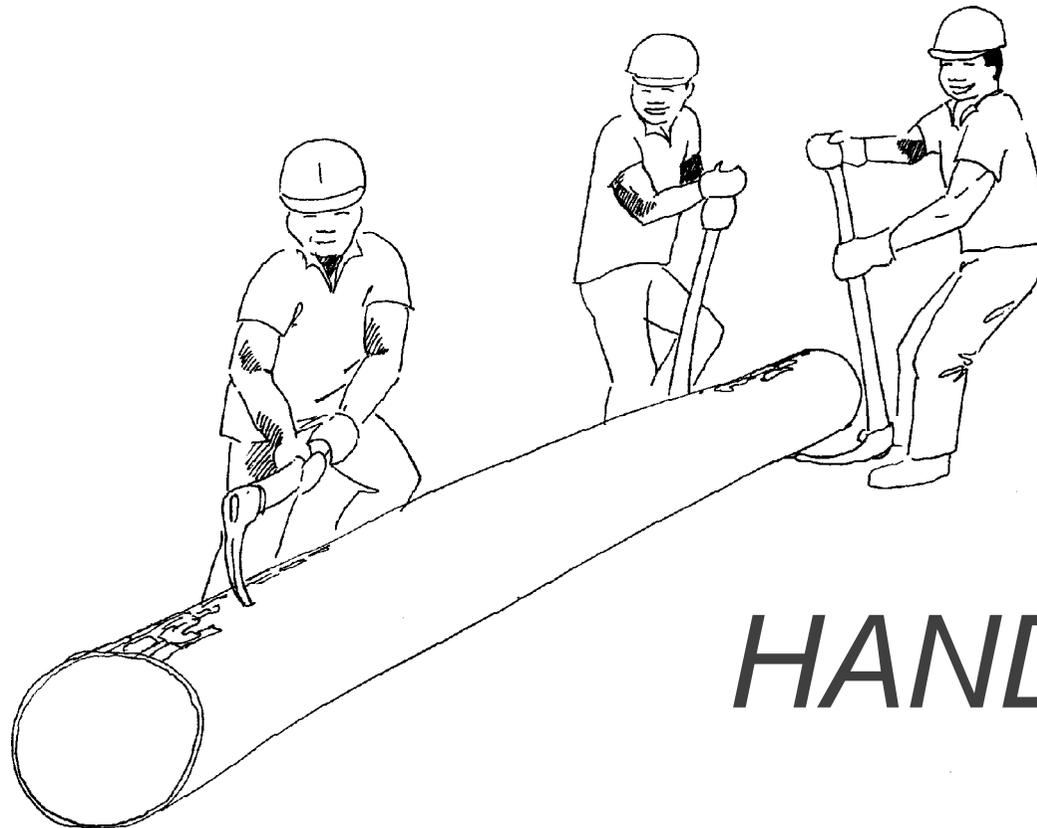


APPRODEV REFERENCE MANUAL - PART 4

***PRACTICAL INFORMATION
COLLECTED FROM THE
APPRODEV PROJECT ON
HAND TOOLS - FOR
SUPERVISORS, LOGGING
TEACHERS AND WORKERS***



HAND TOOLS

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 *hand tools* is written for the level of:

supervisors, logging technology teachers and workers
- This manual is suggested for use as reference information for short training courses or elements of curricula.
- If you require more detailed information on the subject you will find many references listed in the text and in the manual's contents section on the next page.
- This particular manual is also supported by the following materials:

wall posters
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)*
- *Unquoted drawings by Veijo Kangasmäki and (Mark Seymour)*
- *Other drawings: ILO, Geneva*

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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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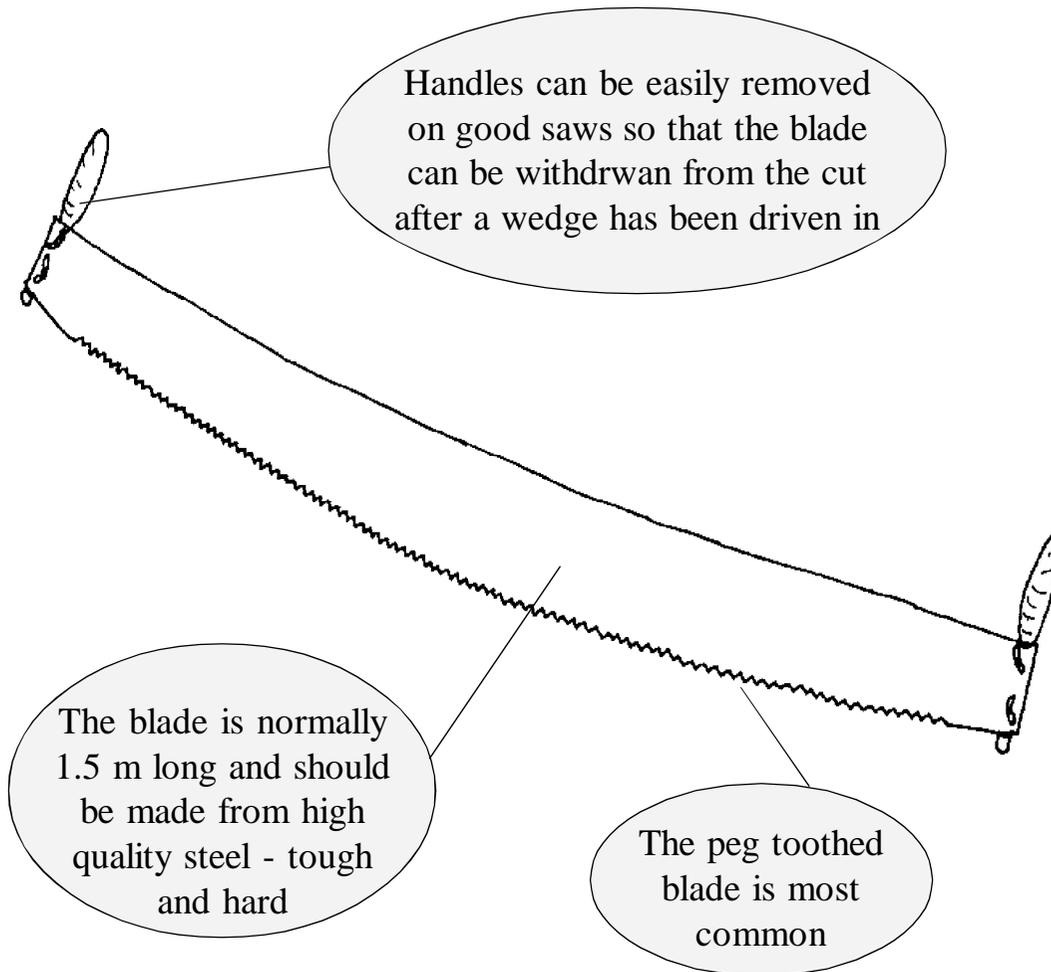
Financed by:

FINNIDA
Finnish International Development Agency

The Sections of Part 4 - Hand Tools	No. of Pages	Further References
TWO-MAN CROSS-CUT SAWS	3	* Kantola M & Virtanen K. 1986. Handbook on Appropriate Technology for Forestry Operations in Developing Countries, Part 1. ISBN 951-46-9589-5. * FAO. 1989. Design Manual on Basic Wood Harvesting Technology. FAO, Rome. ISBN 92-5-102537-1. * ILO. 1992. Fitting the Job to the Forest Worker. ILO, Geneva. * ILO. 1987. Wood Harvesting with Hand Tools. ILO, Geneva. ISBN 92-2-106217-1. * FAO/ILO. 1980. Chainsaws in Tropical Forests. FAO, Rome. ISBN 92-5-100932-5.
BOW SAWS	2	
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CANT HOOKS	2	
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■ TWO MAN CROSS-CUT SAWS

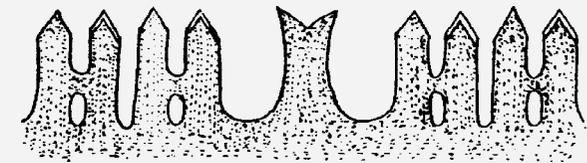
1 Description



TOOTH TYPES

- ◆ *Raker tooth* blades have a very effective cutting action when properly sharpened.

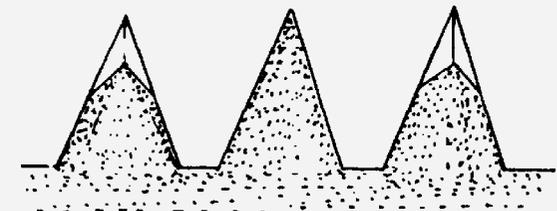
Raker tooth



Sharpening the raker tooth is more difficult than the peg tooth.

- ◆ It is better to use the *peg tooth* blade unless the experienced saw sharpeners are available.

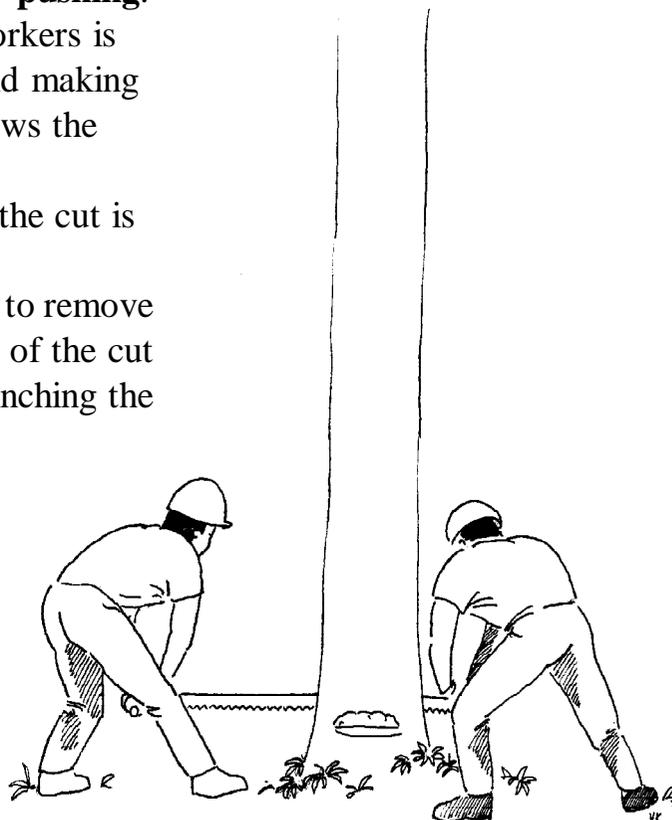
Peg tooth



2 Using the cross-cut saw

- Used for cross-cutting into logs and for making the felling back cut.
- The cross cut saw is held in two hands and used by two workers.
- The **cutting action** is made when **pulling the blade** towards the worker, **not by pushing**.
- Coordination between the two workers is essential - when one is pulling and making the cut the other relaxes and follows the blade, and vice versa.
- Use a **wedge** behind the blade if the cut is tight and pinching the blade.
- On good quality saws it is possible to remove the handles and pull the blade out of the cut when behind a wedge, to avoid pinching the blade in felling for example.

