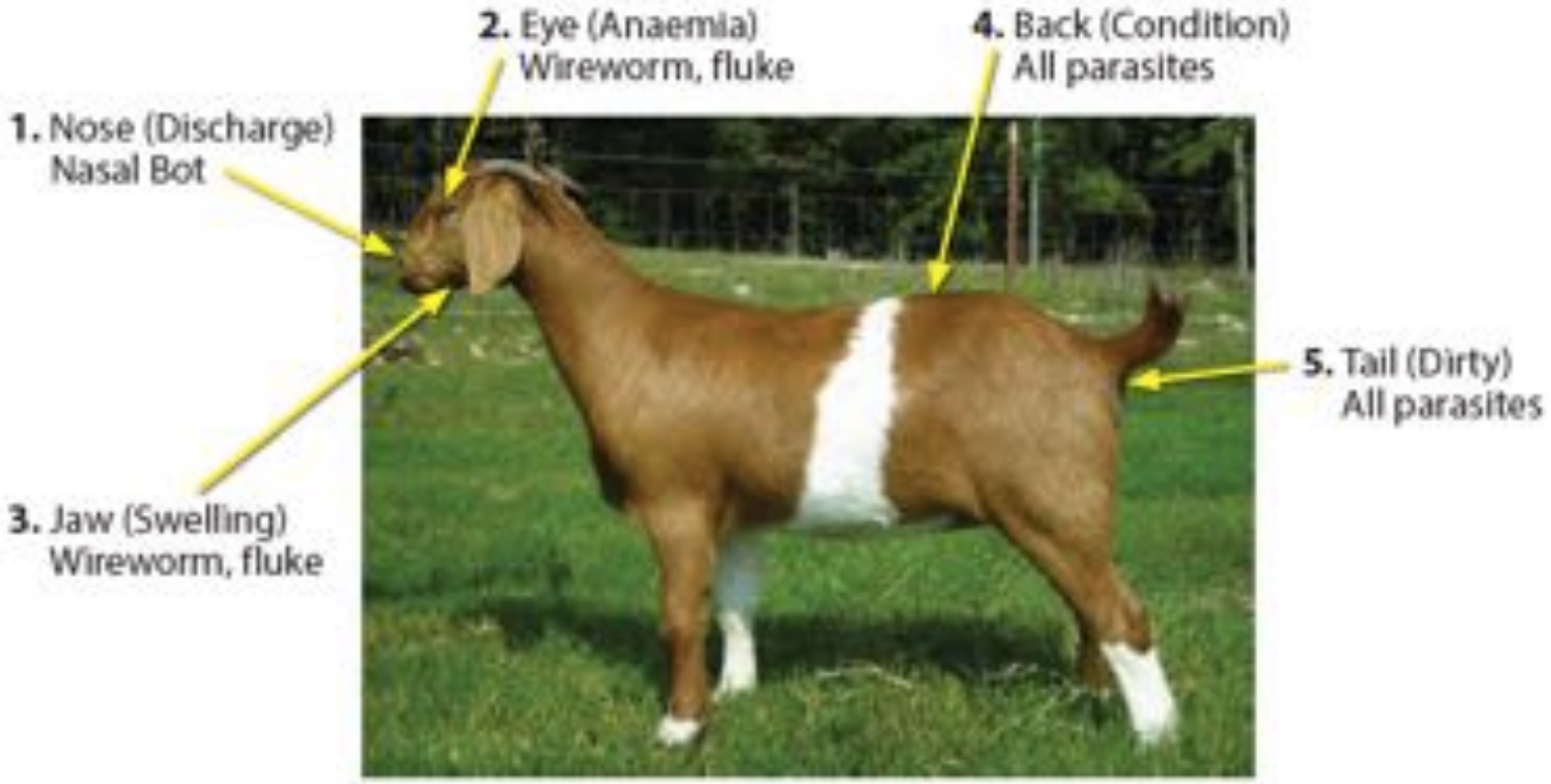
Creep Feeder design (*ESGPIP, 2010*)



Breeding and Reproduction

- Breeding is NOT reproduction
- Breeding –Choose correct genes into your flock
- Reproduction – producing new generation
- Reproduction without Breeding is mere multiplication
- Controlled breeding and reproduction leads to genetic improvement
- Breeding is not possible without knowledge of performance
- Recording therefore is vital means to achieve this end…

My Healthy Goat!



Five-Point Internal Parasite Check Guide

Bath and van Wyk, 2009

Five-Point Internal Parasite Check

- **Nose**: Discharges from the nose may indicate nasal bot fly (Oestrus ovis).
- **Eyes**: anaemia (as determined by the use of FAMACHA©) may be due to wireworm (Haemonchus contortus) and other worm species that cause anaemic conditions such as hookworm
- **Jaw**: A soft subcutaneous swelling below the jaw is known as the bottle jaw. This is another symptom of worm species that cause anaemia.
- **Back**: Body condition scoring is the assessment of overall condition of the animal. If only a few in the flock show poor condition, this may show worms that suppress the animals' appetite such as bankrupt worm, brown stomach worm and conical fluke.
- **Tail**: Parasites such as conical fluke and roundworms cause mild or severe diarrhoea. Parasites are known to be major cause of diarrhoea therefore the farmer needs to treat those with visible diarrhoea.

Goats can be kept healthy by…

- Ensuring that they have access to enough feed of the correct quality
- Ensuring they have access to clean water
- Following a vaccination programme against common diseases
- Keeping internal and external parasites under control
- Keeping sick goats separate so that disease does not spread to healthy goats
- Making sure that any goats introduced to the flock are disease-free
- Sheltering goats from adverse weather.

- Other observations such as a pot belly, when combined with poor condition or growth rate, is usually an indication of tapeworm infestation.
- Anaemia diagnosis can be checked by observing the eye lid paleness

Goat Farm Records

- Below is a list of records that may need to be kept under Ethiopian conditions. The value and relevance of the different types of records will vary with differing sheep and goat production systems.
- • Lambing records, which include identity, dam ID, weight, date of birth, type of birth and sex.
- • Growth or weight records kept periodically by recording the body weight of animals.
- • Health records including morbidity, mortality, signs and symptoms, diagnosis, treatments and vaccinations, etc.
- • Feed consumption: This is difficult to estimate on farms where animals graze, but for capital-intensive farm businesses, such as finishing or fattening operations, the amount of concentrate fed should be recorded to calculate profitability.
- • Milk production records: recording once weekly may suffice as this is highly correlated with total milk production. Therefore, in dual-purpose sheep and goats, or even in meat types, a random sample of lactating females may be selected for recording their once-a-week milk production.
- • Mating records: Sire, dam and progeny identification is important in breeding, sale, and culling decisions.
- • Testes size: Recording testes size at one year of age can assist in sire selection. Testes size in males is related to ovarian activity (multiple ovulations) in females.
- • Carcass yield or dressing percentage is a factor that has tremendous economic value, particularly in a community-based breeding program involving meat breeds. This information could be obtained from slaughterhouses/abattoirs.
- • Hides and skins: For a crossbreeding program there may be a need to record skin quality aspects such as area of hide, skin thickness, elasticity, pigmentation and density of hair.

