

## ***APPRODEV REFERENCE MANUAL - PART 2***

***PRACTICAL INFORMATION  
COLLECTED FROM THE  
APPRODEV PROJECT ON  
OXEN LOGGING  
- FOR JUNIOR MANAGER  
AND SUPERVISOR LEVEL***



# ***OXEN LOGGING***

## ABOUT APPRODEV TRAINING MATERIAL

- These reference manuals contain information on the subjects that were found relevant during the development and training activities of the APPRODEV project in East and Central Africa.
- This particular manual on *oxen logging* is written for the level of:  

junior managers and supervisors (e.g. forestry certificate level)
- The manuals are suggested for use as reference information for short training courses or elements of curricula. If you require further information on the subject you will find **references** listed in the **contents section** on the following page.
- The reference manual is most effectively used in conjunction with the workbook, which provides various tasks and exercises for the purpose of analysing and understanding the subject.
- This particular manual is also supported by the following materials:

workbook 2  
wall posters on oxen management and yoking  
overhead transparencies of selected drawings/pages

## PARTS OF THE APPRODEV REFERENCE MANUAL

- 1 - *Logging Management*
- 2 - *Oxen Logging*
- 3 - *The Sulky*
- 4 - *Hand Tools*

- *Manual design, research and texts by Mark Seymour (update 1996)*
- *Drawings by Veijo Kangasmäki and (Mark Seymour)*

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NATIONAL BOARD OF EDUCATION GROUP

## APPRODEV PROJECT

**"DEVELOPMENT AND PROMOTION OF APPROPRIATE TECHNOLOGY FOR ENVIRONMENTALLY AND ECONOMICALLY SOUND FOREST HARVESTING"**

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OXEN LOGGING TECHNIQUES * Skidding methods (long and short chain) * Skidding sledges * Oxen and sulkies * Oxen pole trailer * Oxen cable logging	10	* <b>APPRODEV</b> study 1992, Oxen Skidding Production Rate Study on Zomba Plateau, Malawi. FTP Helsinki.
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# ■ APPRODEV AND OXEN LOGGING

## 1 Information source

The information presented in this part of the APPRODEV manual has been produced as a result of practical development work, trials and studies in the African countries of Malawi, Tanzania, Uganda and Zambia. The majority of the information on oxen management has been collected in Malawi with the assistance of **Mr. M.P. Musukwa**, Chief Field Officer of the Malawi Forestry Department's **Logging Oxen Training Unit (LOTU)**. The oxen logging and management system used in the Malawi Forestry Department was introduced in 1972 based on the systems found in Chilean forestry. In Malawi in 1992 over 90% of Forestry Department logging was done by oxen.

Yoke development has been carried out in Malawi and Tanzania by APPRODEV and a new type of neck yoke has been developed for use with the short chain logging system as used in Malawi. Skidding sledges have also been developed for assisting in long chain skidding, these sledges being based on the **KITE sledge** developed at ZAFFICO's Kafubu Frame Mill in Zambia.

## 2 Use of APPRODEV oxen logging information

The information presented here is for forestry students, logging officers or contractors running or establishing an oxen logging system. **Detailed information on veterinary care and the feeding and housing of animals must be obtained from local experts, such as veterinarians.** This manual can give guidelines only on these subjects.

### SPECIALISTS MUST BE USED

- ◆ Always consult a trained professional for advice on feeding, housing, health and sickness
- ◆ This manual gives guidelines only
- ◆ Much more information can be found in the further references listed on the contents page of this manual

### Notes:

# ■ INTRODUCING OXEN LOGGING

## 1 Animal logging

For various reasons, economic, environmental, and so on, animals are used for skidding logs to some extent in most countries of the world. For small logging operations they are often cheaper to use than machines. In developing countries, where labour is a relatively low cost input they are cheaper than machines also in large operations. Very often, animals are more reliable than machines, not suffering from regular breakdowns and relatively easy to replace if they do. There are other significant advantages to animal logging in developing countries, such as the ability to use local resources and skills rather than importing machinery, fuel and so on.

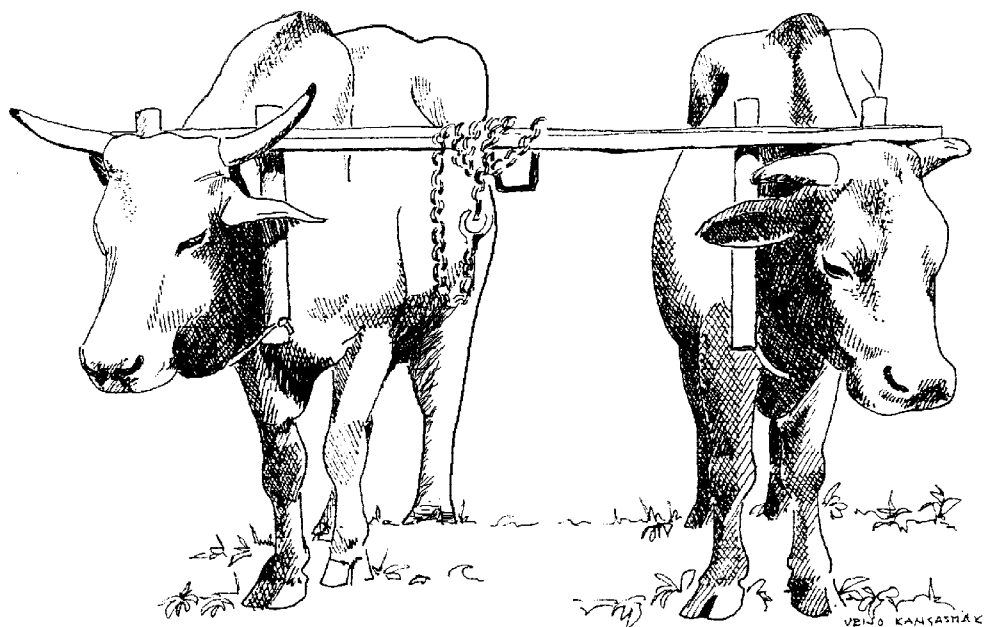
In all countries where animal logging is used an extremely important consideration is the small environmental impact of animals in logging operations. Considering the power of animals such as oxen or horses in pulling loads it is perhaps the kindest of all logging methods to the environment when considering the ratio of pulling power compared to logging damage.

The most commonly used logging animals are horses (Europe), oxen (Africa and America), Indian elephants and water buffaloes (Asia). The pulling capacity of animals can be increased by joining them together in teams or by combining them with implements such as skidding sledges to reduce friction.

Notes:

## 2 Oxen as draught animals

- An ox (oxen for more than one) is a **castrated bull** trained and used for draught work (pulling loads or implements).
- Compared to bulls, oxen are more **docile** (less fierce) and **trainable**, yet they are still strong.
- The **working life** of an ox is about **8 years**, between the ages of 2½ to 10½.
- The length of a **working day** for logging oxen is normally **5-6 hours**.



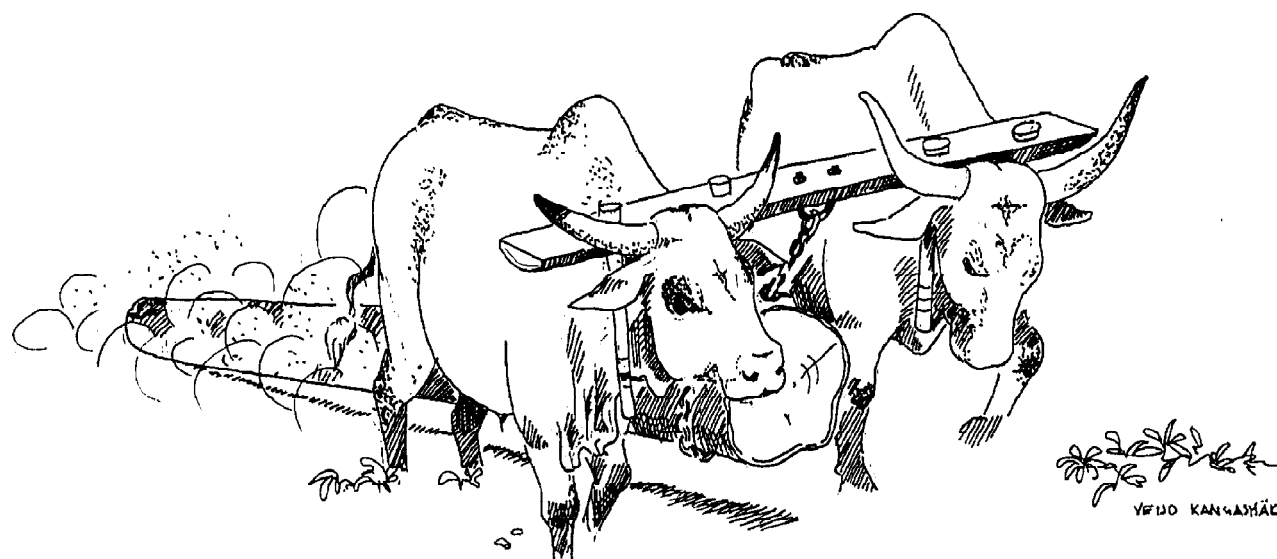
Notes:

- An oxen **pair** may **weigh** between **700-1100 kg**, depending on the breed.
- An oxen pair can **pull** about **10% of its own weight** in draught, i.e. **70-110 kg**.
- For large logs it may be necessary to use more than one pair of oxen.
- **Two pairs** together can pull around **1.6 times the load of a single pair**, not two times the load.

### OXEN PULLING CAPACITY

- ◆ One pair can pull between **70-110 kg**
- ◆ Two pairs together can pull around **110-175 kg**

### Notes:





### 3 Oxen or tractor?

When selecting a skidding method in a developing country the choice is often between the forestry equipped farm tractor (or even wheeled skidders) and oxen. Both can be used for large plantation operations.

For instance, one large sawmill in Zambia receives some 120,000 m<sup>3</sup> of logs per year from a skidding operation consisting mainly of 50 pairs of oxen and manual sulkies. This oxen system was introduced **to replace** a mechanical skidder operation.

In Malawi, over 90% of skidding in Forestry Department plantations is done by oxen. These oxen are supplied specially trained for logging work by an oxen training unit. Tractors were gradually replaced by oxen from the mid 1970s and up to the present time no new tractors have been introduced for skidding.