*Workers should **bend at the knees** to make felling cuts low down and to avoid physical strain to the back*



SAW BLADE MAINTENANCE

Cleaning and sharpening of the various types of saw blades is described in the following book:

Kantola M. & Virtanen K. 1986. Handbook on Appropriate Technology for Forestry Operations in Developing Countries, Part 1. FTP Helsinki. ISBN 951-46-9589-5

Notes:

Cross-cutting action

Picture: ILO



- As previously described, the **cutting stroke** is made when **pulling** the saw.
- When beginning the stroke, pull slightly downwards to get a good bite.
- When *worker a* is pulling, *worker b* relaxes and follows the blade through. When *worker b* is pulling it is the turn of *worker a* to follow.
- A **good body action** means using the **leg muscles** to pull and then follow the blade, bending at the knees and keeping a straight back.
- Cross-cutting requires good **teamwork** and practice .

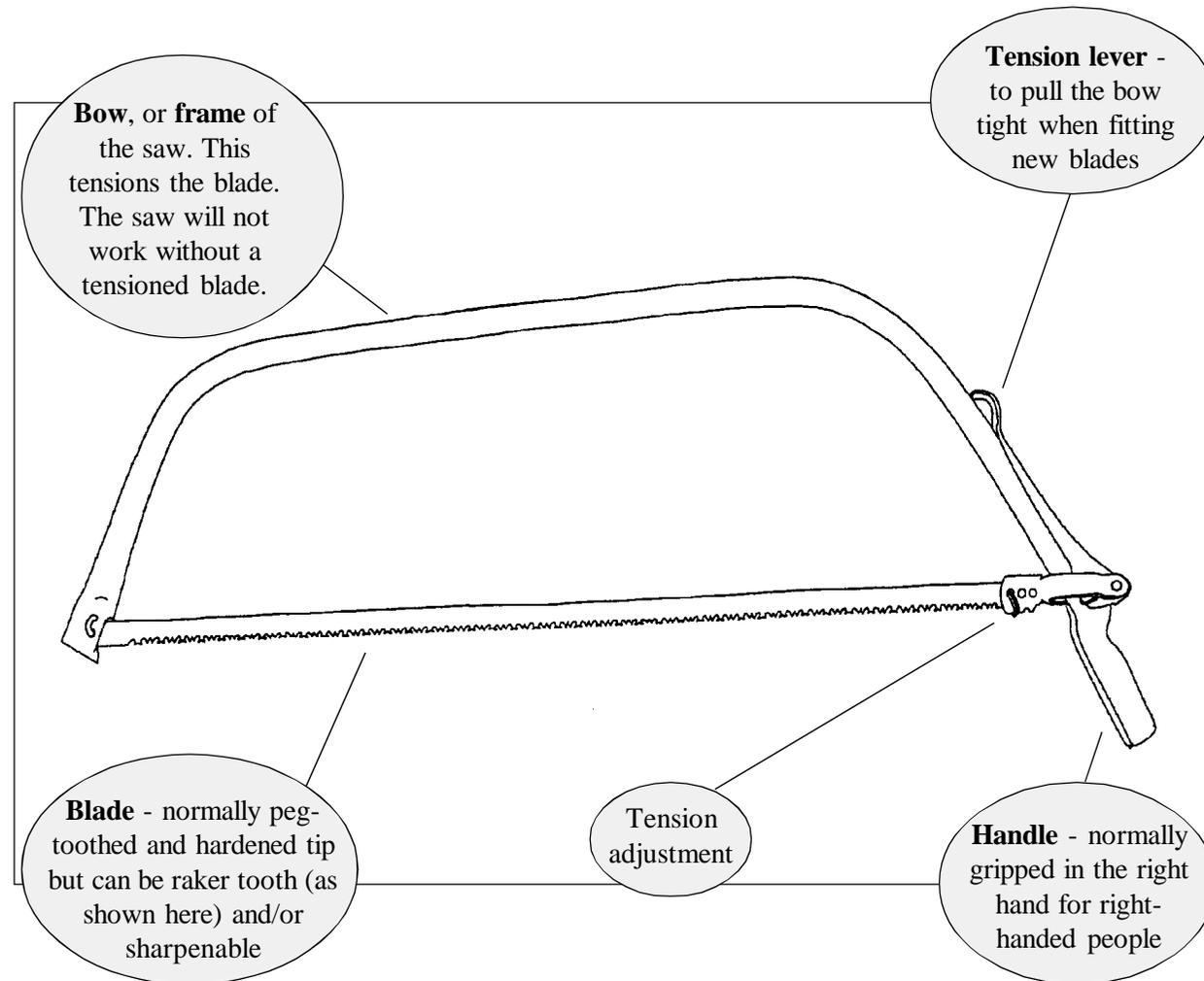
ERGONOMICS & SAFETY

Good instructions on this can also be found in the following book:

***International Labour Organisation*
1992. *Fitting the Job to the Forest Worker*. ILO Geneva.**

BOW SAW

1 Description

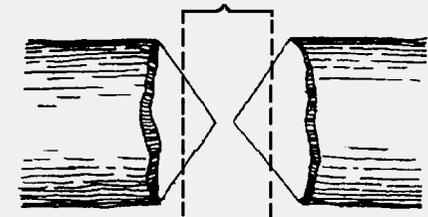


USES OF THE BOW SAW

- ◆ An efficient, lightweight, one or two person saw for felling and cross-cutting.
- ◆ Can be used for tree or log diameters up to two times the depth of the bow (frame).
- ◆ Bow saws reduce waste compared to an axe.

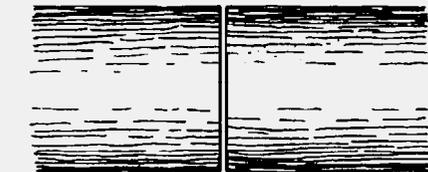
The cross-cutting kerf width by axe may be 10 times that of the bow saw on an average size log

AXE



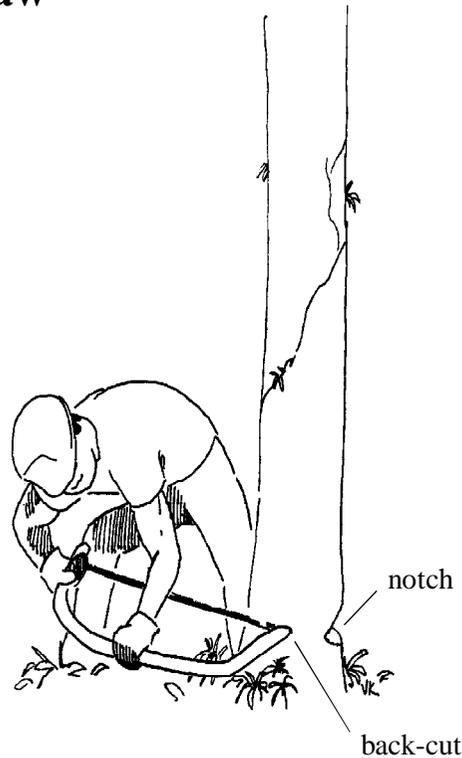
Average kerf width 0.4 cm

BOW SAW



2 Main points for using the bow saw

- Workers should **bend at the knees** to make felling **cuts low down** and to avoid physical strain to the back
- The bow saw is held in two hands, as shown in the diagram (right)
- Use a **wedge** behind the blade if the cut is tight and pinching the blade
- make sure that the blade is always tensioned, otherwise the saw will not cut straight
- keep the blade well maintained, sharp and correctly set (blade maintenance described in *reference*)
- use hardened tip (non-sharpenable, throwaway) blades if workers are inexperienced and damage blades



CUTS BOTH WAYS

- ◆ The cutting action of the bow saw is done on both strokes - backwards and forwards.

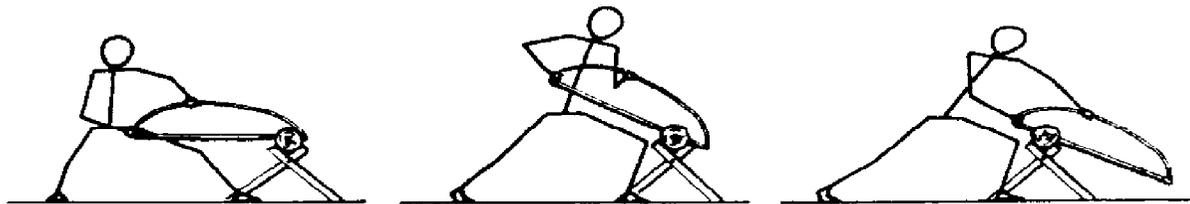
SAW BLADE MAINTENANCE

Cleaning and sharpening of the various types of bow saw blades is described in the following book:

Kantola M. & Virtanen K. 1986. Handbook on Appropriate Technology for Forestry Operations in Developing Countries, Part 1. FTP Helsinki. ISBN 951-46-9589-5

Cross-cutting action

(picture: ILO)