Monrovia Liberia

2. Industry matters…

Goat Industry matters…

- Most goats in Liberia are of the trypanotolerant West African Dwarf breed (FAO, 2011).
- There are considerable numbers of the Red Soot breed and crosses between the WAD and the Red Sokoto goat breeds. Nimba , Bong , Grand Gedeh , Grand Kru and Lofa counties have the highest goat population.
- Liveweights of 20.7 kg and 22.3 kg respectively for adult female and male WAD goats were reported at the Central Agricultural Experimental Station at Suakoko, Liberia
- Average age at first kidding of 16 months, 200% kidding, 80% twining, litter size of 1.6, and kid viability of 65%. Birth weight for single lambs averaged 1.5 kg, and 1.3 kg for twin lambs. Kids weighed 1.2 kg at birth and 9.6 kg at weaning for WAD goats under a semi-intensive production system (Kamara, 2011)

- ***“Today, by God’s grace and with the help of our various partners, we have a modern slaughter house that can process and store minimum 20 cows plus 50 sheep and goats per day, according to international food safety and hygiene standards,”***

- Mr. Samuel Thompson, chairman of the board of Conex/M.D. Sow & Associates,

Agriculture Minister, Dr. Moses Zinnah

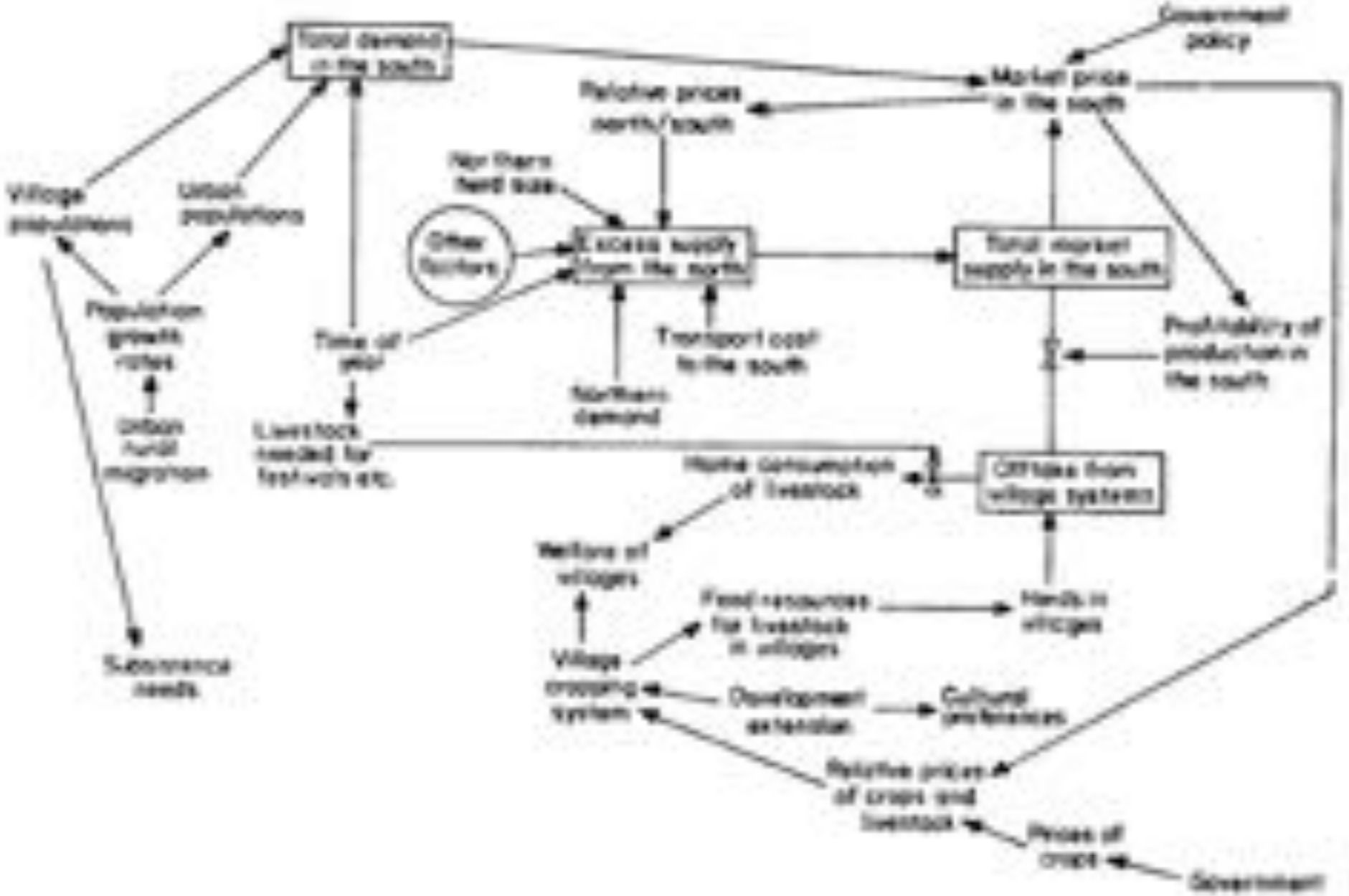
New Us$4M Slaughter House Revamps Meat Value Chain, Mon, 09/05/2016 - 01:40 tjohnson

Daily OBSERVER

SHEEP AND GOATS IN HUMID WEST AFRICA

PROCEEDINGS OF THE WORKSHOP
ON SMALL RUMINANT PRODUCTION SYSTEMS
IN THE HUMID ZONE OF WEST AFRICA,
HELD IN IBADAN, NIGERIA,
23–26 JANUARY 1984