Oxen skidding is not the answer for every logging operation of course, but as found in the examples given above there can be **many reasons why it is the most appropriate solution.**

#### 3.1 Advantages of oxen

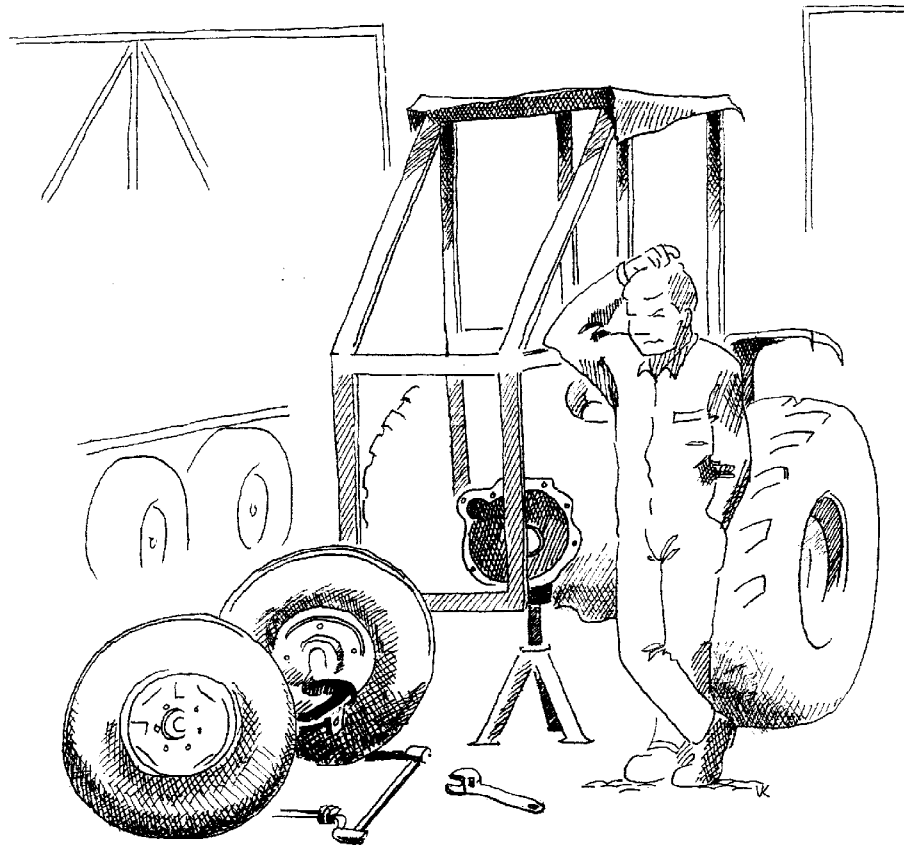
##### ■ *LOW INVESTMENT*

A new forestry equipped farm tractor may cost **fifty times** the price of a trained oxen pair. If **capital is expensive** and **machine utilization time is low** (due to breakdowns, lack of spare parts, etc.) it is better to choose low cost investments in logging such as oxen. A high capital investment such as a **tractor cannot be left standing unproductive** in the workshop since it is costing money in interest and depreciation.

#### OXEN CAN REPLACE TRACTORS

- ◆ **Mechanical skidders replaced by 50 oxen pairs in Kafubu Sawmill, Zambia**
- ◆ **Over 90% of Forestry Department logging in Malawi done by oxen**
- ◆ **Oxen logging unit gives much lower logging costs than tractors at Mt Meru, Tanzania**

Notes:



*"Why didn't I invest in some oxen instead of all this trouble?"*

■ **NO MAINTENANCE DELAYS**

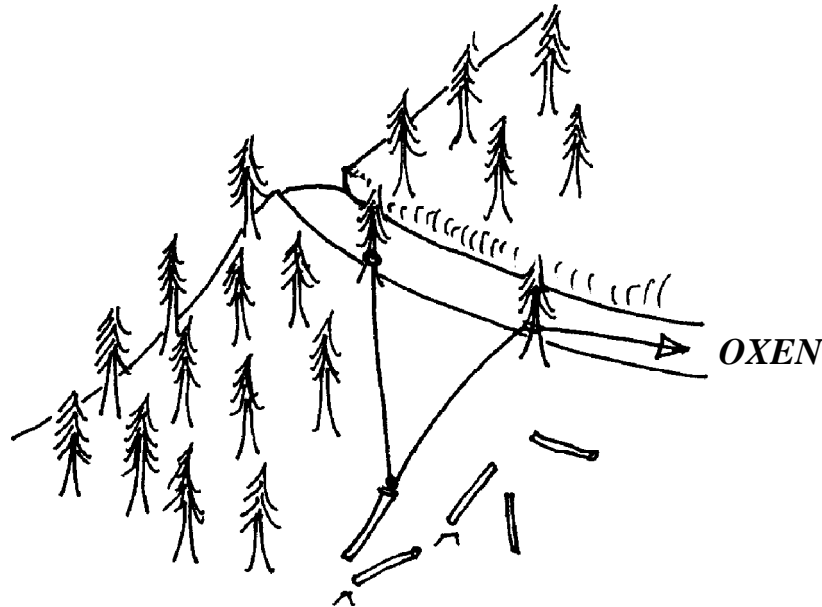
Maintenance of oxen is much easier to sustain than tractors at many logging sites. **No waiting for expensive imported spare parts and no production stopping breakdowns.**

**Notes:**

■ *FLEXIBILITY*

Oxen can do all the work that can be done by a forestry equipped farm tractor or a wheeled skidder.

- **Large operations** can be run by having **many pairs** of oxen working on the same logging site.
- **Large logs** can be skidded by **joining together many pairs** of oxen. For instance, giant redwood forests in the USA were traditionally harvested by **teams of up to 20 pairs** of skidding oxen.
- **Trained oxen** can work on **slopes of up to 40%**.
- For steep slopes, **oxen powered cable systems** can be used.

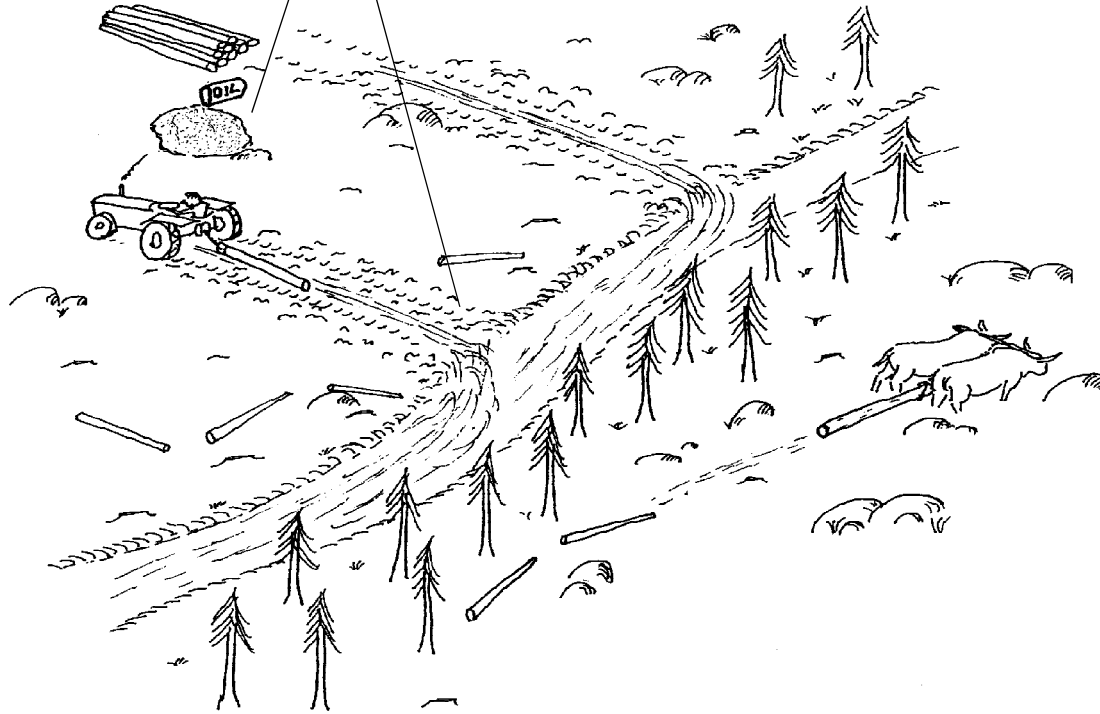


**Notes:**

■ **ENVIRONMENTALLY FRIENDLY**

There is **no petro-chemical pollution** associated with oxen logging and **soil disturbance is very light**.

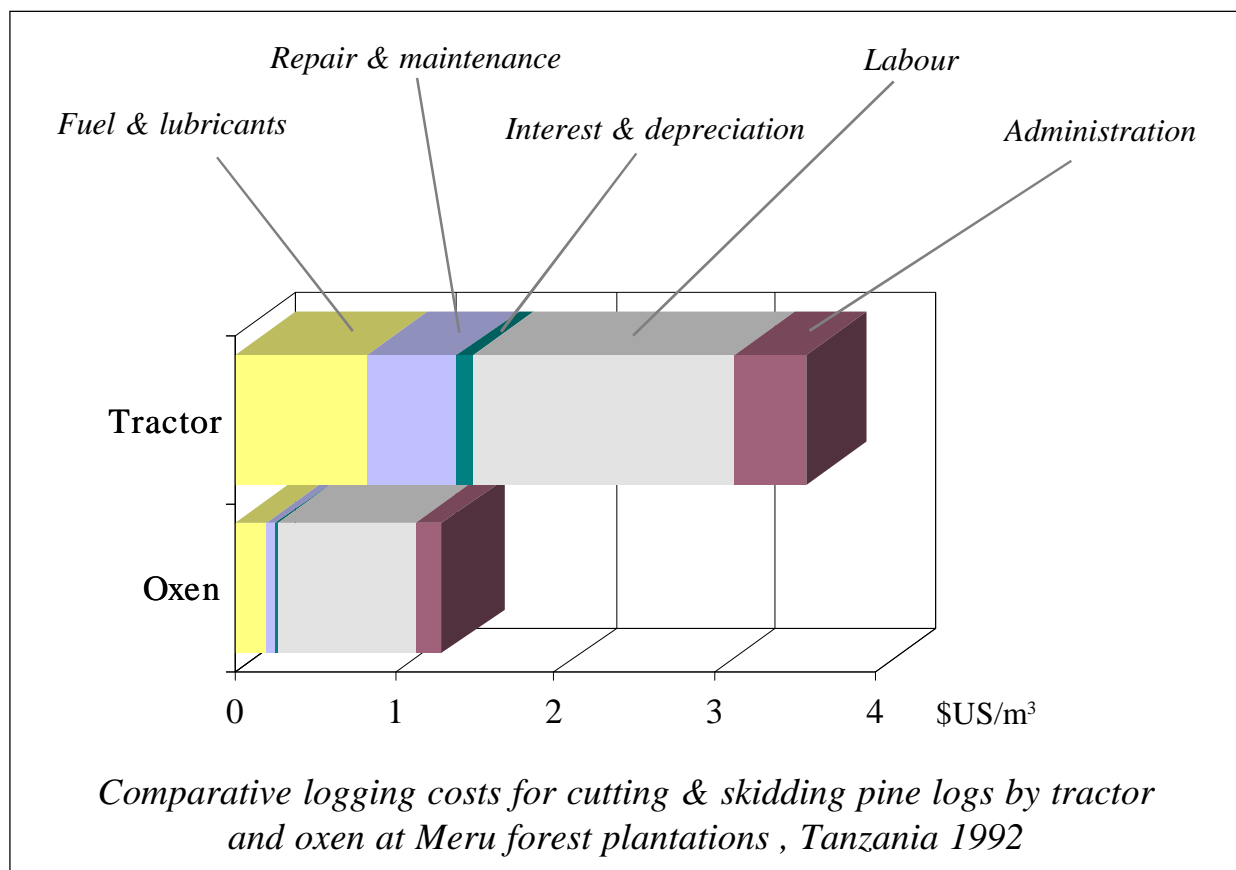
*Soil and mud disturbed by machines such as tractors may be washed into streams. Careless machine operation can also pollute soil and water with petro-chemicals from oil leaks, tractor repairs and maintenance, etc.*



**Notes:**

■ *LOW LOGGING COSTS*

Logging costs with oxen may be significantly lower than those with the tractor in developing countries, mainly due to fuel costs, the high interest and depreciation costs of new tractors or the repair and maintenance costs of old tractors. APPRODEV has made a comparative study of oxen and tractor skidding in Tanzania. In this case the logging cost per m<sup>3</sup> was under half that of the tractors used (10 yr old tractors).



**Notes:**

## 4 Oxen logging production rates and costs

APPRODEV has made studies into the production rates achieved with oxen logging in Malawi, Zambia and Tanzania. As a **rule of thumb** it can be said that a pair of trained skidding oxen using the short chain method can skid approximately **5 m<sup>3</sup> of logs per working day**. The skidding costs are commonly between **1-2 \$US/m<sup>3</sup>**.