- Bend at the knees
- Cut on the pushing stroke
- Cut on the pulling back stroke

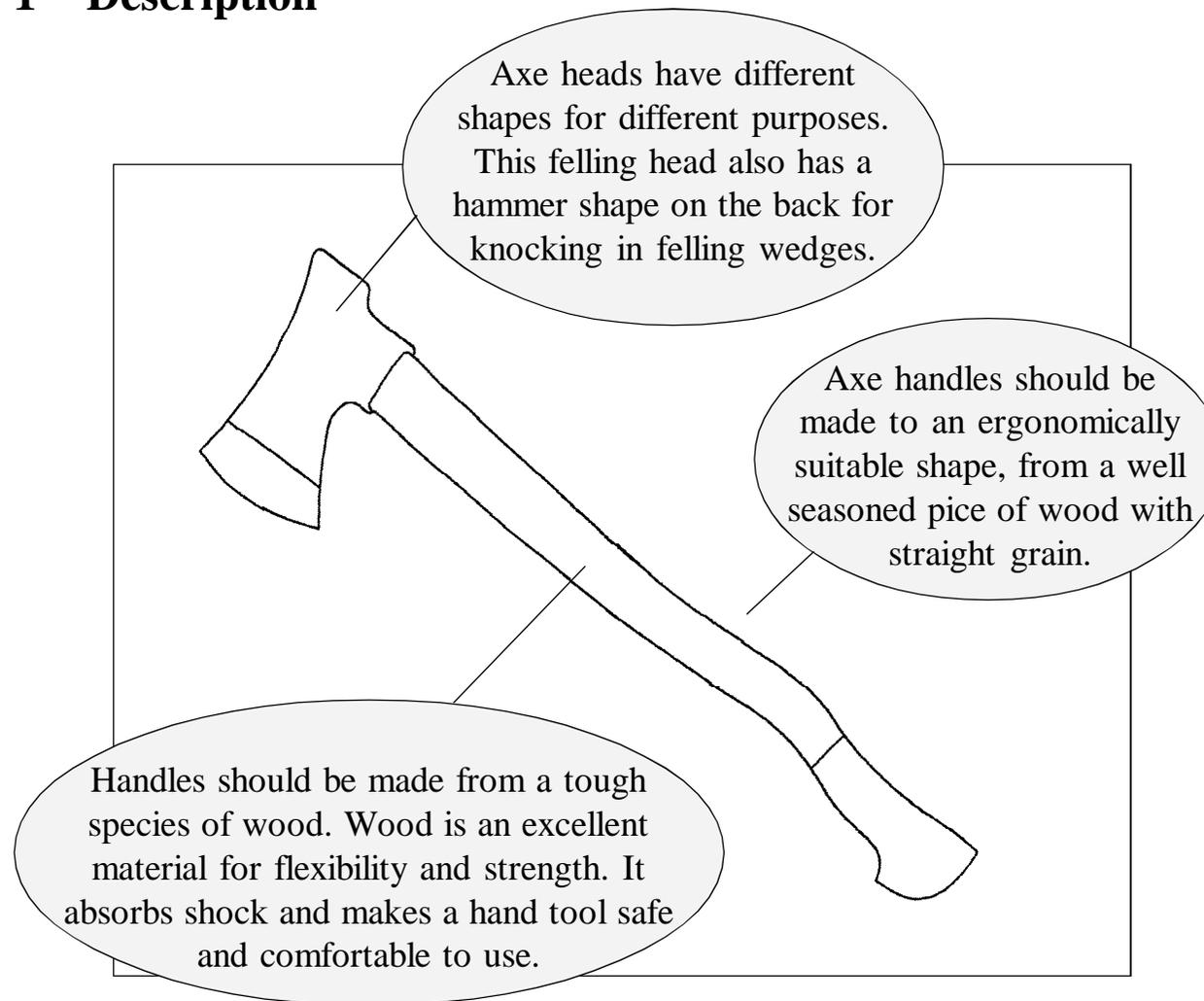
ERGONOMICS & SAFETY

Good instructions on this can also be found in the following book:

International Labour Organisation 1992. Fitting the Job to the Forest Worker. ILO Geneva.

FELLING AXES

1 Description



MAKING HANDLES, FITTING & SHARPENING AXE HEADS

- ◆ More information on the manufacture of axe handles and the fitting and sharpening of axe heads can be found in the following two books:

Kantola M. & Virtanen K. 1986. Handbook on Appropriate Technology for Forestry Operations in Developing Countries, Part 1. FTP Helsinki. ISBN 951-46-9589-5.

FAO. 1989. Design Manual on Basic Wood Harvesting Technology. FAO Rome.

Notes:

2 Using the felling axe

- Used for felling trees, commonly by making the notch in combination with a bow saw or two-man cross-cut saw.
- Axe work requires a good technique in order to be effective and also safe. Cutting with an untrained technique may result in the worker using too much force for too little effect.
- *"In axe work, the whole body moves and supports the stroke by changing the weight from the leg away from the cut to the leg near the cut while the upper hand slides down the handle."*

ILO, Wood Harvesting with Hand Tools



ERGONOMICS & SAFETY

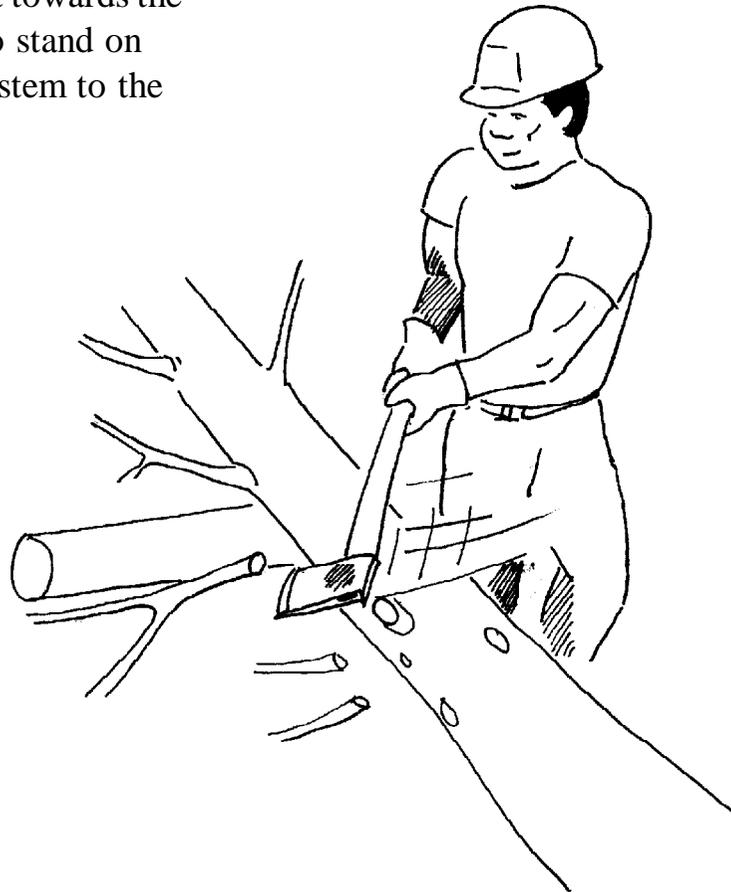
Good instructions on this can also be found in the following book:

International Labour Organisation
1992. *Fitting the Job to the Forest Worker*. ILO Geneva.

Notes:

3 Using the axe for debranching

- After felling, the axe is a good tool for debranching (snedding).
- Debranching is a dangerous job and, as with felling, requires special training.
- It is essential never to cut towards the legs and to always try to stand on the opposite side of the stem to the branch being cut.
- As with all sharp hand tools, direct the blow away from the body.



AXE TECHNIQUE

- ◆ **More information on how to use the axe for felling with a bow saw and debranching can be found in the following two books:**

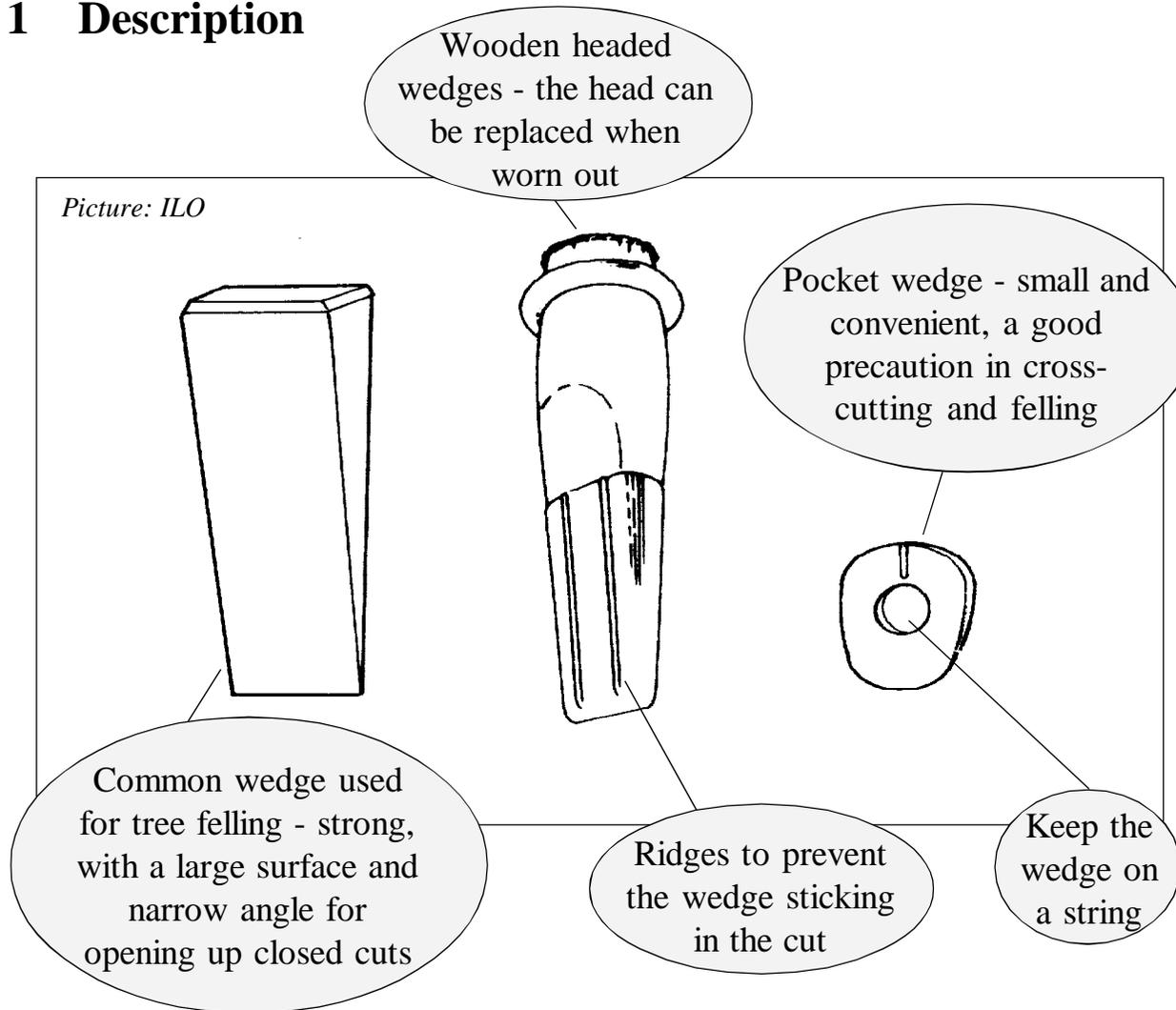
Kantola M. & Virtanen K. 1986. Handbook on Appropriate Technology for Forestry Operations in Developing Countries, Part 1. FTP Helsinki. ISBN 951-46-9589-5.

ILO. 1987. Wood Harvesting with Hand Tools. ILO Geneva. ISBN 92-2-106217-1.

Notes:

WEDGES

1 Description



MANUFACTURE

- ◆ The larger wedges are best made from aluminium alloys, which means it is difficult to manufacture them locally.
- ◆ However, wedges can be forged from spring steel. Make sure that they are not made with a metal grinder, they will not be strong enough.