Edited by
J.E. Sumberg
and K. Cassaday

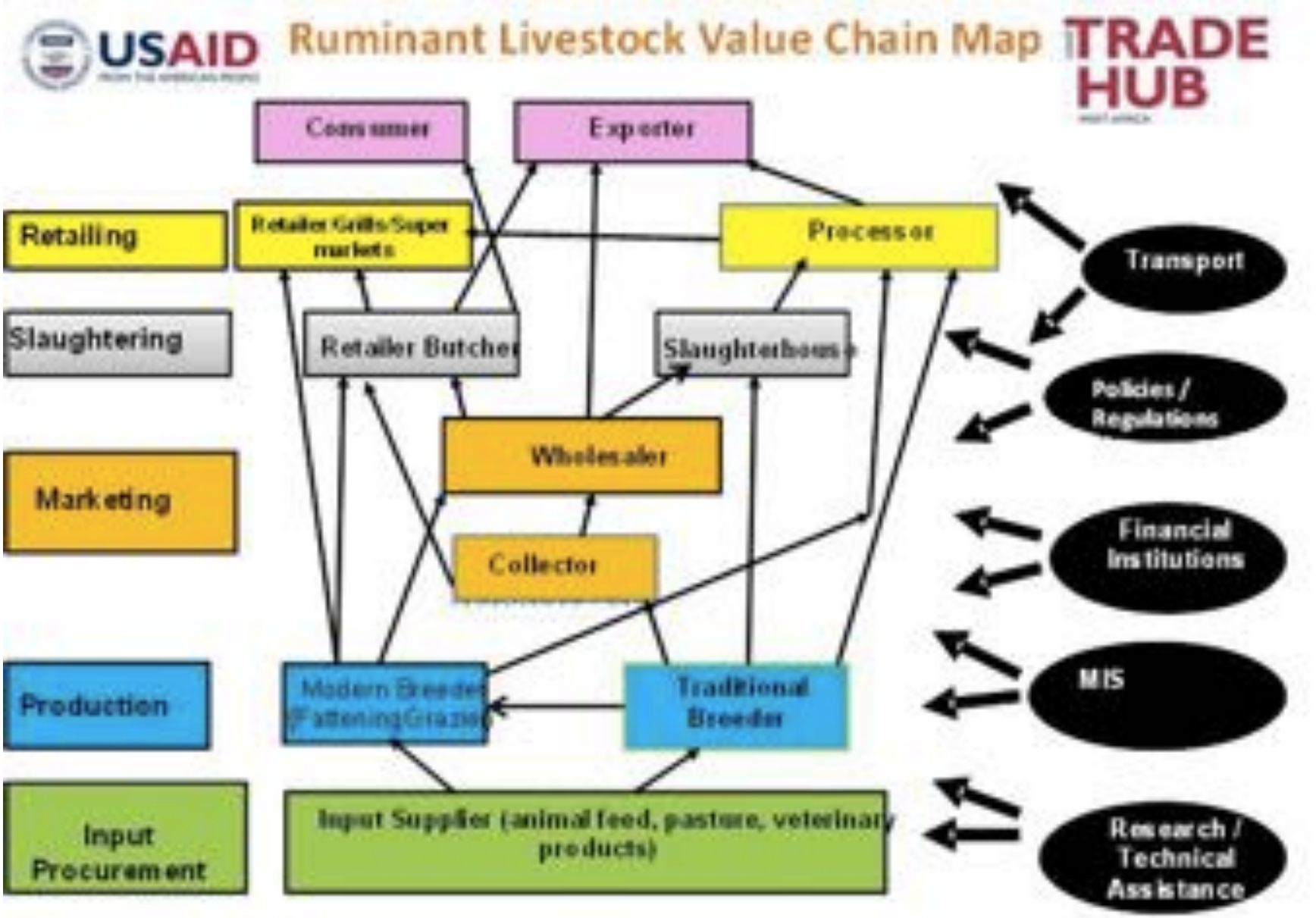


Small Ruminant Value Chain as at 1984 – Nigeria, OKALI and M. UPTON, 1984

Chevon demand in Liberia…4.7M

- Goat meat is in high demand and well-accepted in the Liberian marketplace. The consumption of fish and wild animal (bush) meat in many Liberian dishes suggests a healthy demand for animal protein
- About 9.2 % of animal products (meat, eggs) are covered by local production, and zero of the national milk needs (Rudolf Buntzel, Edwin Nimley, Leroy Cegbe, 2013)
- Domestically raised goats are sold at the slaughter houses
- The real number of livestock raised and/or backyard slaughtered in the villages should be a subject of investigation

Where is the Value in the Chain?



Value dealers…

- **Producers**: Generally producers in West Africa raise small ruminants and sell only if they need some money for familial expenses.
- **Collectors**: Assemble sheep and goats; are generally are commissioned by traders and receive commissions from this service.
- **Traders**: Brokers group facilitate the trade between the seller and the buyer. A live animal market includes the seller (herder or smaller trader), the broker-dealer (selling on behalf of the seller) and the buyer (larger trader or butcher).

Trade Hub and African Partners Network, 2014

Value dealers…

- **Middlemen**: Operate in the informal sector and often contributes more to increasing prices than to facilitating trade, which increases the transaction costs of shipping livestock to the coastal countries. Yet they can save exporters time and money
- **Meat Products Wholesalers**: Slaughter a number of head a day to sell to retailers, butchers, and restaurateurs.
- **Retail-slaughters**: small slaughter operations daily for direct sale to the market. With shops selling grilled meat (*dibiteries*) or traditional roasting ovens, particularly for mutton and goat.

Trade Hub and African Partners Network, 2014

Value dealers…

- **Retail butchers**: Small meat retailers in markets in large cities and neighborhoods.
- **Grillers and *dibitiers***: Mainly small economic actors who do not slaughter the animals but buy sheep and goat carcasses from wholesale butchers in large urban centers, and sell grilled meat
- **Skins processors**: Processors can be divided into two categories—cottage-type and industrial. Cottage-type is the traditional trader of shoes or bags made with sub-products in local market.

Finding the Entry points…

1. Strengths

- Large numbers of small ruminants in Sahelian countries
- Strong regional organization (COFENABVI, UEMOA, ECOWAS)
- Many traditional producers' countries and consumers' countries

2. Weakness

- Irregular supply markets, poor infrastructure
- Inadequate marketing facilities and transportation,
- Difficult access to credit
- Lack of reliable information in the market for sellers and buyers,

Finding the Entry points…

3. **Opportunities**

- Increasingly high demand for sheep meat in local markets.
- ***Relatively short cycle of small ruminants (8-9 months between the farrowing) allows quick observation of the effects of interventions to improve productivity (genetics, health, exploitation and national development techniques)***
- Herd size is easily adaptable to available food or fodder or as a complement.

4. **Threats**

- Continued lack of access to financing opportunities
- Irregular supply markets and poor infrastructure

Pinterest

3. Breeding NOT Mating…

Breeding is NOT Mating

- Mating is the mainly for Reproduction while Breeding is for Genetic improvement
- You don't need records for mating but you need records for Breeding
- You don't need selection for mating but you need selection for Breeding
- You don't need a strategy for reproduction but you need a strategy for Breeding
- However, both activities may need organised groups of farmers for sustainability

Breeding Process…

- Defining the Breeding Objective – where do we want to go?
- Breed selection (pure or cross?) – How do we get there?
- Identification and Recording
- Selection of breeding animals
  - Visual appraisal
  - Records
- Breed improvement
  - Single or multiple traits?
- Breeding strategies
  - Purebreeding, crossbreeding, rotation, synthetics
- Breeding schemes
  - Nucleus? – centralised, dispersed, open, closed

Where do we want to go? The Breeding Objective

Sets the target to aim for derived from the Production Objective

- Guides choice of stud, bloodline, rams and replacement ewes
- Includes
  - **Traits to be changed**
  - Desired level of performance
  - Time frame

Suppose the export market requires Goats with an average live weight of 30 kg as opposed to the current level of 27 kg. – **Meat Goat**

- **Breeding objective**: Increase the number of animals qualifying for the export market through genetic improvement of weight at marketing (e.g., yearling weight) with no or minor changes in management.
- **Breeding goal**: Improve the average yearling weight of the breed from 27 to 30 kg (market requirement). (ESGPIP, 2010)

Why is it important?

- Sets long term production goals
- Helps make faster progress
- Sets a consistent breeding direction
- Provides the basis against which you can measure improvement
- Can be Formal (strictly commercial) or Informal

Case File 1:

What is our Breeding Objective for WADG in the CBBP?