### RULE OF THUMB

- ◆ A trained oxen pair can skid about 5 m<sup>3</sup> of logs per day
- ◆ The skidding cost in East Africa is commonly 1-2 \$US/m<sup>3</sup>

#### A 1 week study on Zomba Plateau in Malawi revealed the following:

<b>Average production rate:</b>	<b>5.3 m<sup>3</sup>/day</b>
• Oxen pairs in study:	4
• Average skidding distance:	75 metres
• Average slope:	flat
• Average log volume:	0.32 m <sup>3</sup> ( <i>Pinus patula</i> )
• Largest log:	0.968 m <sup>3</sup>
• Time on logging site:	3 hrs/day

<b>Skidding cost:</b>	<b>\$US 1.2/m<sup>3</sup></b>
• Oxen depreciation:	negligible
• purchase cost \$US 400	
• working life 10 yrs	
• "residual" value \$300-375	
• Total running costs:	\$US 6.4/day
• food & medicine, implements, interest on investment	
• handler's & log piler's wages, administration	

#### Notes:

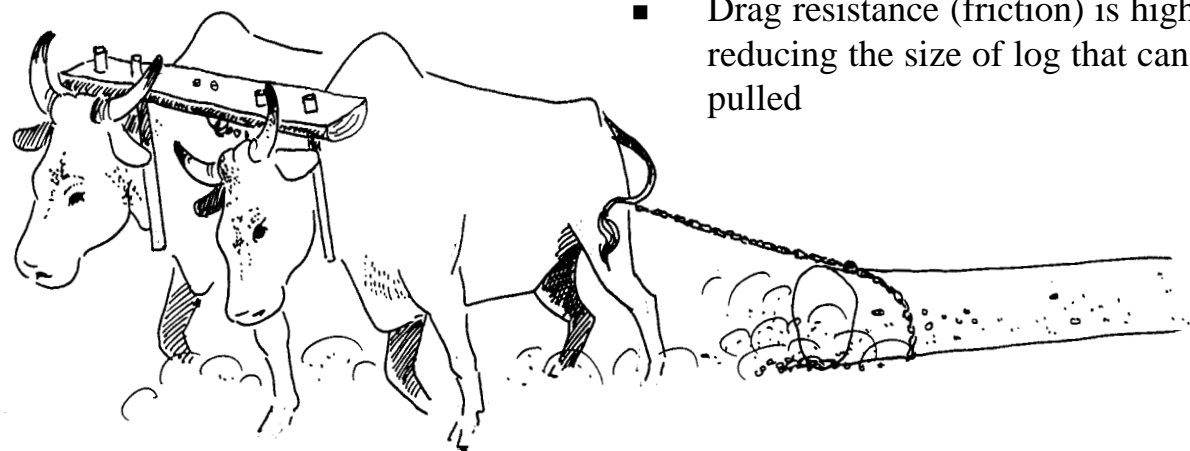
# ■ OXEN LOGGING TECHNIQUES

## 1 Skidding methods

Skidding logs with oxen requires different working techniques than when using oxen in agriculture for ploughing or pulling carts. When pulling logs across the forest floor they can become stuck on obstacles such as tree stumps, other logs and branch waste, stopping the momentum of the oxen and making it difficult for them to begin pulling again. This is particularly the case when using a long chain for skidding, copied form field ploughing work for example.

### 1.1 Long chain skidding

- Logs can become caught on obstacles, making skidding work slow and difficult
- Drag resistance (friction) is high, reducing the size of log that can be pulled



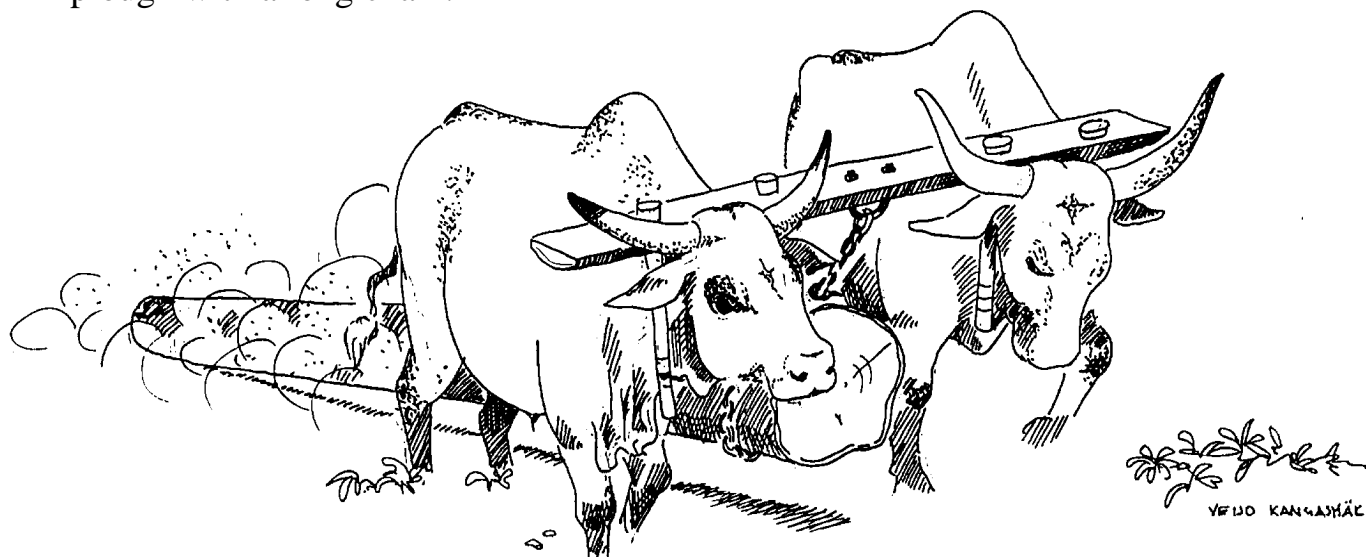
Notes:

## 1.2 Short chain skidding

Short chain skidding has been developed very successfully in countries such as Malawi, adapting the head yoke methods of South America to the neck yokes more commonly used in Africa.

Using a short chain between the yoke and the log is **very efficient** for skidding because the **front of the log is lifted from the ground** when the oxen lift their heads and move forwards. This **reduces the drag resistance** and the possibility of the log becoming caught on **obstacles**. It also means that the log collects **less dirt** as it is skidded, which is important to sawmills for reducing the blunting of their saw blades.

Short chain skidding must be taught to oxen at an early age, it is difficult to convert agriculturally trained oxen as they are more accustomed to the feeling of pulling a plough with a long chain.



### SHORT CHAIN IS MORE EFFICIENT FOR LOGGING

- ◆ Less drag resistance, allowing larger loads
- ◆ Less snagging on obstacles, allowing higher productivity
- ◆ Cleaner logs to the mill

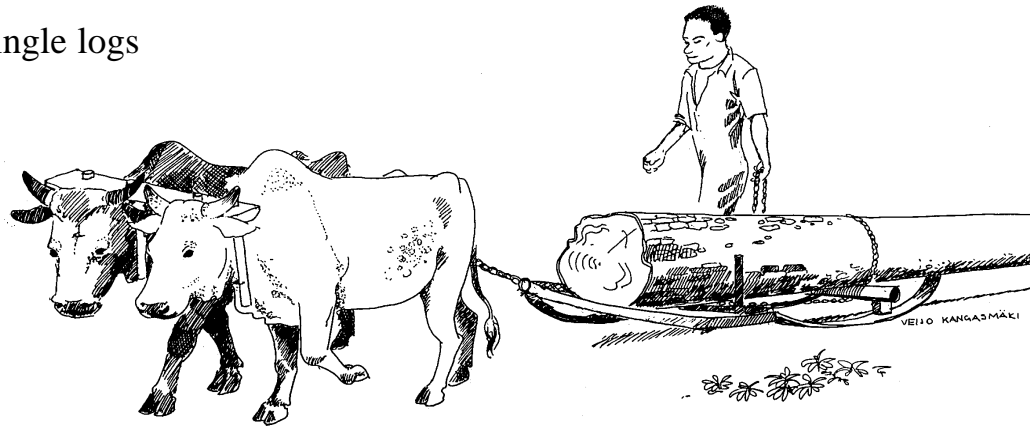
#### Notes:



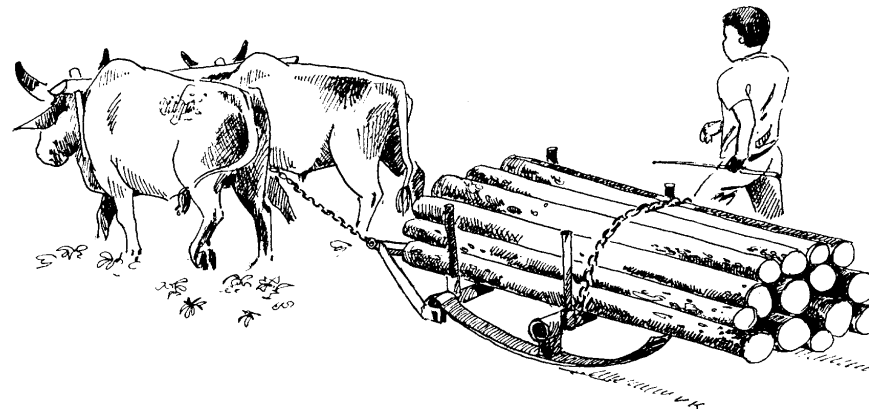
## 2 Skidding sledges

One way to **increase the efficiency of long chain skidding** is to put the log on a **sledge** or in a **log cone** so that it glides over obstacles and reduces drag resistance.

- For single logs



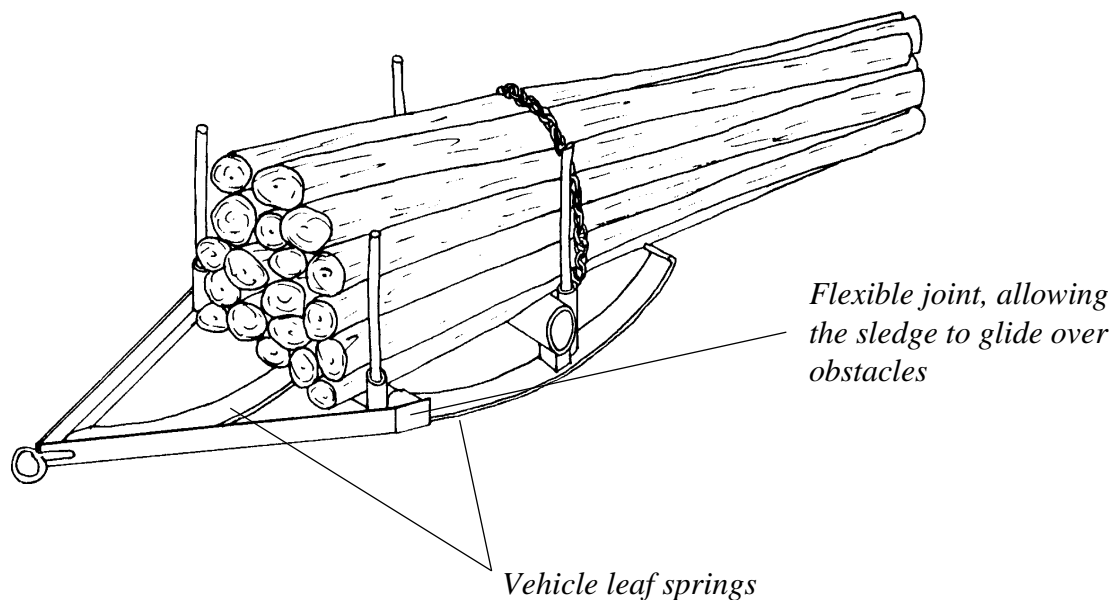
- For bunches of logs or fuelwood



Notes:

APPRODEV has developed a skidding sledge based on the **KITE sledge from Zambia**. This sledge is manufactured from old vehicle leaf springs and other scrap metal. Manufacturing drawings for the sledge can be found in the *manufacturing drawings* part of the APPRODEV reference manual.