FURTHER REFERENCE

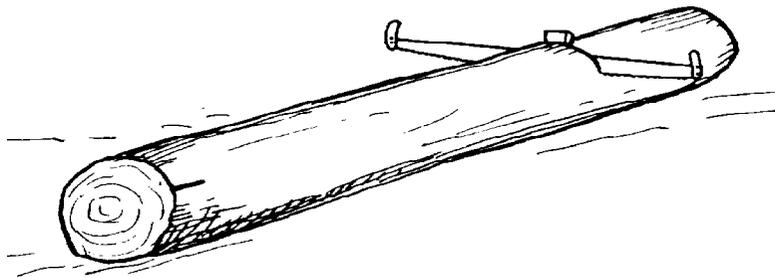
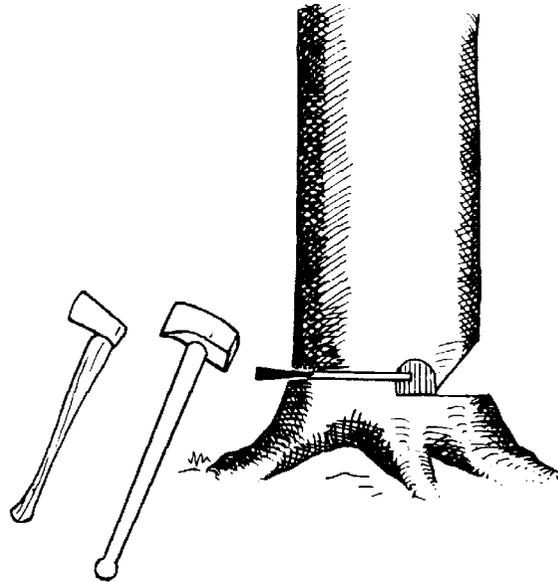
ILO 1987. Wood harvesting with hand tools - an illustrated training manual. ILO, Geneva.

Notes:

2 Using wedges

- Wedges can be used in **tree felling** for preventing a tree falling back and pinching the blade. In certain cases it can also be used to help the tree fall by hammering it into a completed back cut. Strong wedges with a steeper angle are needed for this.
- The wedge should be knocked in with a strong hammer or an axe with a hammer backed head. Do not use a simple axe with a round backed head because it will soon break.
- Wedges are normally required to prevent pinching when **cross-cutting** logs with manual saws. The kerf is quite narrow and likely to close even if the compression in the log is very small. It is a good precaution to use a small wedge.

Pictures: ILO



FELLING LEVERS

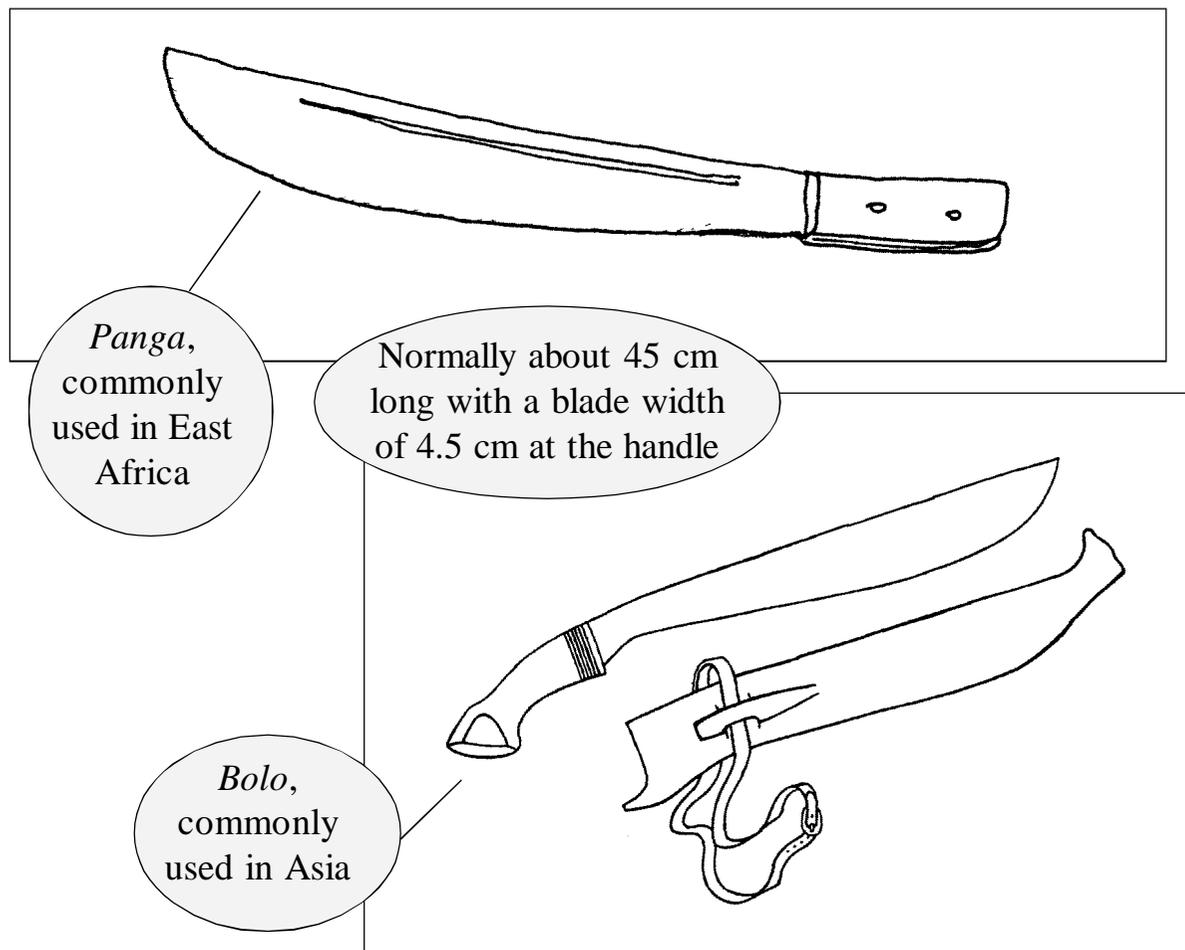
- ◆ Helping the tree fall when using a chainsaw can also be done with a felling lever.
- ◆ The following reference gives information about felling trees with a chainsaw:

FAO/ILO. 1980. Chainsaws in Tropical Forests. FAO Rome. ISBN 92-5-100932-5.

Notes:

■ FORESTRY KNIVES (MACHETES)

1 Description



MAINTENANCE

- ◆ It is important to maintain a sharp blade.
- ◆ Information on sharpening and manufacture is given in the following book:

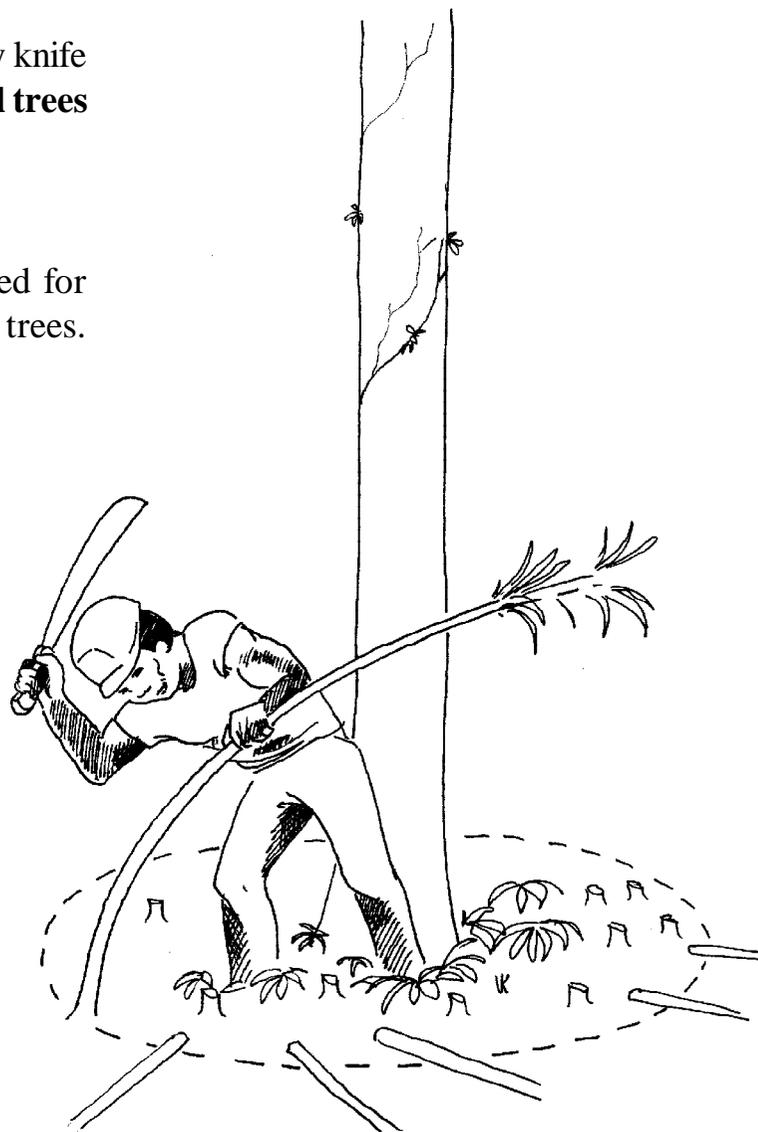
FAO. 1982. Basic Technology in Forestry Operations. FAO Rome. Pages 44-45.

Notes:

2 Using forestry knives

- The main use of the forestry knife should be for **clearing small trees and bushes**, such as when preparing to fell a tree.
- Knives are not recommended for felling or debranching large trees.
- Likewise, it is not good to use knives as a general purpose tool, such as for digging holes, since the blade will be blunted.
- When using the knife, always avoid making the blow towards the body.