Practice session

- Write on a card what you consider as the reasons why you keep Goats,
- Write the things you like about your Goat
- Write the things you don't like
- Try and discover the attributes contributing to what you like and what you don't like
  - E.g. I keep my Goat for Beauty, I like its Gottee!, I don't like its colour!,
  - Its Gottee is nice because its long and curly, its colour is bad because it is dark and unattractive

Formal Breeding Objective definition

- Economic aspects :
  - - Specification of the breeding, production and marketing system.
  - - Identification of sources of income and expense in commercial herds.
  - - Determination of biological traits influencing income and expense.
  - - Derivation of the “economic values” of each trait.

- Genetic in nature
  - - Choice of selection criteria.
  - - Estimation of phenotypic and genetic parameters.

Breeding, Production and Marketing Systems

- Specifying the breeding system involves defining the role of the breed (for which the breeding objective is being defined) in the production system – maternal line, general purpose etc.
- Specification of the production involves the description of how animals are fed and managed, the age composition of the herd, the replacement policy and
- Specification of Marketing systems involves defining ages of animals at marketing and slaughter

Practice session

- Specify your breeding system for a particular class of animal
  - E.g. Ram
- Specify your Production system
  - E.g Free range grazing
  - Stall fed semi-intensive
- Specify your marketing system
  - E.g Live animals ….live weight for Slaughtered…carcass weight

Identifying sources of income and expenditure

- Allows for the building of a Profit equation
- A Profit function accounts for effect of prices of outputs over costs of inputs
- Here outputs from the production systems are identified and the cost of production are incorporated
  - E.g. Meat from slaughter Goats, Bucks, Does, etc, how many per year at what price per kg?
  - What about, feeding, healthcare, labor, fixed costs etc
- Profit = Revenue (Meat x Price) – Costs (Feeding x price)

Determination of biological traits

- With respect to Income (Revenue) and Costs (Expenditure)
- Debunking the traits that support Revenue
  - E.g. Meat is supported by Birth weight, yearling weight etc
- Debunking the traits that incur expenditure
  - E.g. Growth rate incur feed costs, healthcare etc
- The major impact of a trait on the efficiency of commercial production should be able to be validated
  - This allows for restrictions on the number of traits to account for in the breeding objective

Derivation of economic values

- The net genetic improvement which can be brought about by selection among a group of animals is the sum of the genetic gains made for the several traits which have economic importance.
- Trait gains are therefore weighed by the relative economic importance.
  - The concept of weighted averages to optimize rather than maximize the genetic improvement
- Economic values could be discounted to account for comparison of trait that are not expressed at the same time

(Hazel, 1943)

Informal breeding objectives: Participatory approaches

- PRA – Participatory rural appraisal
  - E.g. Gizaw et al. (2010) working with two indigenous sheep breeds of Ethiopia provided producers with pebbles to rate trait categories. The process involves listing of pre-identified traits which is normally done with knowledgeable local villagers. Then producers are asked to rank/assign a score for each of the traits or trait categories
- Choice Experiments: Valuing non-market, public goods are categorized as revealed and stated preference methods
- Phenotypic ranking of live animals, aided by animal life history
  - Stakeholders in the value chain play a major role

Example of choice experiment card

Please indicate the most important attribute and the least important attribute when you are buying a sheep (Tick only one case as most important and one case as least important)

Most important	Sheep 1	Least important
	Male	X
	1 year	
X	Dor x BHP	
	3,500 KSH	

Would you buy this sheep? Yes ☐ No ☐

Modes of Identifying Breeding objectives

Properties	Personal interviews	Workshops	Choice cards	Ranking of live animals	
				Own animals	Unknown for farmers
Advantages	-A large number of persons can be interviewed - Possible to verify the consistency of the responses -Additional information can be gathered at the same time	-Information from different persons collected at once - Differences can be directly discussed	-Large sample size -Enumerator introduced bias likely to be lower than in interviews -Price can be included as a characteristic	-Relatively easy to handle -Closer to reality than choice cards: Seeing a live animal is better than a picture -Information from different family members can be considered	-Easily done by farmers -Closer to reality than choice cards: seeing a live animal is better than a picture
Disadvantages	-Language barrier -Enumerator introduced bias may be high -Important traits may not be mentioned	-Some people (e.g. with higher social status) might dominate the discussion	-Limited number of animal profile choices can be made per person -Visual illustration of some traits can be complicated or impossible	-There may not be enough animals of the same category available in small herds	-Large 'pool' of animals often no readily available -Hypothetical life history provided with a given animal may not be compatible with the visual appearance according to farmers' experience

Adopted from Haile *et al.* (2011)

http://grasseacres.com/more-about-goats/

HOW DO WE GET THERE!?

- Now that we know where we want to go?, then….
  - How do we get there?
- The intention is to improve the Traits identified as our objective
- How? By evaluating the trait in the animals (Goats)
  - This requires information
  - Can be memory (verbal animal history) or
  - Written Records

IMPROVEMENT OF ANY TRAIT DEPENDS ON.....

MEASURING DIFFERENCES IN A TRAIT

ACCURATELY IDENTIFYING SUPERIOR INDIVIDUALS IN THE TRAIT

USING SUPERIOR INDIVIDUALS AS PARENTS

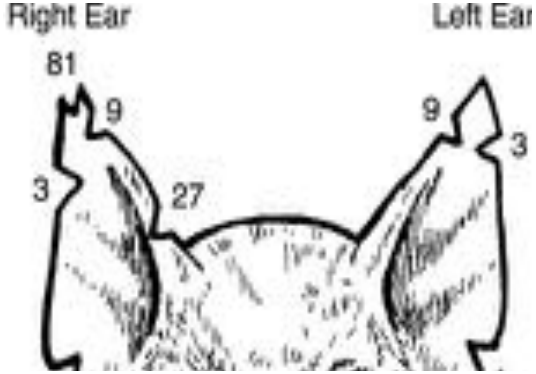
HOW HERITABLE THE TRAIT IS (heritability)

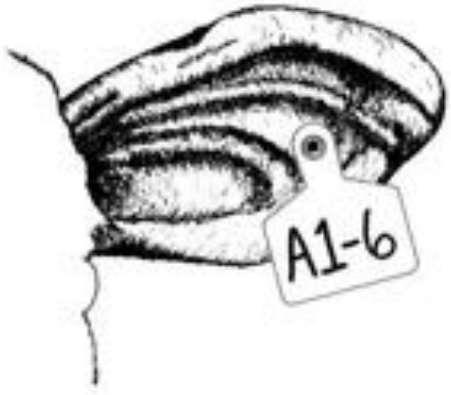
Recording performance…

- Note: animal Performance records are part of farm records targeted towards organised breeding for genetic improvement of certain traits.
- Purpose of records:
- To identify animals belonging to a particular owner; proof of ownership.
- To use as a management tool to:
  - undertake performance evaluation; perform genetic selection,
  - keep proper health records; accurately measure production and reproduction; perform other important management functions

No recording without identification!