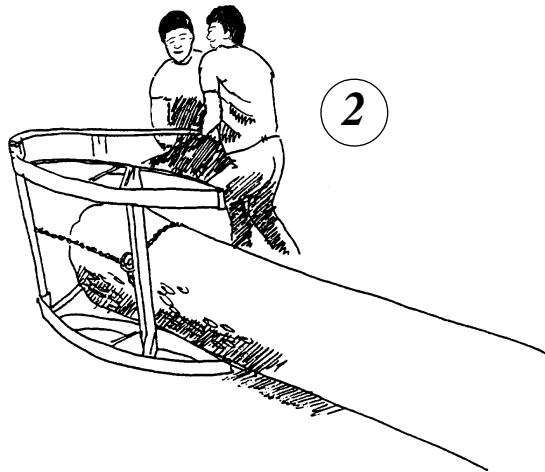
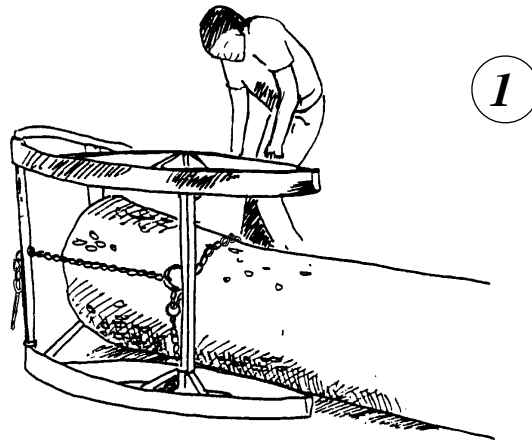
The sledge is particularly effective for skidding wood such as long poles, shown here, since loading is relatively simple and larger loads can be bunched together and skidded compared to standard long chain skidding. Short chain skidding is difficult with wide loads such as bunches of poles as the oxen are nervous of injury.



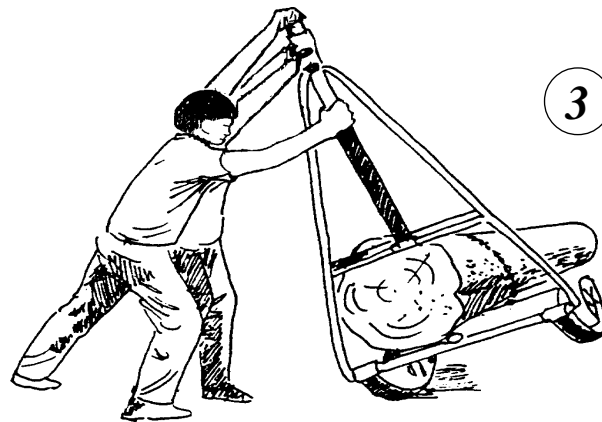
**Notes:**

### Sledge loading sequence for single logs:

Turn the sledge on its side next to the log and make a **choker ring** around it. Thread the chain through the **sledge cross bar ring** and connect the end of the chain to the **notch on the sledge's flexible joint**.



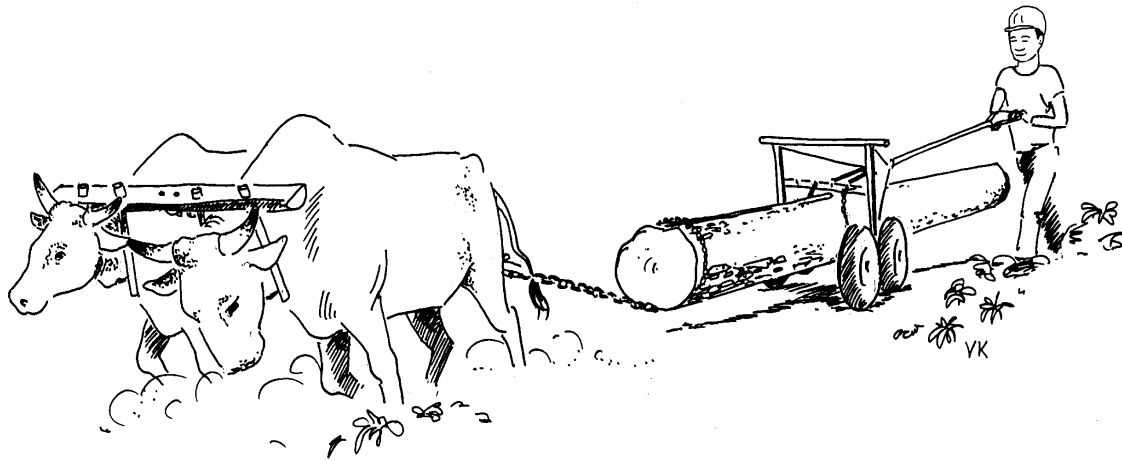
Turn the sledge back onto the ground.



Notes:

### 3 Oxen and sulkies

The sulky (manual log arch, see Part 3 of APPRODEV manual) can be used in combination with oxen to transport heavy loads over short distances. Putting a load on wheels reduces the skidding resistance, allowing animals to pull heavier loads. This is particularly useful for any **large logs** left at the end of a logging operation.



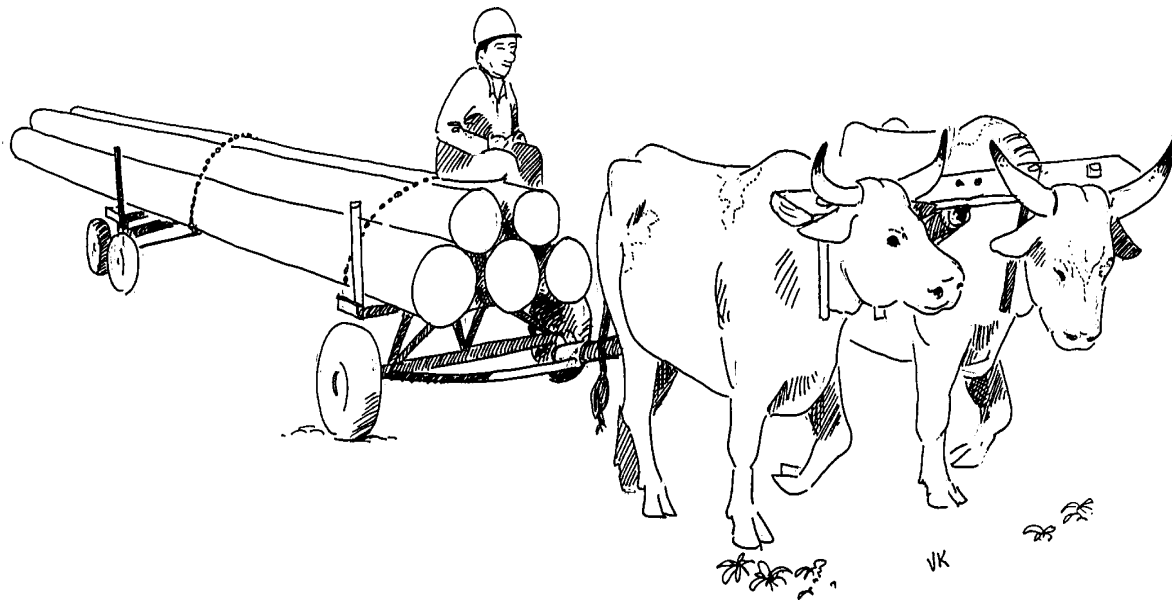
#### How to use the sulky with oxen:

- *turn sulky around so that oxen handler can steer sulky using handle*
- *raise handle for **emergency brake***
- ***not for use downhill**, no steeper than 15 %*
- *use **well trained animals** which are accustomed to pulling wheeled loads*

Notes:

## 4 Oxen pole trailer

An oxen drawn pole trailer is very useful for transporting poles over short distances, such as 1-3 kilometres. Over such short distances it is often uneconomical to transport by truck due to the high percentage of its time that the truck is standing idle during loading and unloading. A lower cost investment such as the pole trailer and oxen does not cost as much when it is not moving.

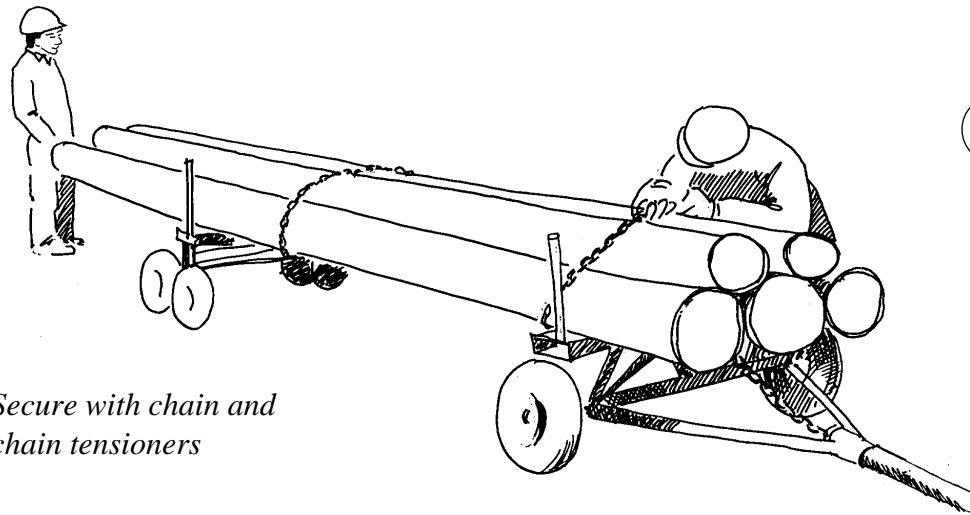
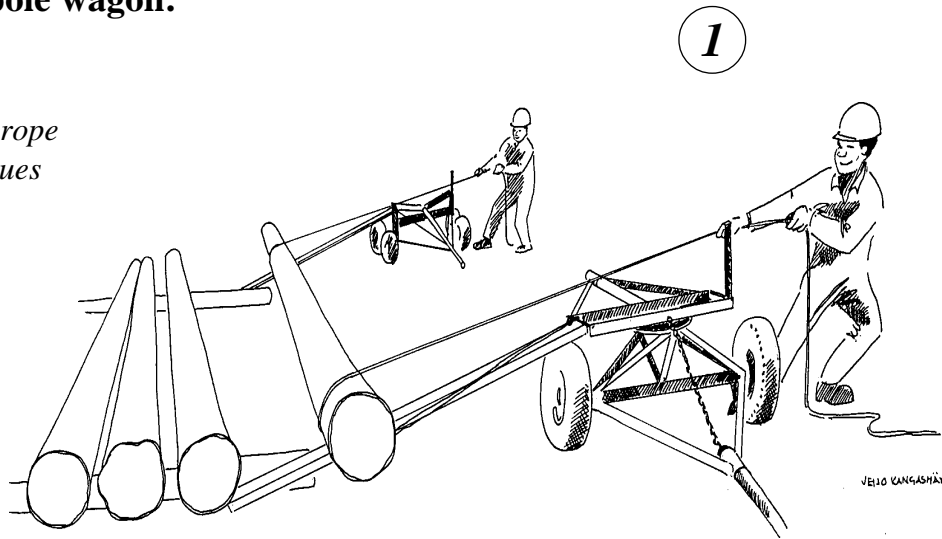


The pole trailer utilizes the poles being transported to join the front and rear wheel sections together. This makes the pole trailer **light and flexible**. See the *manufacturing drawings* part of the APPRODEV reference manual for design specifications.