Using a panga to clear a safety zone and escape route in tree felling



ERGONOMICS & SAFETY

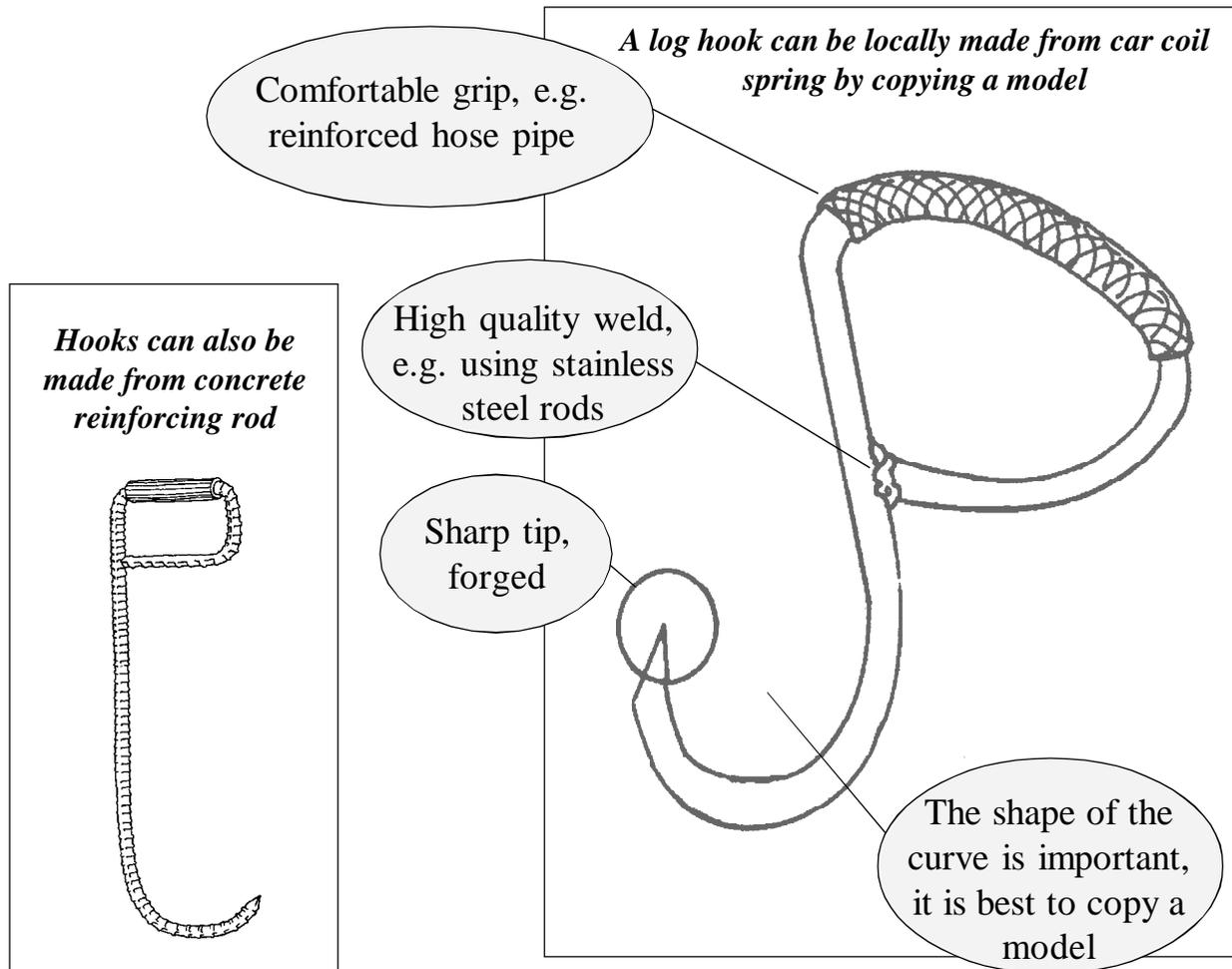
Good instructions on this can also be found in the following book:

International Labour Organisation
1992. **Fitting the Job to the Forest Worker.** ILO Geneva.

Notes:

LOG HOOKS

1 Description



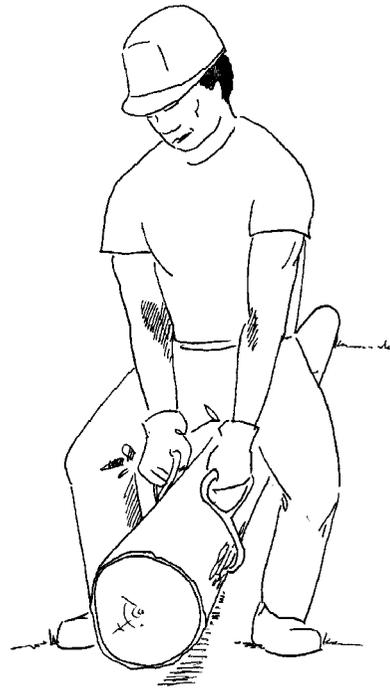
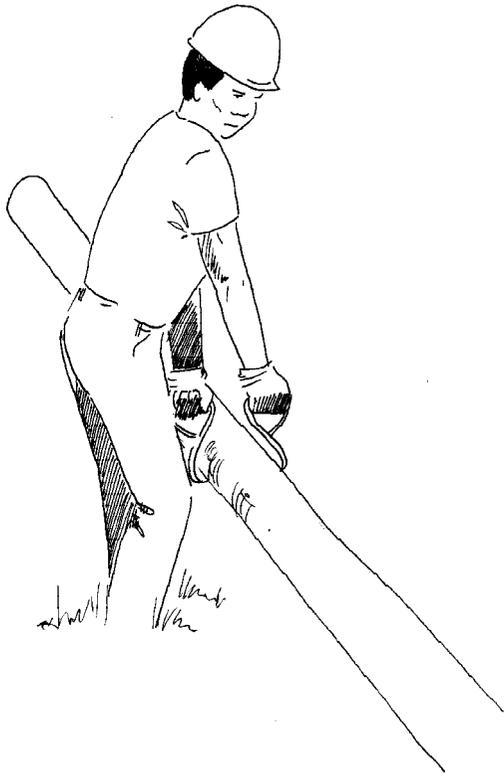
MANUFACTURE

- ◆ A good material to use for making log hooks is car coil spring.
- ◆ When making the hook it is very important to achieve the right profile (curve) for the hook . If it is wrong, such as too tight or too loose a curve, then the hook will not hold the log well enough.
- ◆ Use a model for copying the profile.
- ◆ Always hammer the hook's tip to a point (forge, grinding will give a soft and useless tip).

Notes:

2 Using the log hook (or hooks)

- Used for **rolling logs**, such as for turning the log when debranching. One log hook is sufficient for this.
- Also used for **lifting or moving** the position of logs, as shown. Two hooks are necessary here.



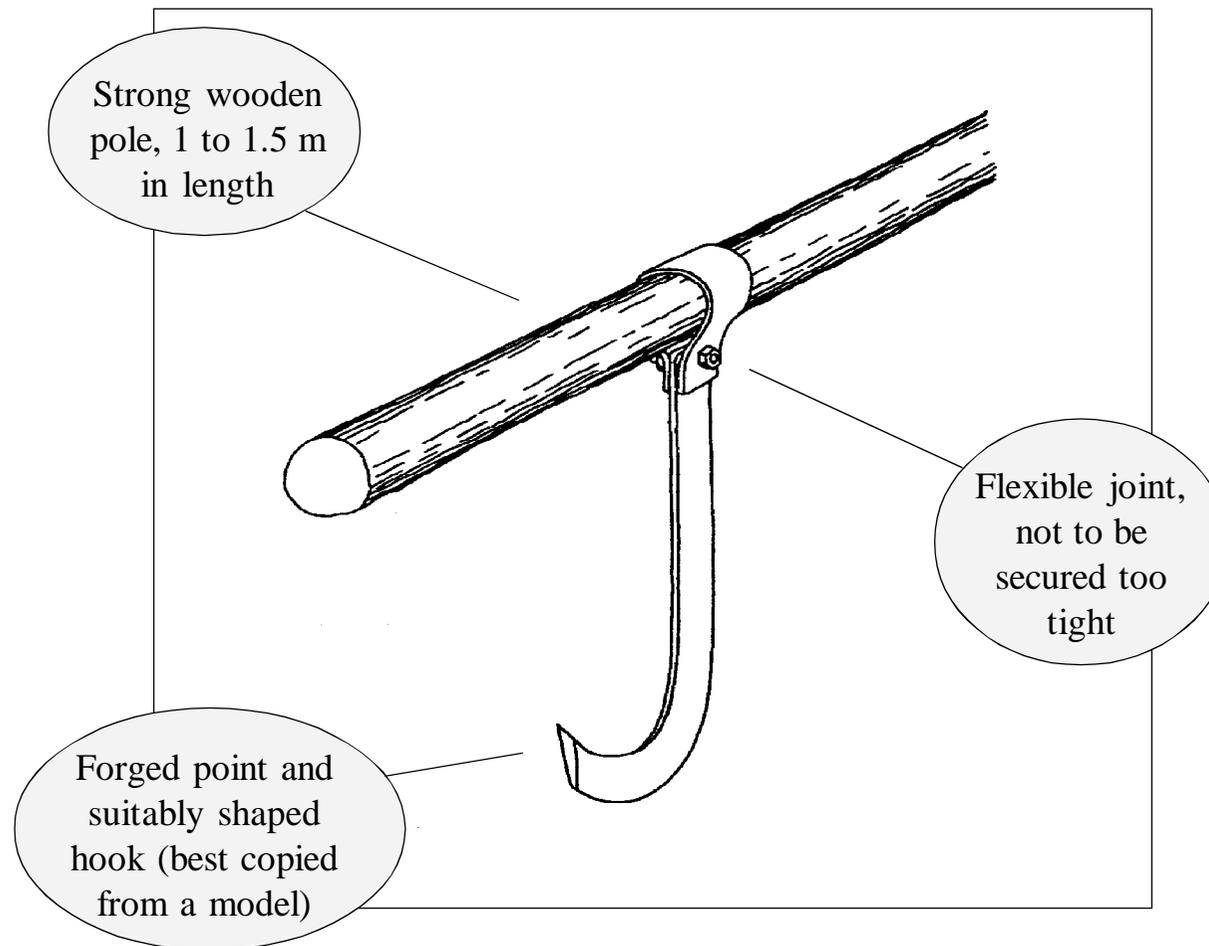
LIFT SAFELY

- ◆ **Always lift using a straight back and bending at the knees**

Notes:

CANT HOOKS

1 Description



MANUFACTURE

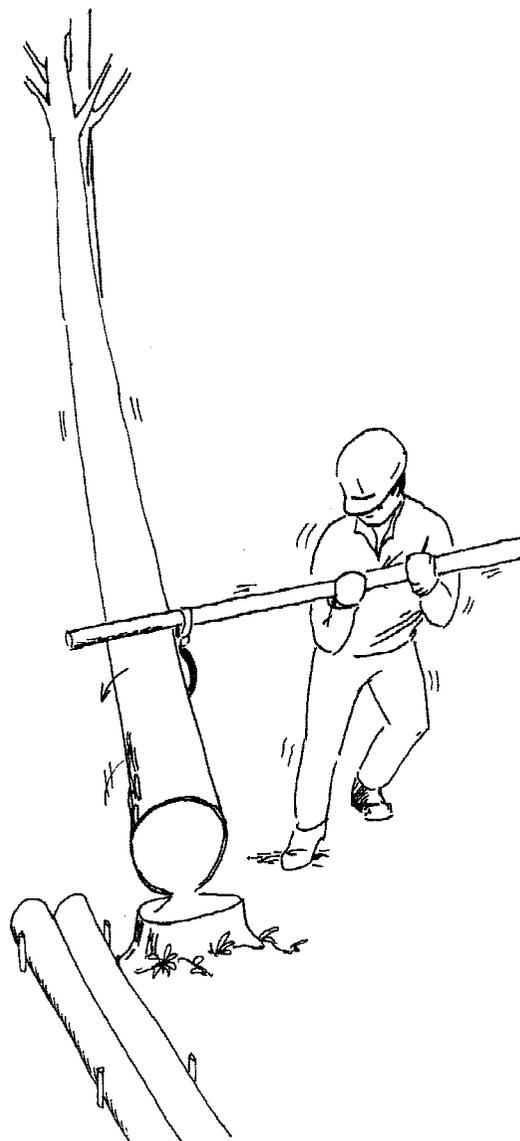
- ◆ Cant hooks of various types can be manufactured on a blacksmith's forge.
- ◆ Manufacture of various type of cant hooks and other hand tools is described in the following book:

FAO. 1989. Design Manual on Basic Wood Harvesting Technology. FAO Rome.