- Animals need to be identified before recording,
- To be able to trace the record to the individual
- Methods
  - Branding
  - Tattooing
  - Ear Notching
  - Ear Tagging





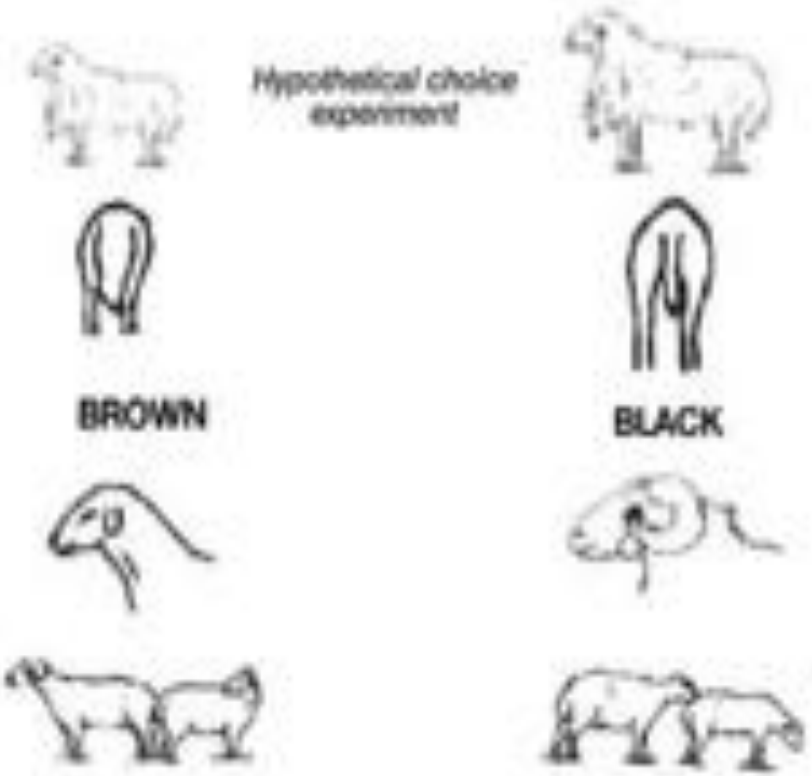
Performance evaluation data

- Normally based on the breeding objective traits
  - Identifying traits correlated to the breeding objectives that can be measured
  - These measurable traits used in selection are called **selection criteria**
  - For an Objective like Sale weight, performance data could be:
    - Weight – for amount of product
    - Reproduction – for frequency of product
    - feed intake etc – efficiency of production

Performance evaluation

- The breeding objective is being expressed by many animals
  - Which one is the best?
  - What is our definition of best?
  - How many sources of information should we use
    - Individual
    - relatives

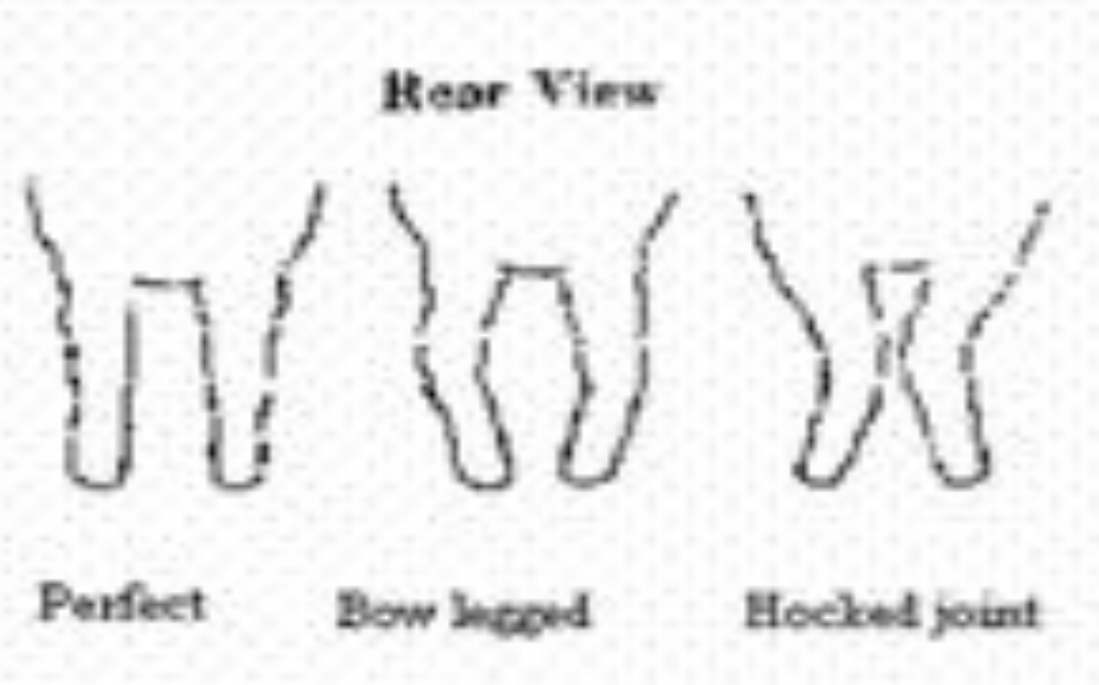
Example from sheep breeding programme: Ethiopia

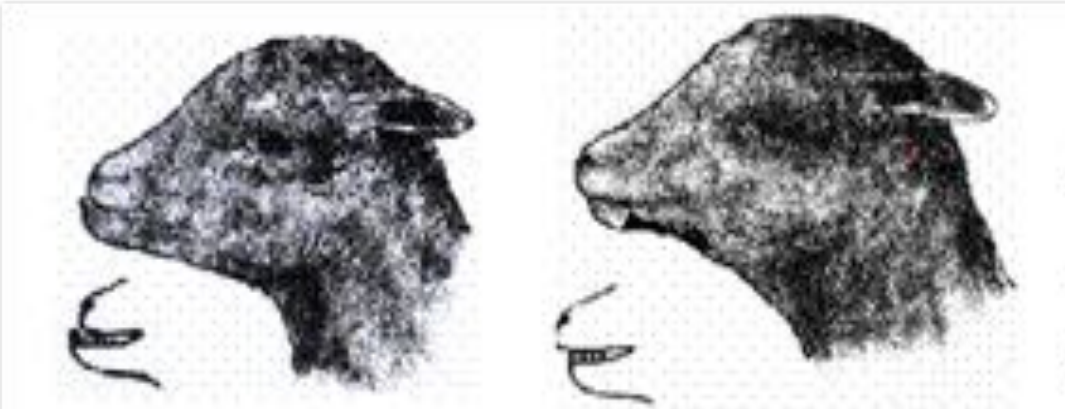


(Haile et al., 2011)