Notes:

## Loading the pole wagon:

*Use ramps and rope loading techniques*



*Secure with chain and chain tensioners*

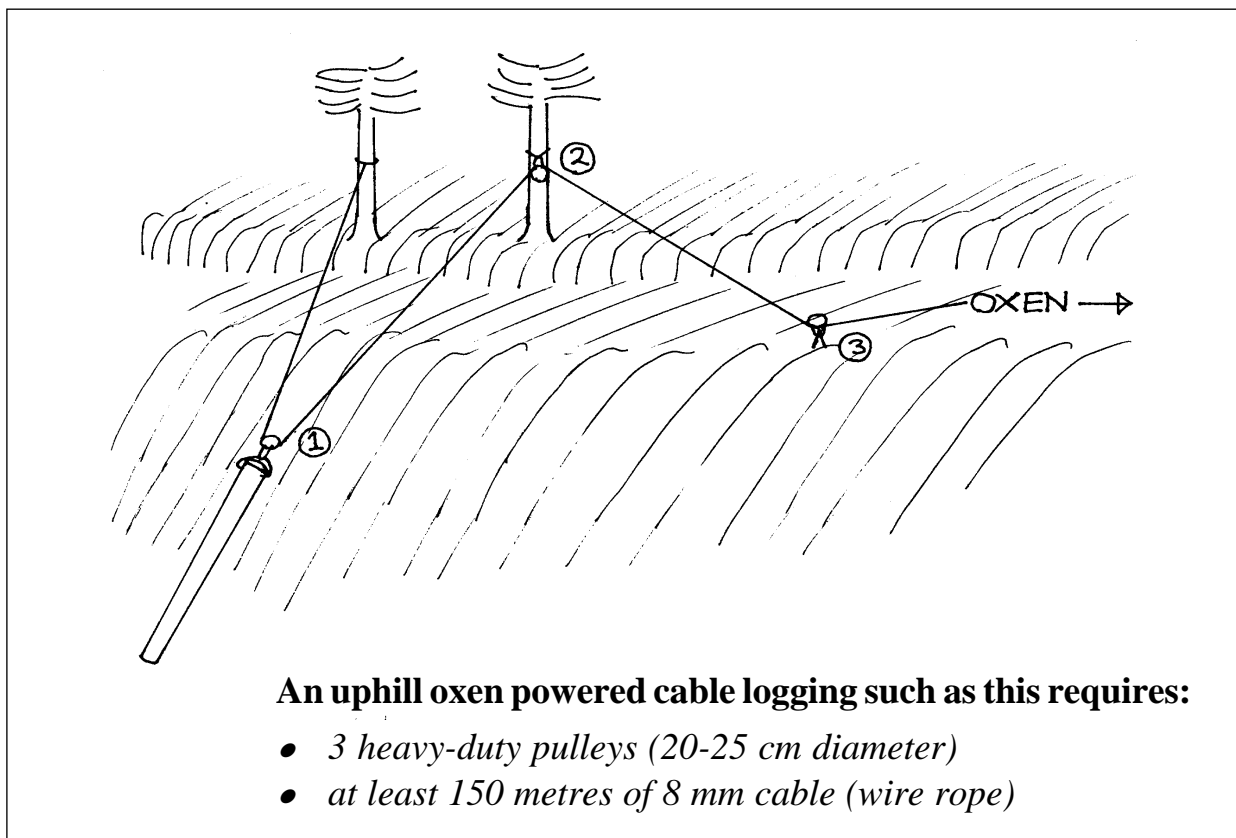
**Notes:**

## 5 Oxen cable logging

In steep terrain oxen can be used to power simple, but very effective cable logging systems. Such a system may be the only option for slopes in excess of 30-40%.

APPRODEV has been working with the **uphill system** shown here in Malawi and Tanzania. More information is given in the *basic cable logging* part of this manual.

Notes:



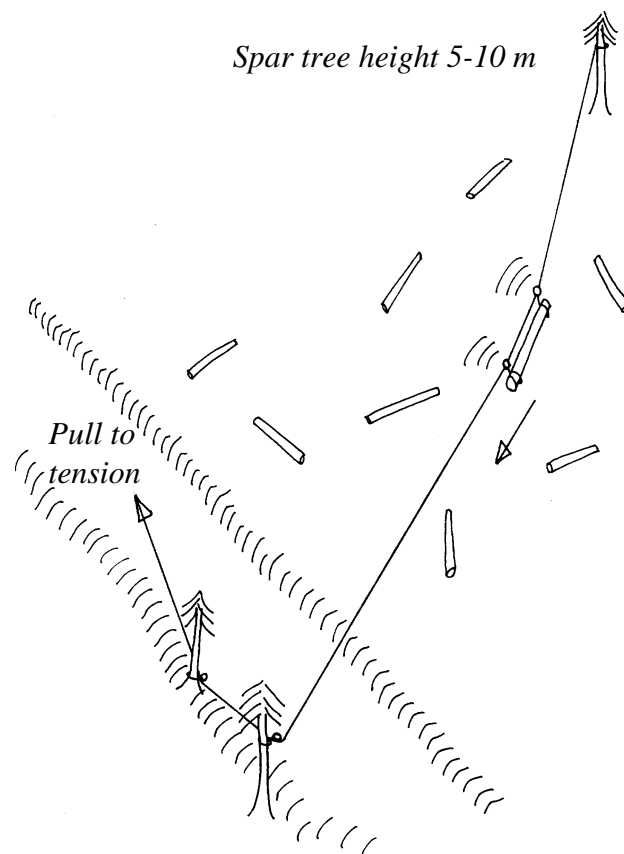
A simple **downhill gravity cable system** can also be powered by oxen. It should always be remembered however that **downhill cable logging is more difficult to control and potentially more dangerous than uphill cable logging.**

This gravity system has been tested by APPRODEV in Uganda. More information can be found in the *basic cable logging* part of this manual.

**Notes:**

**The downhill gravity cable system works by:**

- *fixing the log to free rolling pulleys on the cable*
- *tensioning the cable, by pulling with oxen for instance*
- *as the cable is tensioned the log is lifted from the ground and slides downhill by gravity*





# OXEN YOKING

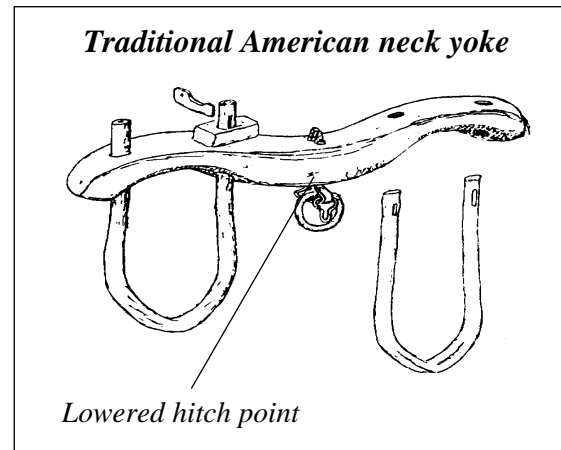
Notes:

## 1 Introduction

In order to pull a load efficiently each type of animal must be harnessed to the load in the correct way. **Equines** such as horses have a **specific draught point** above their front legs and harnesses are therefore designed to utilize this point. **Bovines** such as **oxen are strongest in the neck and shoulders** and they are therefore loaded on the head or upper neck to utilize the shoulder strength. The implement used to load an oxen pair is called a **yoke**.

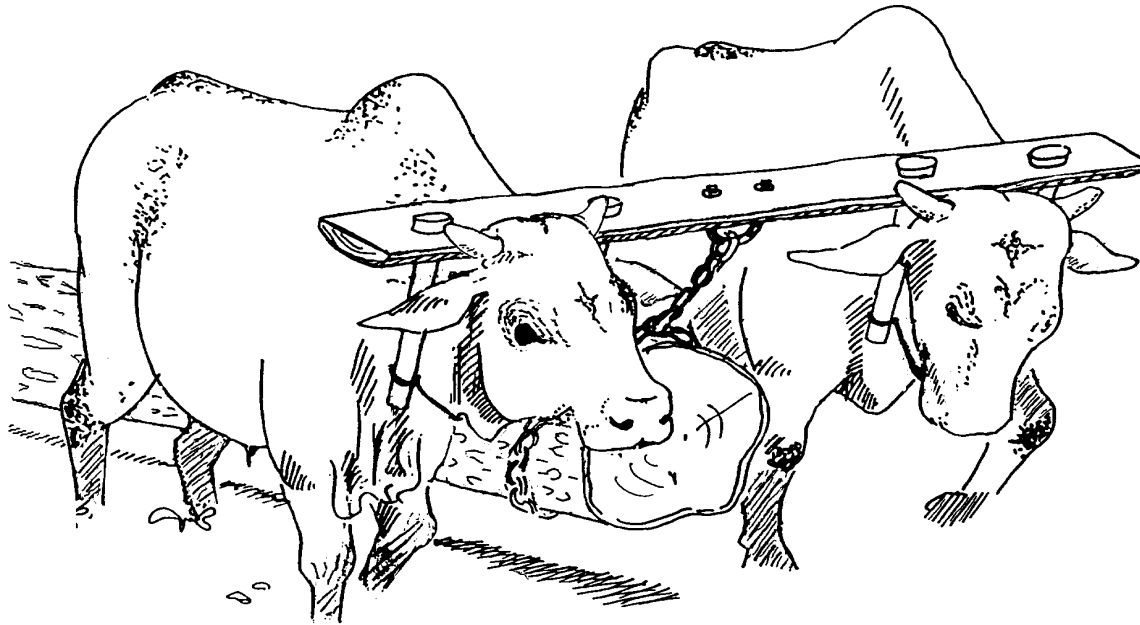
To make a yoke efficient, so that the oxen can pull without discomfort and with their full potential, the design of the yoke must be good. **A simple round bar and some rope for hitching (connecting) the bar to the load is not sufficient.**

There are two basic types of yokes, **neck yokes** and **head yokes**, each being suited to different breeds of animals. With the neck yoke in particular it is important to pay attention to certain essential design features, such as the **lowered hitch point**, obtained on this traditional American yoke by carving the wood of the yoke body to be lower in the middle (the hitch point) than on each end (the loading areas).



## 2 Yoke types

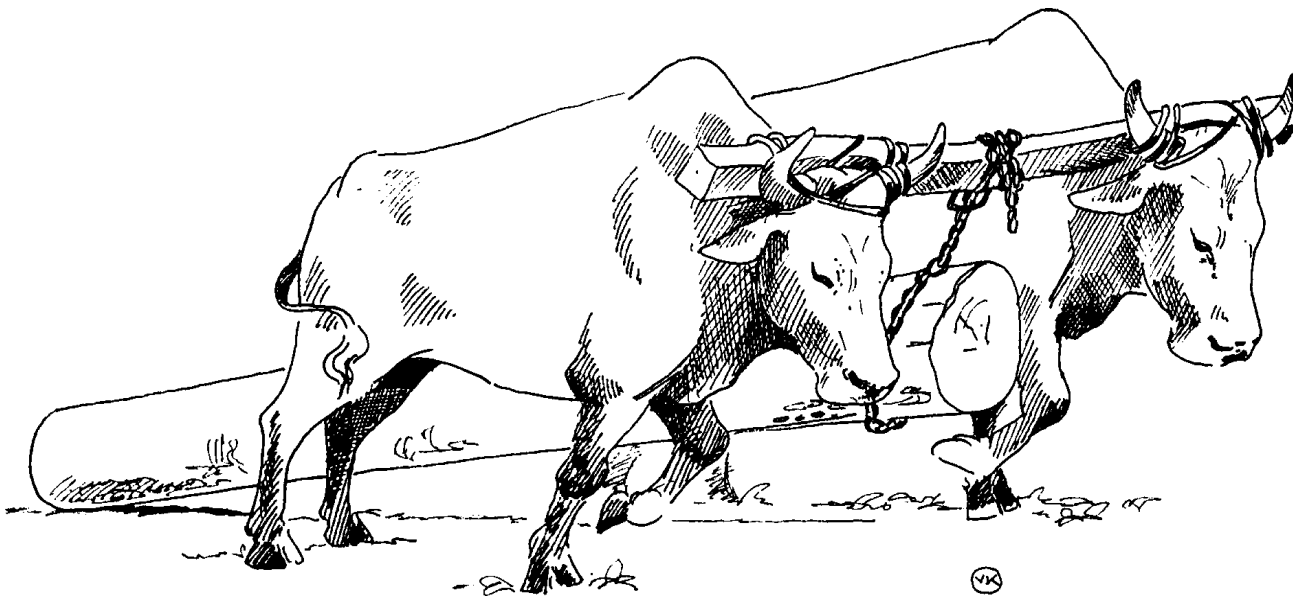
### NECK YOKE (OR WITHERS YOKE)



- Places the load on the upper neck (or withers) and into the **hump**.
- Commonly used in Africa with breeds such as Zebu.
- Relatively easy to manufacture and use but **must be well designed and comfortable to be efficient**. The simple round bar type is not recommended.