Notes:

2 Using the cant hook

- Used for turning or rolling logs on the ground.
- Also used for turning lodged trees (hang-ups) off the stump when attempting to take them down.
- The log is firmly gripped between the end of the pole and the hook. Powerful leverage can be obtained in this way.
- For the strong, tightening grip the hook must remain digging into the wood. This is why it is important to have the correct angle on the hook's curve and point.
- As with all physical forest work, it is essential to use the correct working posture, using the leg muscles effectively and keeping the back straight.



ERGONOMICS & SAFETY

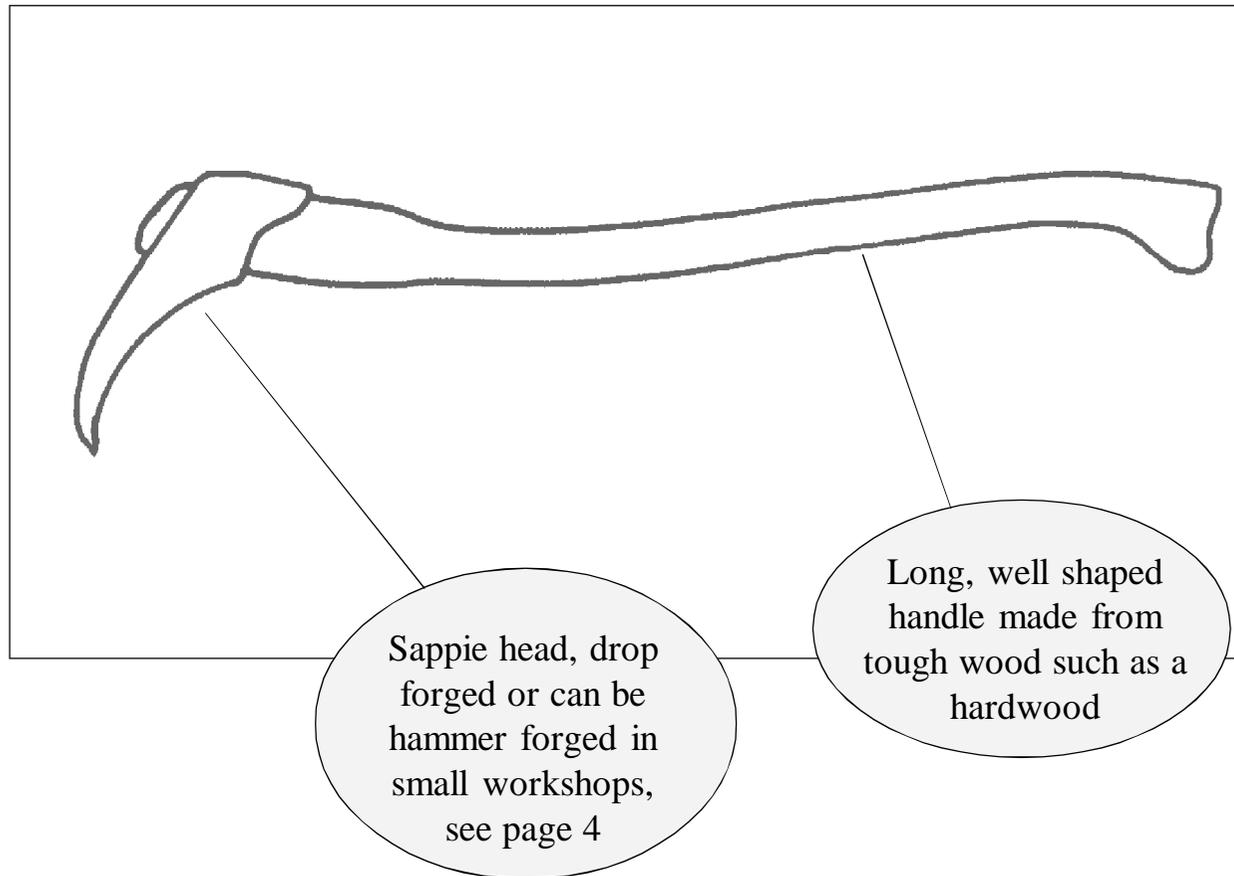
Good instructions on this can also be found in the following book:

International Labour Organisation
1992. *Fitting the Job to the Forest Worker*. ILO Geneva.

Notes:

SAPPIES

1 Description



PURCHASE AND MANUFACTURE

- ◆ Sappies can be purchased from most forestry equipment suppliers, where they may also be known as a *pickaroon* or *hookaroon*.
- ◆ Manufacturing a sappie head is possible in a small blacksmith's workshop, using vehicle leaf spring as the raw material. The process is described on page 4.

Notes:

2 Using the sappie

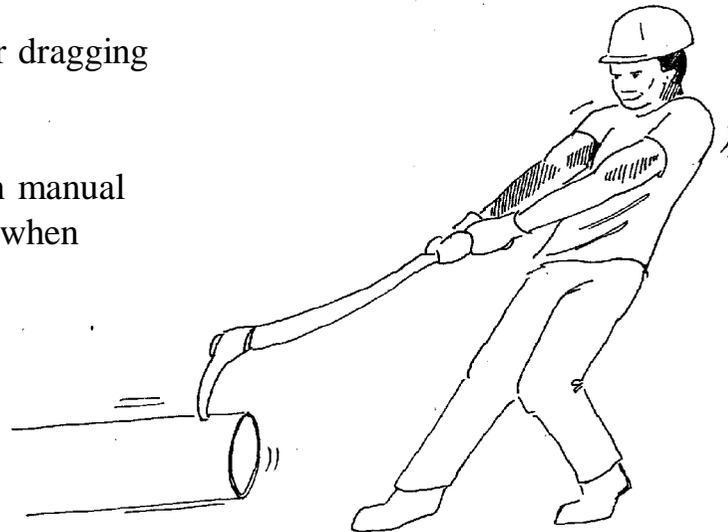
- Sappies are very useful tools for lifting and turning logs, using the sappie as a lever. The sappie has a long handle to give a good effect as a lever.
- This is useful for manouvering logs on the logging site, turning them into position for skidding, clearing them when caught on obstacles and so on.



LEVERING TECHNIQUE

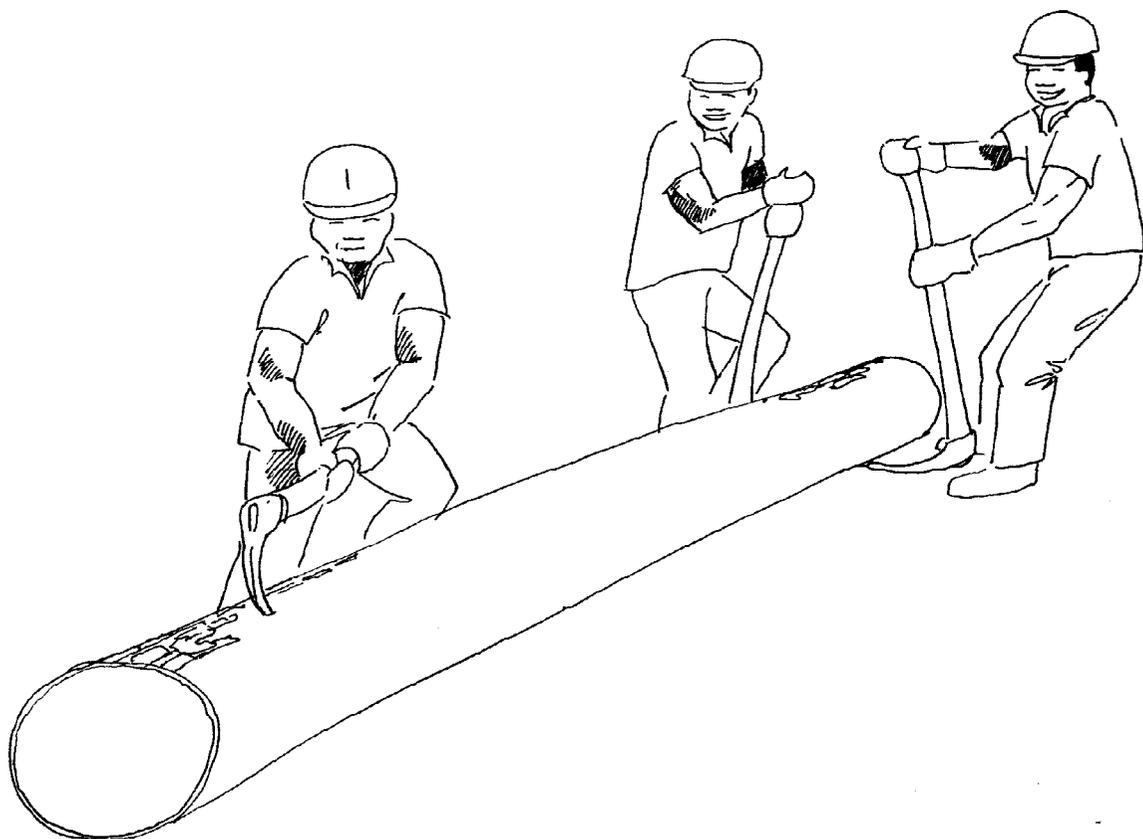
- ◆ **Make sure that workers who normally use ordinary poles for moving logs do not use the sappie in the same way. The oval shape handle will break very quickly.**
- ◆ **Technique is important with the sappie. When used properly it is more effective and safer for the worker than a simple pole.**

- Sappies can also be used for dragging logs.
- This is particularly useful in manual loading operations, such as when pulling the load fully up onto the trailer.



Notes:

- For moving logs over short distances several workers with sappies is very effective, particularly compared to using ordinary wooden poles.



ERGONOMICS & SAFETY

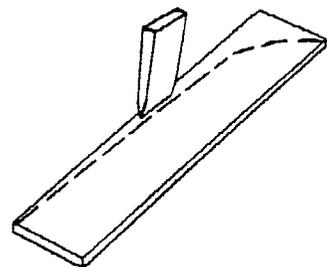
Good instructions on this can also be found in the following book:

International Labour Organisation
1992. *Fitting the Job to the Forest Worker*. ILO Geneva.