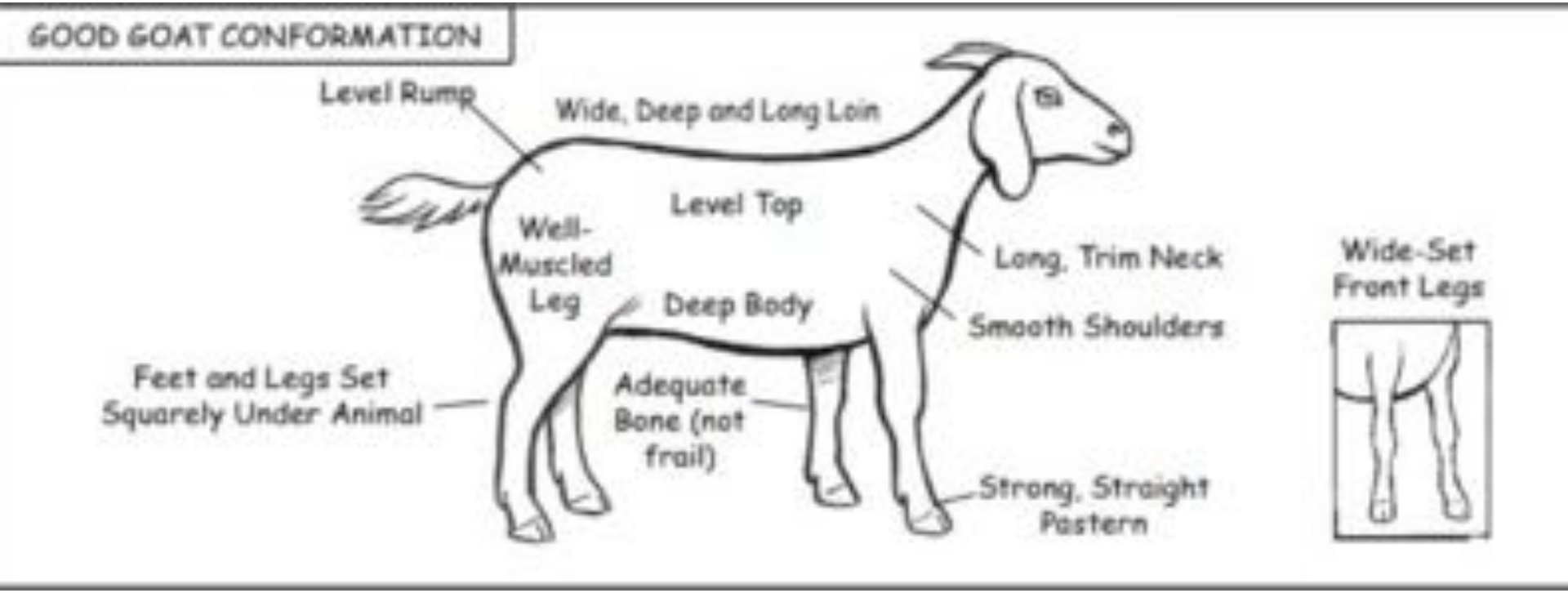
Selection Breeding Goats – appraised breeding value

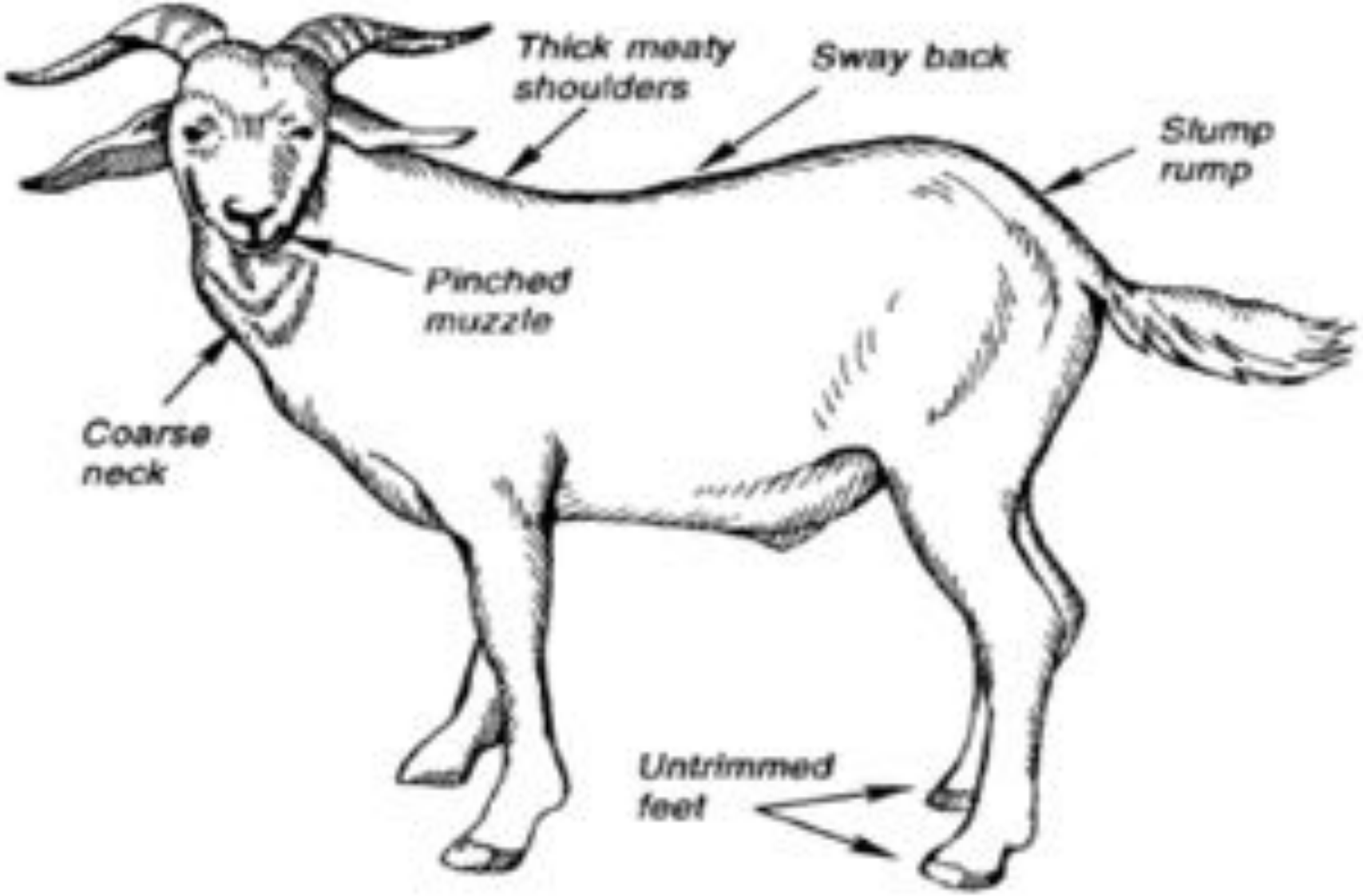
- Visual Appraisal
  - Appearance
  - Conformation
  - Defects
  - Legs
  - Teeth
  - Testes
  - udder