Notes:

## HEAD YOKE

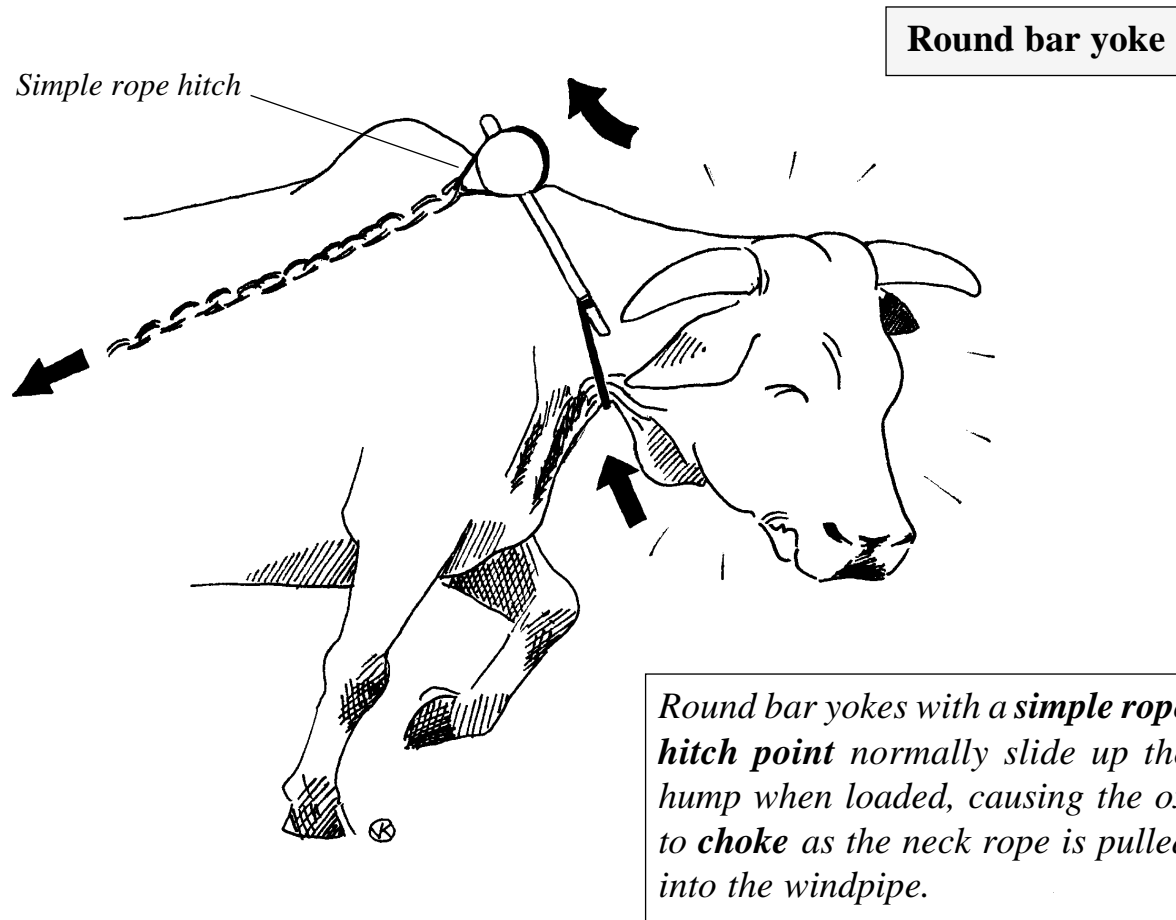


Notes:

- Head yokes are firmly tied to the horns of the oxen, normally with leather straps.
- Head yokes are **only suitable for breeds with horns and short strong necks**. Long necked breeds such as pure Zebu do not have sufficient strength in their necks to transfer the load to the shoulders.
- **Head yokes require well trained oxen**. In forestry they can be dangerous in falls for instance because they do not come free as easily as the neck yoke. However, since the yoke is firmly tied to the oxen, **downhill braking is possible** with this yoke type.

### 3 Neck yoke design

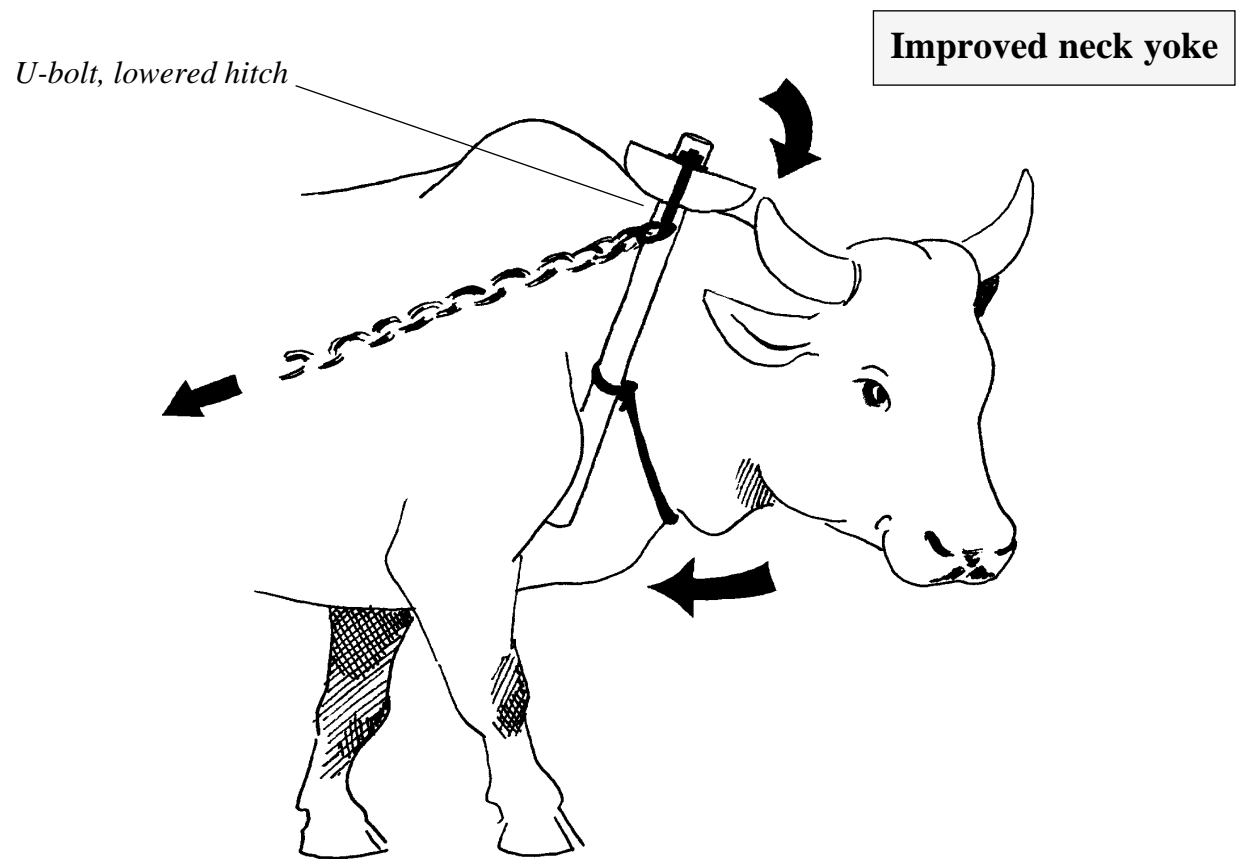
Neck yokes must be designed so that they **do not choke** the ox or **put too much load pressure in one point**. The load should be spread over a wide, smooth surface and the yoke should not ride up the neck so that the neck rope chokes the ox. The traditional round bar yoke is poor in both these points.



#### AN UNCOMFORTABLE YOKE MEANS LESS STRENGTH

- ◆ With an uncomfortable yoke the discomfort increases the harder the oxen pull.
- ◆ Oxen will not pull hard if they are choked or if the yoke bar digs hard into their shoulders.

Notes:



### A COMFORTABLE YOKE MEANS MORE STRENGTH

- ◆ A comfortable yoke encourages the oxen to put all their strength into pulling the load

Notes:

*An improved neck yoke features a **lowered hitch point**, commonly obtained by using a **U-bolt** for the hitching point. In this way the **loading surface** of the yoke is **turned flat onto the shoulders**. It also means that the neck rope is not pulled into the windpipe and that the staves (side bars) **may fit comfortably into the leg joint** as the ox walks. Also, the **loading surface** of the yoke is **wide and smooth**, spreading the load comfortably.*

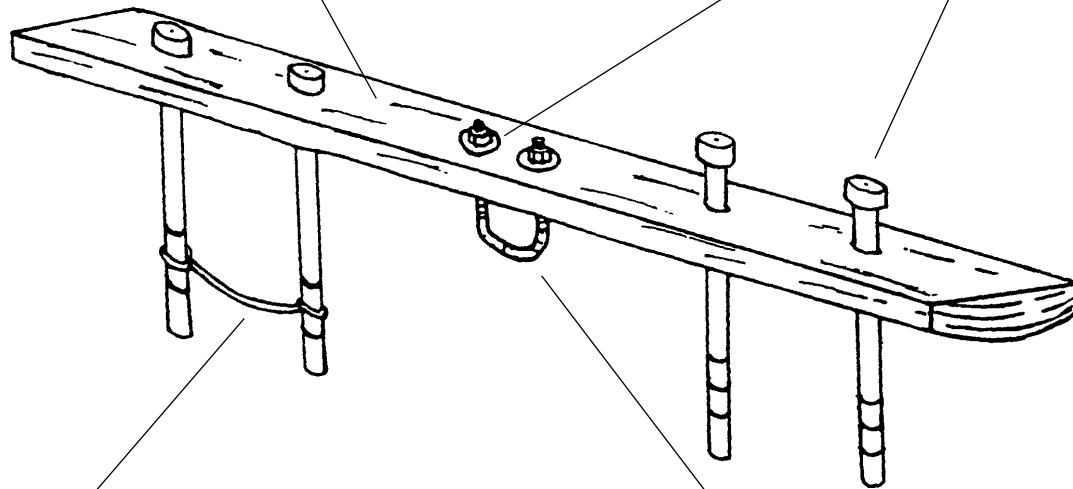
### 3.1 The Meru improved neck yoke

APPRODEV development work in Malawi and at Meru forest plantations in Tanzania has resulted in the design of a neck yoke that is light, strong, has a lowered hitch point and is easy to manufacture from sawmill waste wood.