Notes:

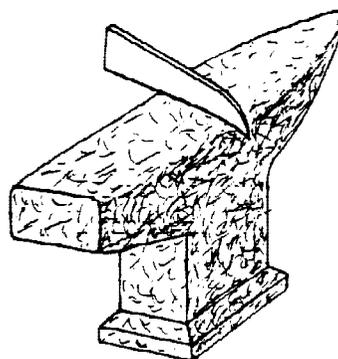
3 Making a sappie head on a blacksmith's forge

① Heat the iron to an orange colour in the forge and cut to shape using a hammer and cutting wedge

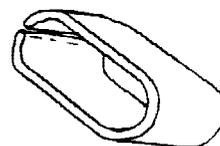


② Hammer a sharp point

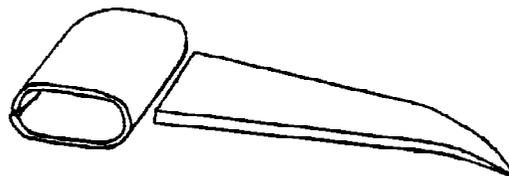
③ Hammer the end to a hook shape



④ Forge a ring from a second piece of leaf spring



⑤ When both pieces are cold, weld the blade section to the ring



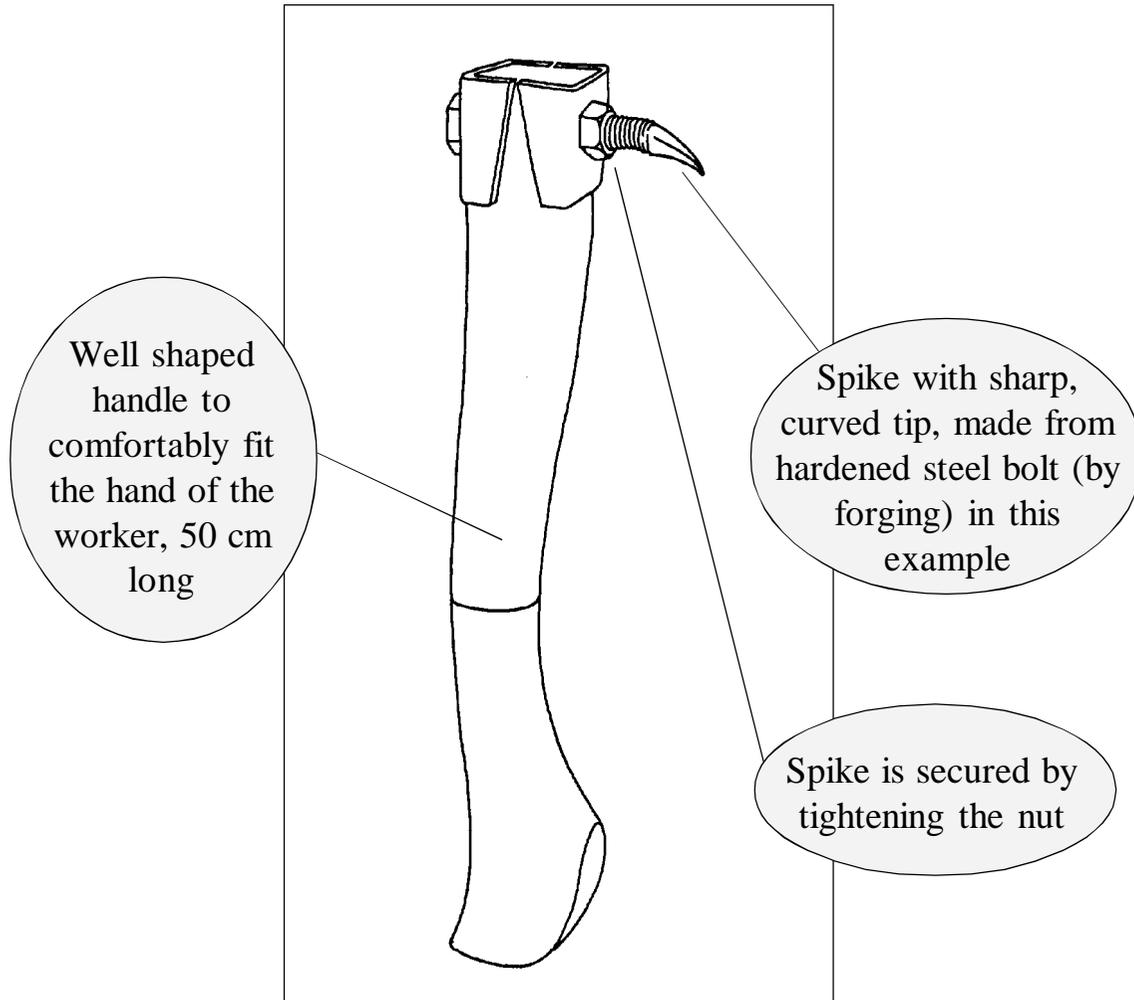
FORGED SAPPIE FROM OLD LEAF SPRING

- ◆ Two sections of used leaf spring can be used to make a sappie head
- ◆ Use leaf spring about 10 mm thick (e.g. Land Rover) and two pieces about 30 cm long
- ◆ When welding the two pieces together, be sure to use high quality welding, such as stainless steel rods if arc welding
- ◆ Fit a tough hardwood handle to the sappie

Notes:

LOG PICKS

1 Description



MANUFACTURE

- ◆ The most important factor when making the log pick is not to use a grinder or file to make the point on the spike
- ◆ Forging is the only way to make it hard and tough enough

Notes:

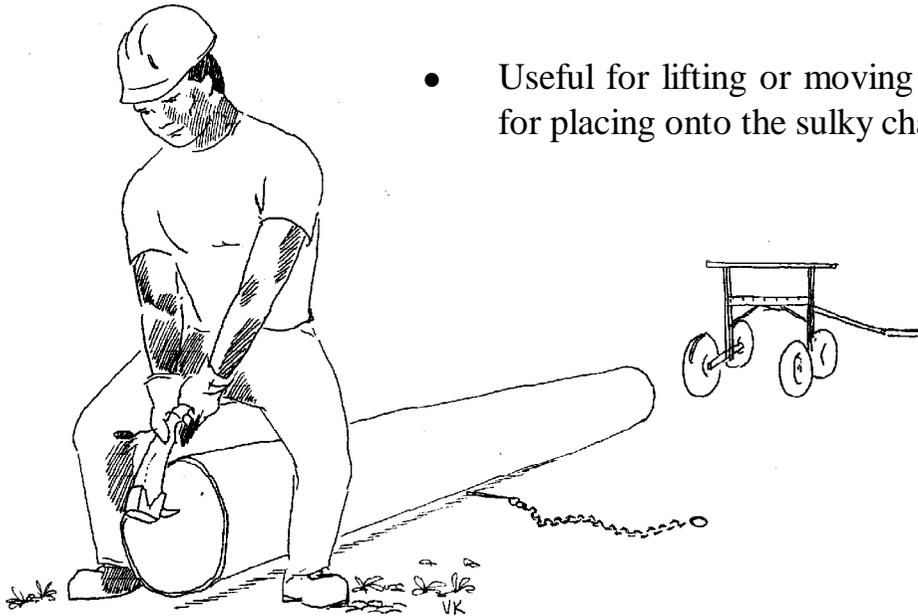
2 Uses of the log pick

- Useful for picking up and handling small pieces of wood, such as fuelwood billets.



Picture: ILO

- Useful for lifting or moving larger logs, such as for placing onto the sulky chain, as shown below.



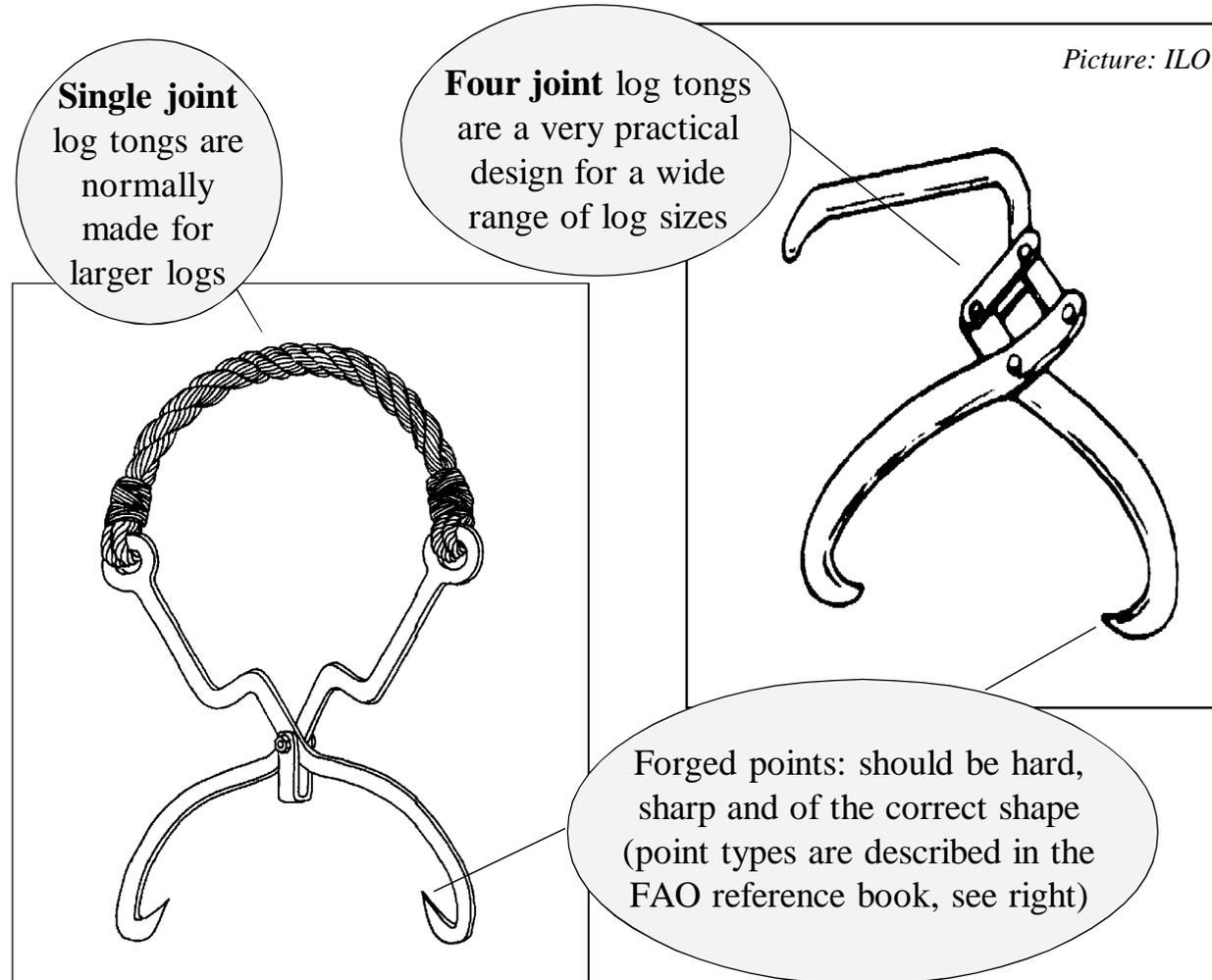
SAFE LIFTING

- ◆ **Keep a straight back and bend at the knees, particularly with heavy loads such as the log shown in the diagram**