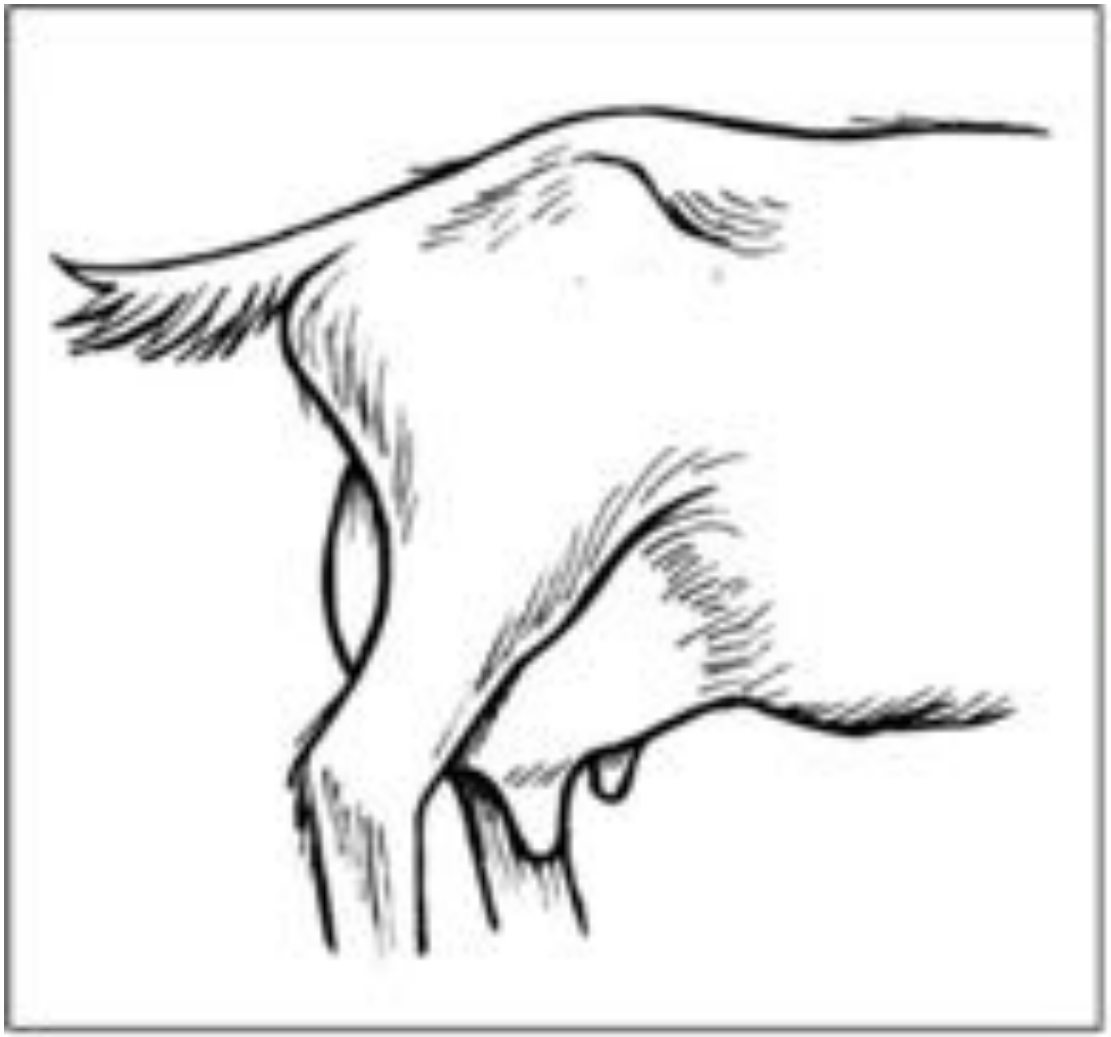


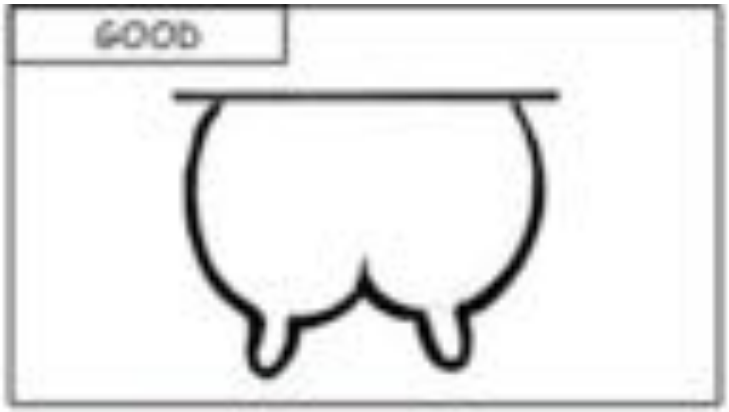
Goat structures





Poor body conformation.





Avoid animals with really small or really large teats. Other udders to avoid:

A Good Meat Goat has:

- Fairly level rump
- Level overall body shape
- Straight level top
- Length of rump
- Length of body
- Length of leg for market desirability
- Straight legs placed square under body
- Muscle in leg
- Muscle in hindquarters, loin, shoulders, and neck.

Using estimated breeding values (EBV

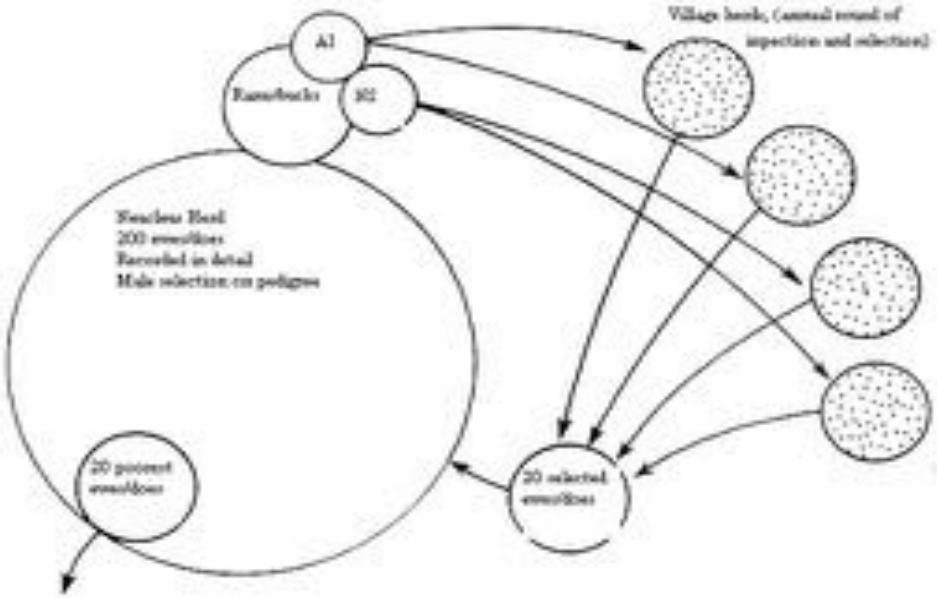
- Breeding value is the worth of genes of a parent to its offspring
- Depends entirely on heritability of the trait
- Example:
  - If weight of mature live goats flock average is 20kgs
  - One Goat weighs 25kgs and another 27kgs
  - What is the breeding value? If heritability is 0.4?
- EBV = heritability x differential i.e 0.4 x (25-20)
  - +2kg the 20kg Goat has an EBV of +2 while the other one +2.8kgs
  - The one with the higher EBV is considered better BUT
  - What if there is more information? from relatives? from other traits?
  - Then the ranking of the two Goats may change!

5. BREEDING STRATEGIES

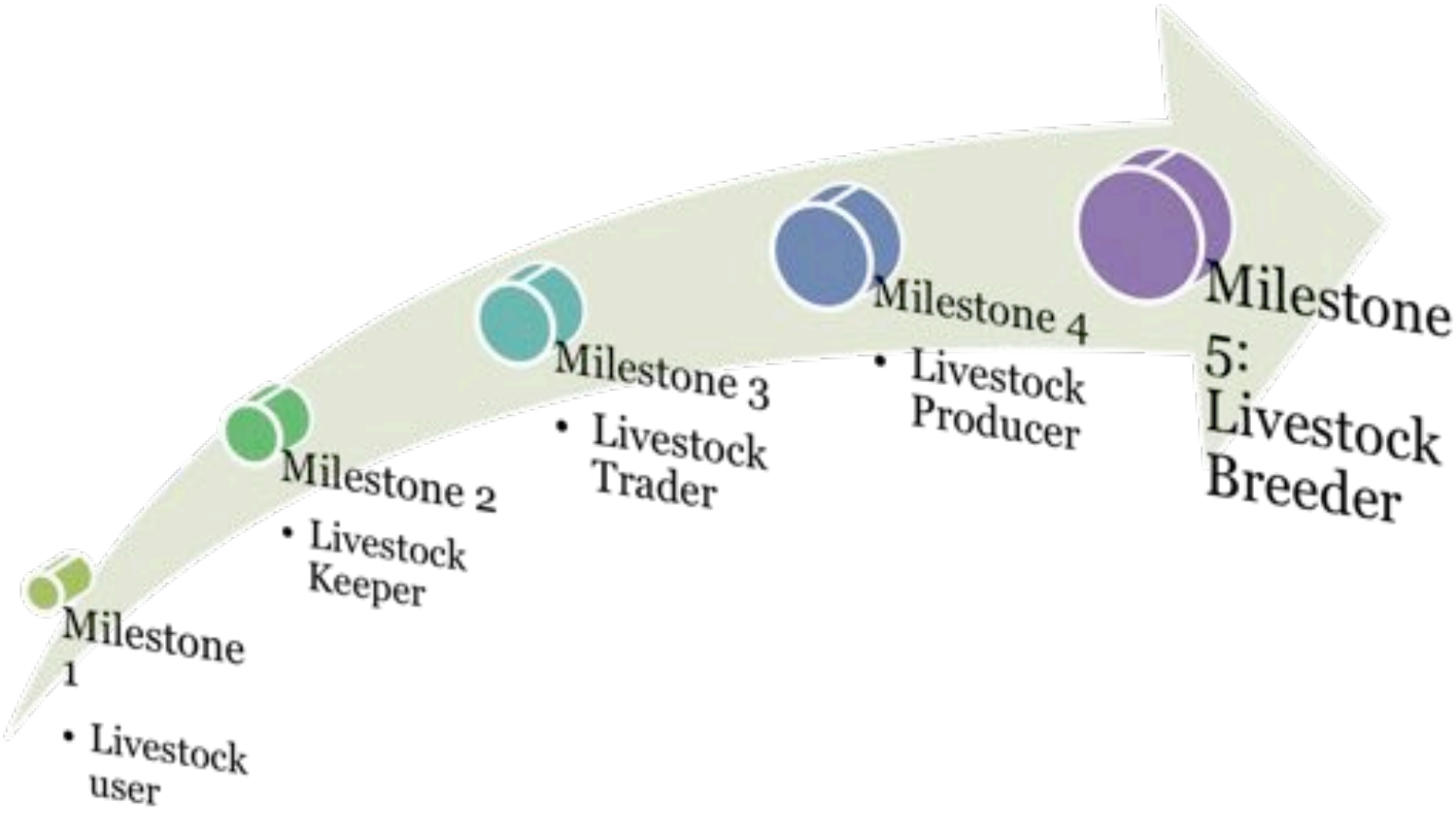
http://nigerianpygmygoats.com/

Pillars of Breeding Programmes

- Have a choice Breed or Breeds
  - West African Dwarf Goat?
- Have a Breeding system
  - Pure breeding
  - Crossbreeding
- Have an organisation
  - Farmer groups
- Have strong support services
  - Formal genetic evaluation, healthcare, nutrition, management, research and credit facilities



Know your farmers…



Neidhardt et al, 1996

Village Breeding Schemes: Advantages

(Wollny, 2003; Kahi *et al*., 2005):

- The breeding flocks are located within the production environment and potential genotype-environment interactions are therefore minimized
- Direct farmer participation is possible
- The farmers are owners of the initiative and benefit from it
- The farmers have a sense of responsibility for the targeted breed, since it is a part of the traditional culture and contributes to their identity and self respect
- Keeping of the targeted breed is economically important

Village Breeding Programmes : Advantages cont…

- Utilization of available feed resources
- Maintenance is labor-intensive and not capital intensive
- The initiative is self-administered by the community, but is supported by government and other organizations. The community therefore knows where to obtain information and technical advice.
- The community has the capacity to run the initiative through relevant training and visits to other initiatives in other areas.

References

- Saidu Oseni, Babafunso Sonaiya, Galman Omitogun, Alaba Ajayi and Ishola Muritala, 2006. West African Dwarf Goat Production under Village Conditions: 1. Characterisation and the Establishment of Breed Standards. The Tropentag, University of Bonn, October 11-13, 2006
- Mdukatshani, 2015. The Goat Handbook. Heifer International, KwaZulu-Natal Department of Agricutlure and Rural Development, 2015.
- Bath, G. F. , van Wyk , J.A.2009. The Five-Point Check© for targeted selective treatment of internal parasites in small ruminants. Small Ruminants Research (86) 6-13. Also available online at www.sciencedirect.com
- FAO (Food and Agriculture Organization). 2011b. Chapter 6: Livestock in Liberia. [reproduced from the ILCA publication: Trypanotolerant livestock in West & Central Africa - Volume 2. Country studies. Monograph No. 2] "http://agtr.ilri.cgiar.org/agtrweb/Documents/Library/docs/x5537e/x5537e07.htm.
- Kamara, A. 2011. Position paper on sheep and goat production in Liberia. http://www.fao.org/docrep/004/s8374b/S8374b18.htm
- C. OKALI and M. UPTON, 1984. The market potential for increased small ruminantproduction in southwest Nigeria.
- Rudolf Buntzel, Edwin Nimley, Leroy Cegbe , 2013. To Produce or to Import? Meat Market Chain Analysis Of Liberia. A Research Pilot Project by the Department of Extension, William R. Tolbert, Jr, College of Agriculture and Forestry (WRTCAF), University of Liberia in https://info.brot-fuer-die-welt.de/sites/default/files/blog-downloads/produce_or_import_meat_market_study.pdf
- Trade Hub and African Partners Network**.** "Value Chain Assessment Report: Small Ruminants." Prepared for the Trade Hub and African Partners Network by Abt Associates Inc., Bethesda, MD, in collaboration with J.E. Austin Associates, Arlington, VA, May 2014.
- ESGPIP, 2010. Ethiopia sheep and goat productivity imporvement program, Technical Buletin 37,.
- Hazel, L.N., 1943. The genetic basis for constructing selection indexes. Genetics 28, 476-490.
- Neidhardt, R., Grell, H., Schrecke, W. and Jakob, H. (1996) 'Sustainable livestock farming in East Africa', Animal Research and Development, Vol 43/44, pp 44 – 52.