*Yoke body: approximately 1.7 m long and 25-30 cm wide, made from an offcut slab from sawmill, e.g. Eucalyptus. Provides a smooth surface and is less likely to spilt than yokes made from sawn timber planks.*

*Staves: round wood with retaining pegs on top, 60-90 cm long*

Washers



*Neck rope: stops the oxen escaping from the yoke*

*U-bolt: creates lowered hitch point (compare this with a rope tied around the yoke at this point, as with simple yokes)*

#### TWO RULES OF YOKE DESIGN

- ◆ Use a lowered hitch point, such as from a strong U-bolt or carving the wood as in the traditional American yoke
- ◆ Make a smooth, wide loading surface

Notes:

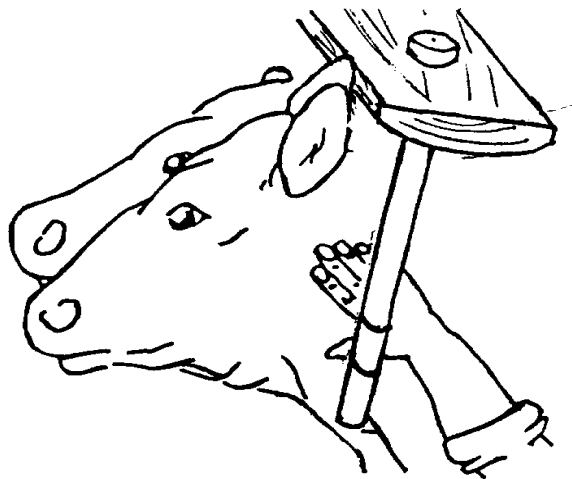
## 3.2 Fitting the yoke

Each pair of oxen should have its **own individually fitted yoke**. The width of the neck is different on each ox and to make the yoke comfortable (so that it does not cause broken skin for instance) the spacing of the staves must be set according to the neck size.

*The way to set the stave spacing is to **measure the neck width** and **add the thickness of two hands**. When the yoke has been made the spacing can be checked by placing a hand between the neck and the stave.*

**Remember:**

- *Keep a record of each ox's neck width and stave spacing*
- *One ox always wears the left side of the yoke and one the right, make sure the yoke is **not put on backwards**, it will be uncomfortable and the oxen will not work*



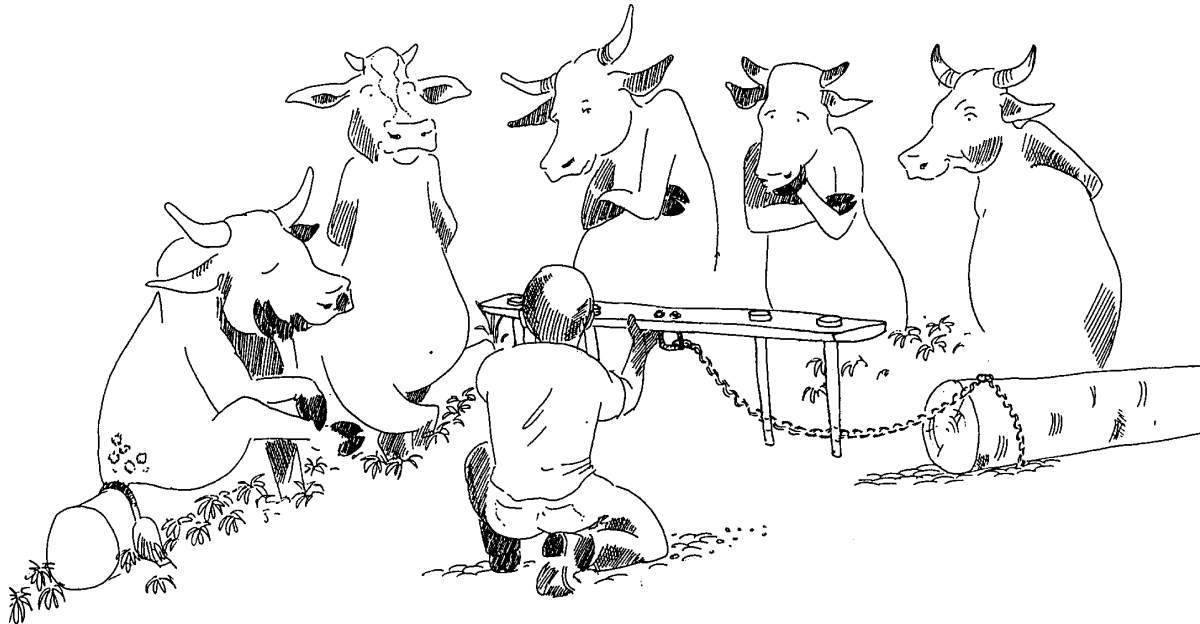
**Notes:**

# ■ THE TRAINING OF LOGGING OXEN

Notes:

## 1 Purpose of training

Oxen training forms an integral part of a good oxen logging system. Well trained oxen are more efficient and productive, capable of working in a larger variety of conditions and much easier and fulfilling to work with for the oxen handler.



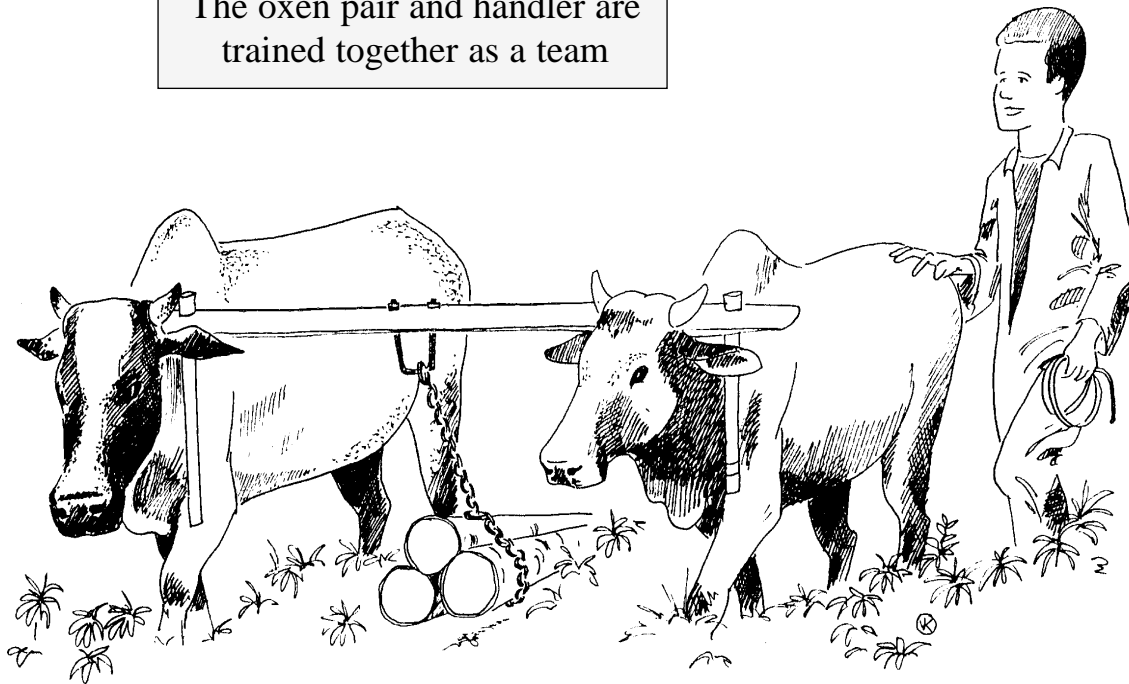
*"As you can see gentlemen, the APPRODEV type yoke is designed to give you a significantly more comfortable working environment, increasing your daily production by some 30-50%!"*



**Oxen training means that:**

- *two suitable oxen can learn to work together as a pair*
- *an oxen pair and their handler can learn to **communicate** and work together*
- *an oxen pair and the handler are always trained together and remain together after the training in the workplace*
- *the oxen become accustomed to wearing the yoke and to working with the noise of a logging site*

The oxen pair and handler are trained together as a team



**Notes:**

## 2 Selecting oxen for training

The first step in training is to select suitable oxen: of suitable **age**, **breed** and **build** and in **good health**. This is a **job for a specialist** such as a veterinarian, although some guidelines can be given here.

### The desirable characteristics when selecting logging oxen are:

- *Resistance to disease*
- *Tolerance of heat (in tropical countries)*
- *Ability to work*
  - *the ox should be calm and docile when under the yoke*
  - *initial nervousness may be expected but should not continue*
- *Fast rate of growth*
- *Good size and build*
  - *the ox should be powerful and sturdy - look for a **strong neck, shoulders and feet** and a **well muscled back and legs***

The correct **age** for beginning training is **between two and three years**.

To obtain the desirable characteristics it is essential to make the **correct choice of breed**. In Africa, most working oxen are **cross-breeds** of local breeds and exotic breeds. Cross-breeding has been done in order to obtain characteristics from both (or more) breeds.

For example, the common breed in East Africa is the **Zebu**, which is very hardy and well suited to the local conditions but small and lacking in strength and stamina. The

### TRAIN YOUNG OXEN

- ◆ **The correct age for beginning training is 2-3 years old**

### Notes:

Zebu has been crossed with exotic breeds such as **Fresian, Brahman, Jersey, Charolais** and **Sinmental**, which are stronger but less tolerant to the conditions and quite likely to succumb to heat and disease. Cross-bred stock retains characteristics of both types.

### 3 Training schedule

The **Logging Oxen Training Unit (LOTU)** in Malawi trains oxen and handlers for the Malawi Forestry Department, which in 1992 had some 140 pairs of oxen working in the forests. The training unit must maintain a regular supply of oxen to the logging sites, replacing old or injured animals. These oxen are all trained according to a three month schedule and all learn the same **commands** and **working methods** so that they can be taken to any logging site in the country.

**In Malawi the commands are given vocally and in English:**

*Head commands are used when  
coupling the log to the yoke:*      "*Heads down*"      "*Heads up*"

*Walking commands are  
used to steer the oxen when  
skidding the logs:*      "*Around*"      "*Back*"  
   "*Left*"      "*Right*"  
   "*Forward*"      "*Stop*"

#### LOTU ADDRESS:

- ◆ **Logging Oxen Training Unit**  
**c/o PO Chikangawa**  
**Mzimba**  
**Malawi**

#### Notes:

<b>Training schedule used at LOTU in Malawi</b>		
WEEK 1	FAMILIARIZATION	<ul style="list-style-type: none"> <li>• Oxen tied to poles between 6-11 am</li> <li>• Food and water given by the handler</li> <li>• Handler talks to the oxen pair using their names</li> </ul>
WEEK 2	YOKING	<ul style="list-style-type: none"> <li>• Yoke placed on oxen pair while held in stall</li> <li>• Each ox has its own side of the yoke, left or right</li> <li>• Oxen freed to begin moving yoked together as a pair</li> </ul>
WEEKS 3-5	COMMANDS	<ul style="list-style-type: none"> <li>• Noise of logging chains introduced</li> <li>• Light logs hitched to oxen for pulling around paddock</li> <li>• Vocal head and walking commands introduced and practised</li> </ul>
WEEKS 5-9	HEAVY LOGS	<ul style="list-style-type: none"> <li>• Full size logs are pulled around the paddock</li> </ul>
WEEK 9+	ACCUSTOMIZATION	<ul style="list-style-type: none"> <li>• Gradual introduction to logging site noises and work</li> </ul>

**Notes:**

# ■ MANAGEMENT OF LOGGING OXEN

## 1 Organisation

Each oxen pair has its **own handler** and they work together as a team. The oxen handler is responsible for the **work done** by the oxen and for their **welfare**.

In addition to the handler the oxen will need a **herdsman** to look after them at night and during grazing.

For large herds there will also be a **stockman** who is trained to maintain the health and condition of the whole herd and will refer any injury or illness to the **veterinary**.



### HOURS OF WORK

- ◆ The working day should begin early in tropical countries, to make use of the coolest hours
- ◆ The working hours in Africa are normally between 6-11 in the morning

### Notes:

As an alternative to the Forestry Department or logging company owning the oxen herd and employing handlers, local **owner operators** can be contracted to skid wood on a piece rate.

## 2 Duties of an oxen handler

- The handler must exercise patience and sympathy towards the oxen, not overworking them when tired
- The handler must not beat the oxen to make them work; trained oxen will obey vocal commands when possible (if they don't they are probably too tired, sick or injured)
- If an ox lies down the handler should never beat it or twist its tail
- The handler must give the necessary supplementary feed to the oxen before handing over to the herdsman

**The oxen must be examined daily by the handler and any major injury or suspicion of other illness (such as those given below) must be reported to the stockman or veterinary:**

- *lameness*
- *running, weeping, sore or otherwise injured eyes*
- *weakness at work, loss of appetite or refusal to eat*
- *loss of weight or condition (e.g. an abnormally ruffled coat)*
- *coughing or any rapid, heavy or noisy breathing*
- *severe diarrhoea or constipation*
- *any sign of blood in the urine*

### OWNER OPERATORS

- ◆ **Local people such as farmers can be encouraged to train oxen for forest work and obtain a livelihood in this way**
- ◆ **Establishing an owner operator system may be better for an individual logging company than establishing and maintaining an oxen herd**

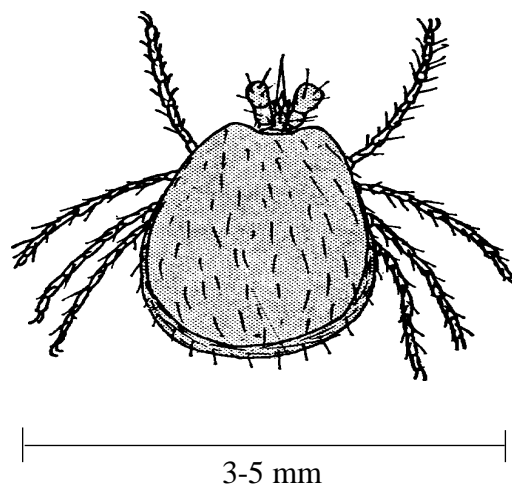
Notes:

### 3 Health and disease control

As with machines, oxen cannot perform well unless they are maintained in good condition. This calls for **control of external and internal parasites**, immediate **attention to wounds and infections**, and **supplementary feeding** of minerals and nutrients that may be lacking in the normal diet.

#### TICKS

- Ticks are *external parasites* which bite through the skin and suck blood from the animal
- Ticks can spread serious diseases such as the *typhus*, *brucellosis* and *piroplasmosis fevers*
- An ox with many ticks will also become weak through the loss of up to half a litre of blood a day



#### WORMS

- Worms such as *tapeworms*, *roundworms* and *pinworms* are *internal parasites* normally living in the intestine, but also in the muscles or lungs
- Worms cause injury to the intestine so that the animals cannot digest properly, causing them to lose weight, become weak and even die

Notes:

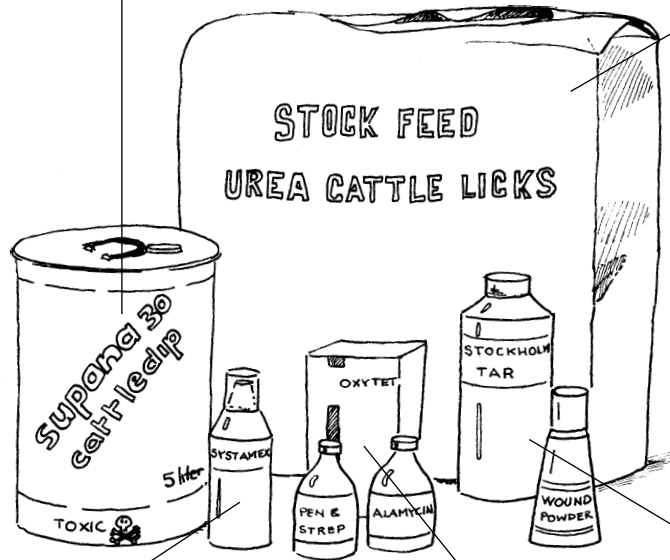
### TICK CONTROL

It is essential to control ticks by **weekly dipping or spraying** with pesticide. The veterinary will be able to recommend the appropriate pesticide and treatment.

### MINERAL SUPPLEMENTS

In addition to good feeding, work oxen often need extra mineral salts to keep bones strong. These can be provided by **mineral lick blocks** or mixing **salt and molasses** with their feed.

### Notes:



### WORMS

De-worming should be done annually by "**drenching**" with the recommended internal medicines.

### INFECTIONS

For infections, injectable solutions of **antibiotics** are applied by veterinarians.

### WOUNDS

Cuts and scratches from logging work **must not be left open** to infection. Treat them with **wound powder** and/or seal them with **Stockholm tar**. Eye sores and scratches can be treated with eye drops.



Diseases such as pleuropneumonia and anthrax can also be prevented by **vaccination** and instruction on this will be given by the veterinary department.

It is also important to remember that local breeds, and crosses of them will be more resistant to diseases and conditions prevalent in the area. In the case of the disease **trypanomaeosis**, which is transmitted by the **tse-tse fly**, the **Zebu breed of cattle is not resistant** to the disease and **should not be introduced to areas with tse-tse fly**. In East & Southern Africa, breeds tolerant to the disease are generally not available.

**To make oxen resistant to disease and in a good, strong state of health for working they should:**

- *be well fed*
- *have clean water to drink*
- *be well housed*
- *be well cared for when sick or injured*

## 4 Feeding

Working oxen need to be fed well so that they are strong enough to work. However, because the oxen spends much of its time working it is not able to gain sufficient nourishment from grazing only. Cattle will normally graze all day long.

To make sure that working oxen obtain sufficient nourishment they are normally given **fodder** and **supplements**.

### TSE-TSE FLY

- ◆ **Zebu oxen are not resistant to the disease transmitted by the tse-tse fly**



**Notes:**

## GRAZING

Cattle can obtain all the nutrients they need from fresh, young grass. Working oxen should be left to graze for some **6 hours during working days** and 11 hours when not working. In the dry season, grass is old, hard and lacking in nutrients, making fodder and supplements even more important.

Pasture land for grazing should be **rotated** to allow good, new grass to grow back. Giving rest time to the pasture also helps to **control animal parasites** which may be in their growing stage in the grass.

## FODDER

Fodders are specially grown or stored feeds crops given to the oxen in their shed as cut **green fodder, silage** or **hay**. The common specially grown fodder crops are **tall grasses** such as **elephant grass** and **Guatemala grass**. These fodder grasses have to be cut at the right moment, neither when they are too young and small or when they are so old that the seeds are forming, since the grass will then be too hard.

Any excess pasture grass in the rainy season can be cut, dried and stored as **hay** or **silage** in a silo pit (compressed, sealed from air and rain).

## SUPPLEMENTS

Extra nutrients and minerals may still be needed for working oxen. Feed supplements such as **nut cakes, molasses, crushed grains** and **maize meal** can provide them. These are often combined together into a prepared **cattle meal**. A typical cattle meal

## Notes:

could contain: 50% maize meal, 10% oil cake, 38% groundnut cake and 2 % mineral salts (such as normal salt and dicalcium phosphate).

Mineral salts can also be provided through **lick blocks** or from **salt** added to fodder.

## WATER

A working ox can drink **up to 60 litres of water per day** in the dry season. Make sure that the oxen are exposed to water three to four times a day. In the wet season, 30-40 litres and exposure twice per day may be enough. The water must always be clean, such as from a fast flowing stream.

## 5 Housing

Because of the need to minimize the walking time and distance to the logging site, logging oxen will live for much of the time in **temporary forest pens** (enclosures), at least **within 2 km of the logging site**.

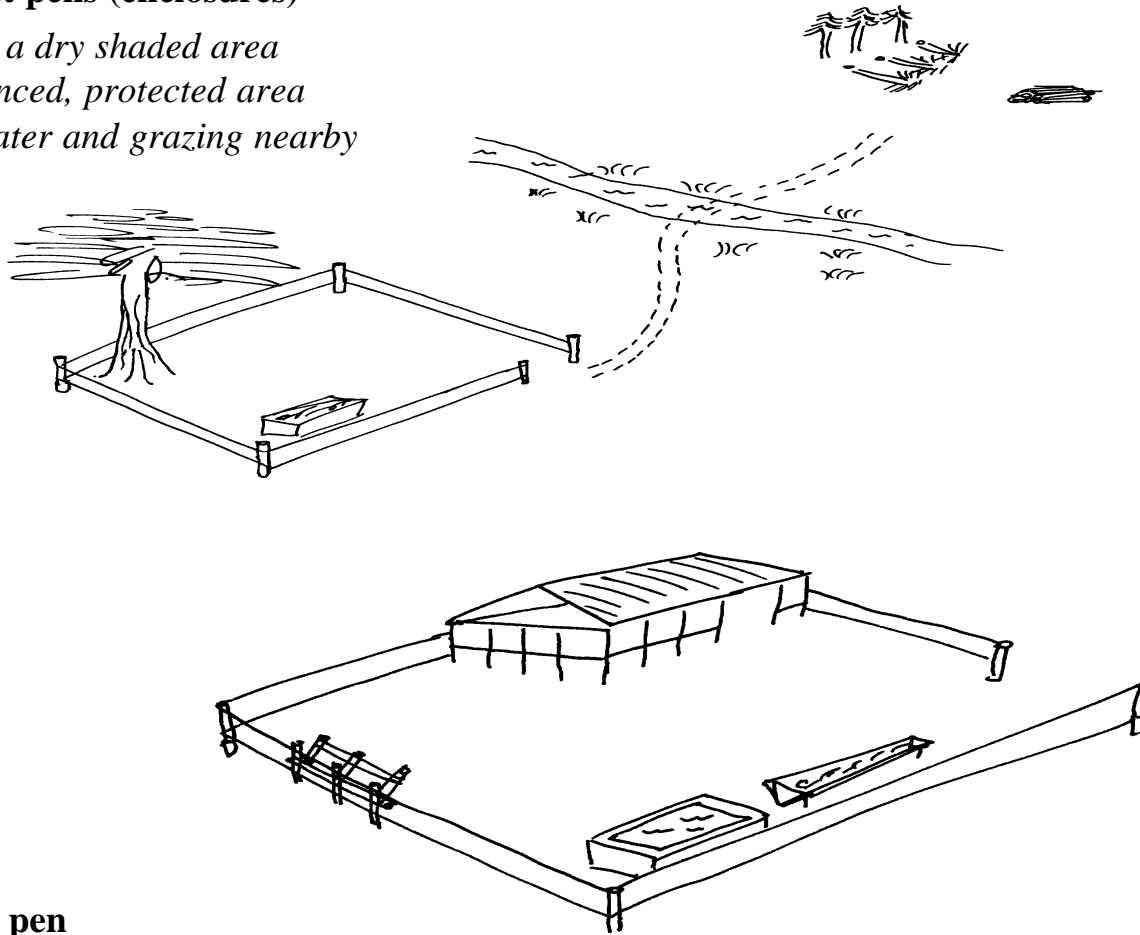
New forest pens will be established as the logging site moves. A forest pen should be in a dry, shaded area and within easy reach of water and grazing. The enclosure consists of a fenced area into which the oxen can be herded, protecting them at night from predators.

Oxen will also need a **main pen** where a **dry shed** and facilities for treating sickness and taking care of preventive maintenance are in place. This will normally consist of an enclosure containing a roofed shed, feeding and watering troughs, a treatment stall and a sickness creche.

**Notes:**

### Forest pens (enclosures)

- *in a dry shaded area*
- *fenced, protected area*
- *water and grazing nearby*



Notes:

### Main pen

- *Located in a dry, well drained place*
- *Shed must be dry with **6 m<sup>2</sup> of space per animal***
- *The fenced enclosure should be about 6 times the area of the shed*
- *Water and feeding troughs and a stall for preventive maintenance*
- *Isolation shed for sick animals where possible*