Notes:

LOG TONGS

1 Description



MANUFACTURE

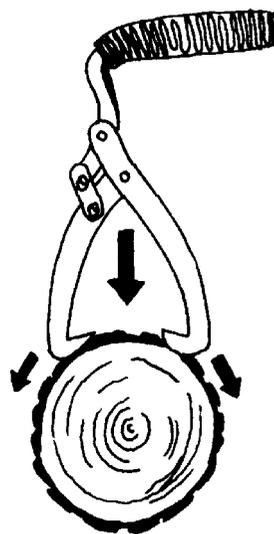
- ◆ Log tongs can be manufactured in good local workshops, preferably by obtaining a model to copy.
- ◆ Joints in the tongs should not be too tight. If so, the tongs will not release logs easily enough.
- ◆ Manufacture of various type of log tongs and other hand tools is described in the following book:

FAO. 1989. Design Manual on Basic Wood Harvesting Technology. FAO Rome.

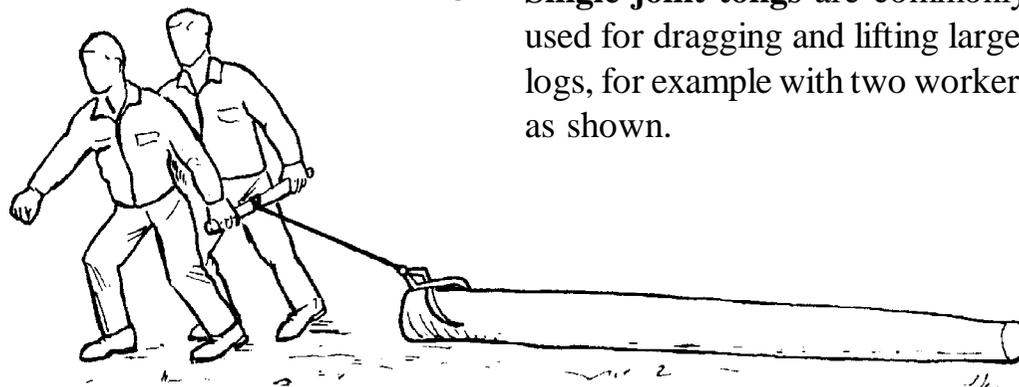
Notes:

2 Using log tongs

- **Four joint tongs** are normally made as shown, as a one person tool. For lifting, turning or moving logs over short distances.
- The arms open when pressed against the log. When the log is lifted the points penetrate the wood and tighten the grip.
- The tongs are released by pushing them down and twisting sideways.



Picture: ILO



- **Single joint tongs** are commonly used for dragging and lifting larger logs, for example with two workers as shown.

ERGONOMICS & SAFETY

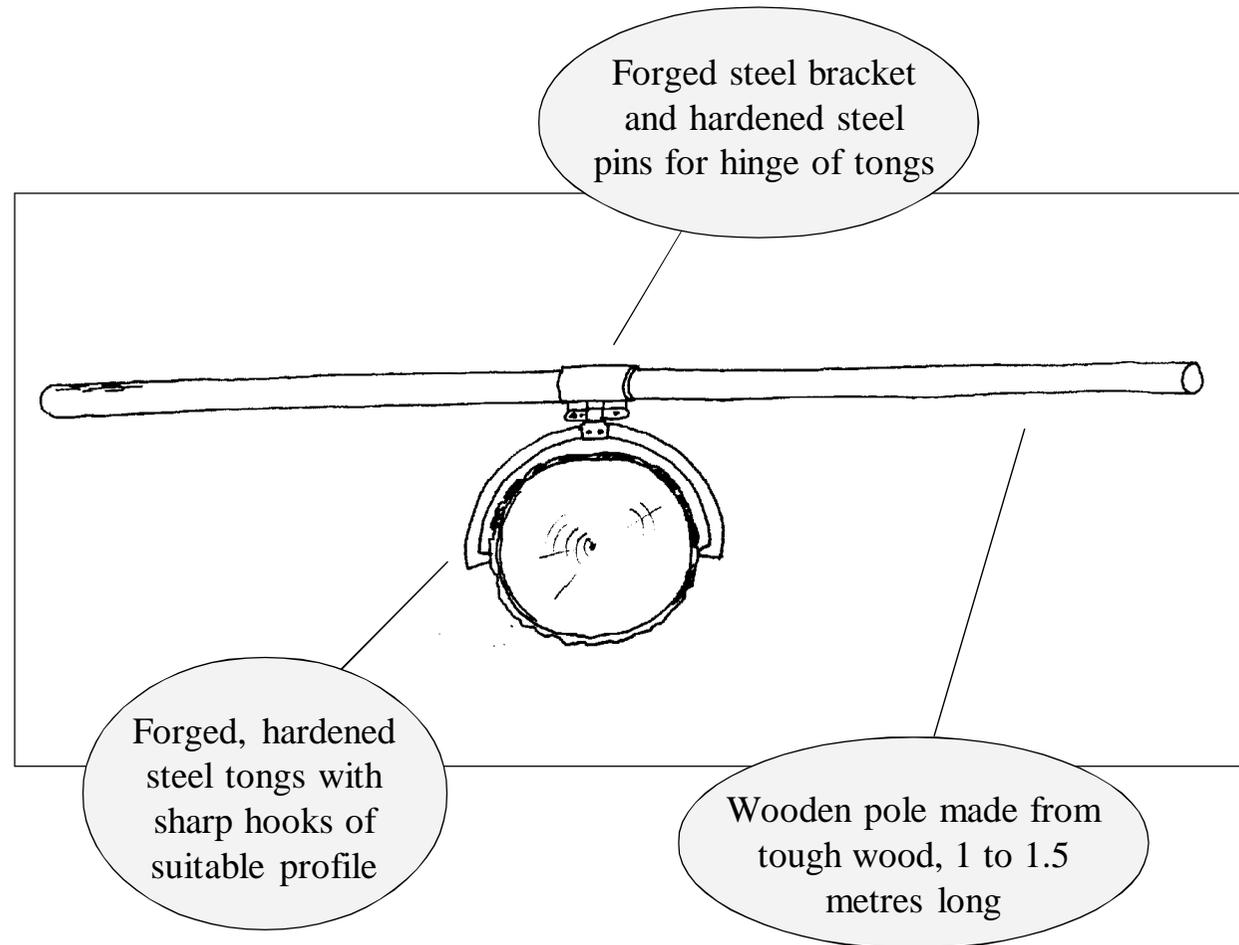
Good instructions on this can also be found in the following book:

International Labour Organisation
1992. *Fitting the Job to the Forest Worker*. ILO Geneva.

Notes:

POLE TONGS

1 Description



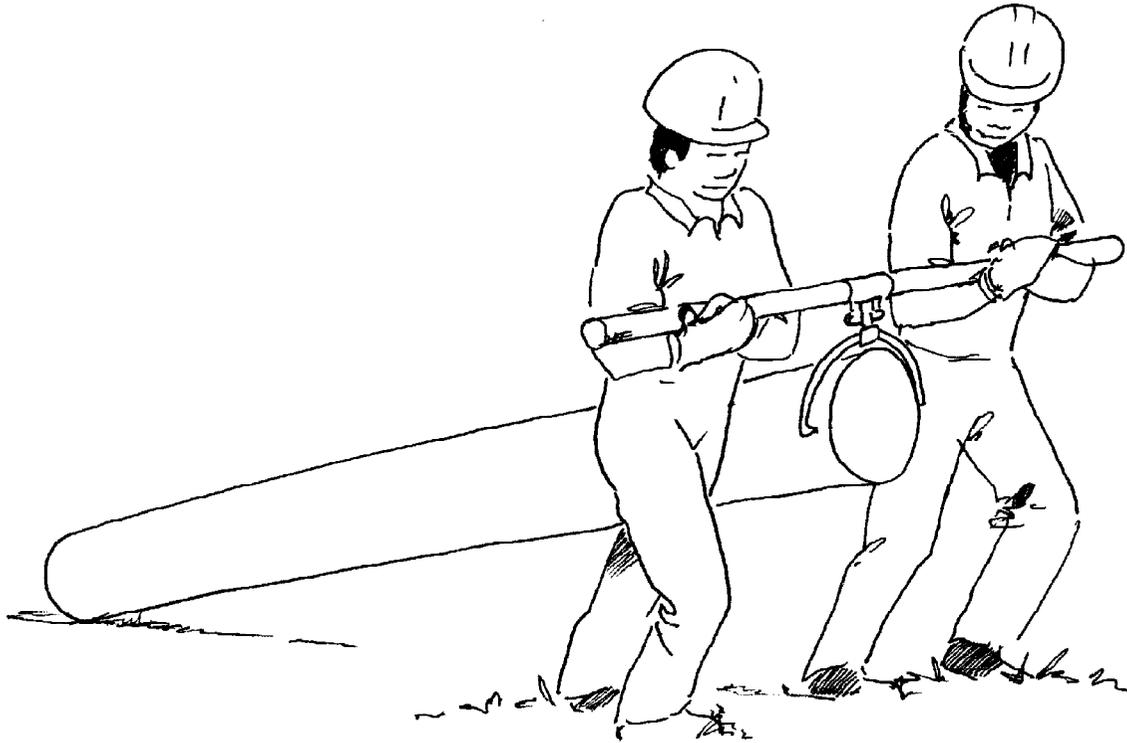
MANUFACTURE

- ◆ Pole tongs can be manufactured on a blacksmith's forge.
- ◆ To get the joint mechanism and the shape of the hooks correct it is better to obtain a model to copy.

Notes:

2 Using the pole tongs

- Used as shown by two workers to skid logs manually.
- Logs can also be lifted completely off the ground by using more than one pair of pole tongs/workers.



LIFT SAFELY

- ◆ **Be sure to bend the knees and lift with a straight back, making good use of the leg muscles.**
- ◆ **Good instructions on ergonomics and safety can be found in the book:**

International Labour Organisation
1992. Fitting the Job to the Forest Worker. ILO Geneva.

Notes: