

Appropriate Forest Harvesting Technologies

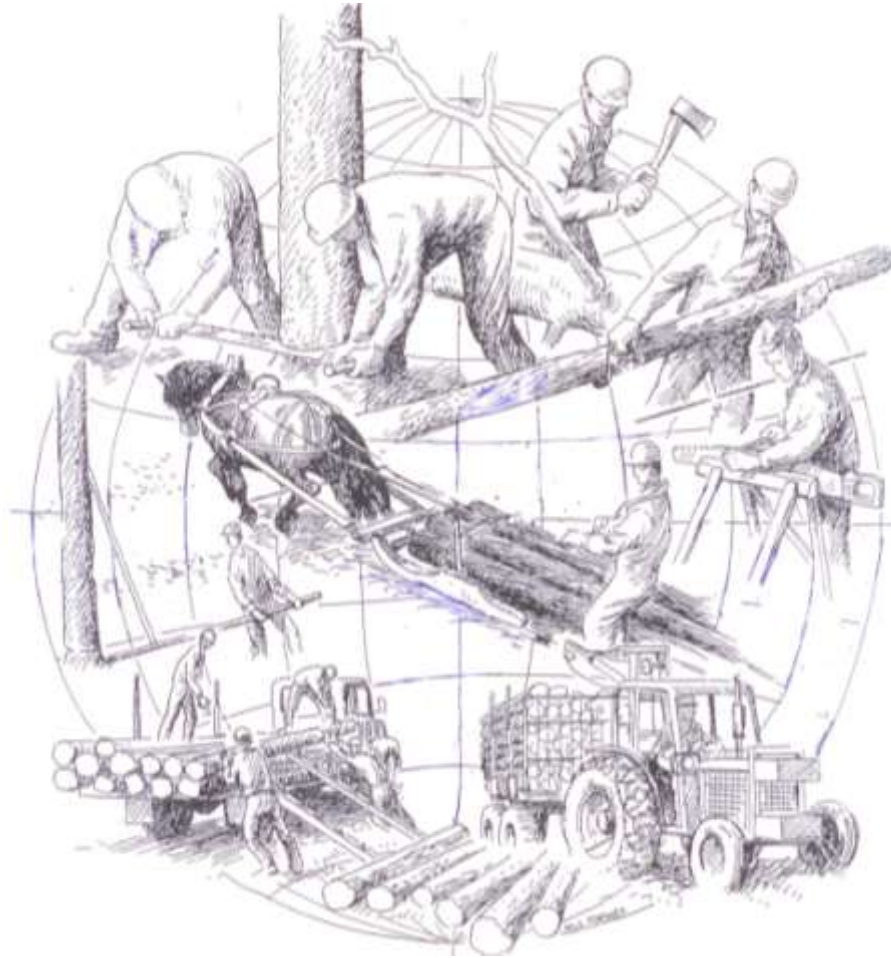


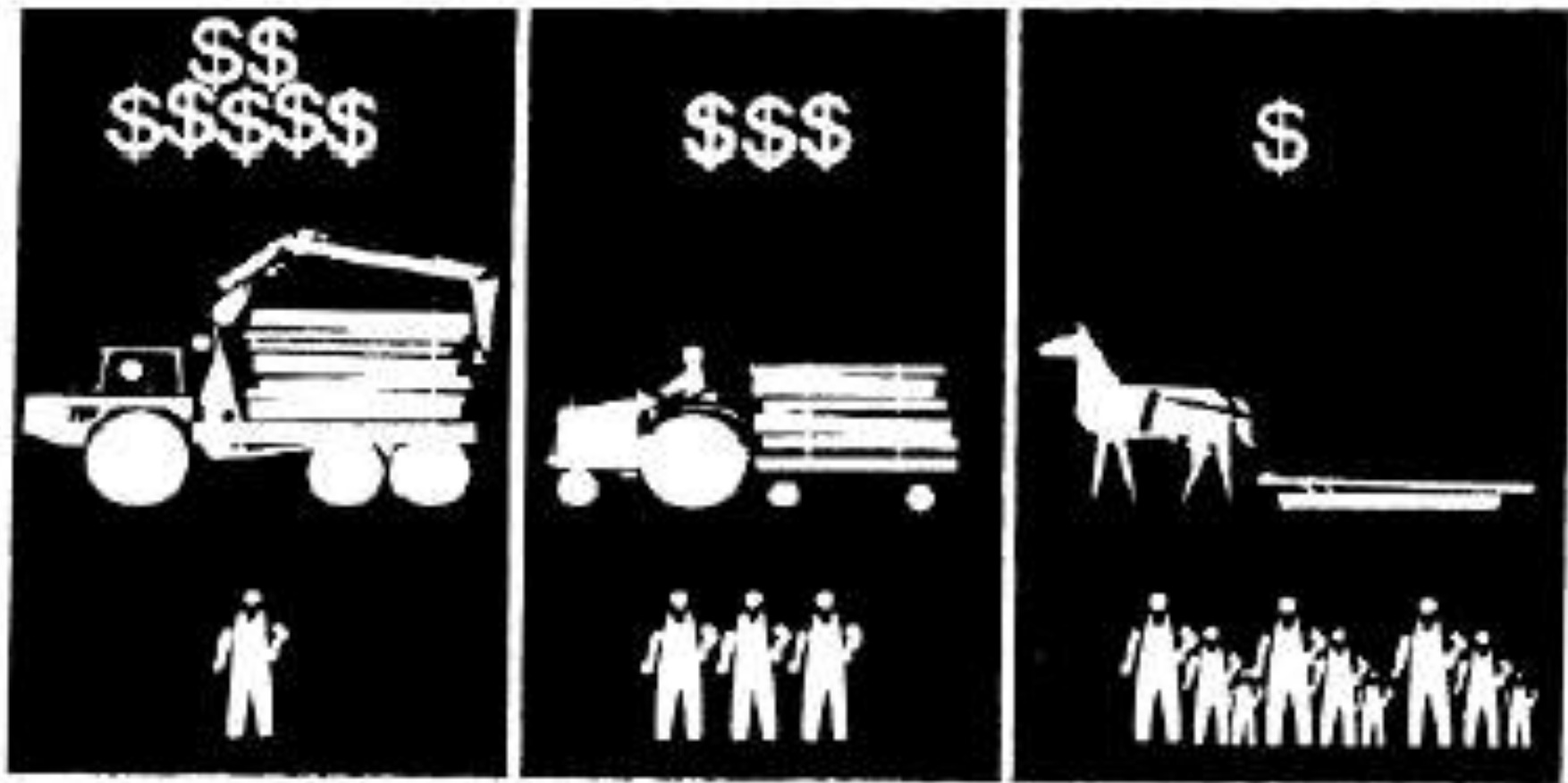
Image source: Skogsarbeten

Why focus on forest harvesting?

Movie

- In forest production starting from nursery seedling stage to harvested logs at a road side landing **50 to 60 % of the costs** are incurred in forest harvesting
- If the primary producer (communities and smallholders) sell standing trees and are not involved in this they lose out on half of the potential income
- If they engage in (mobile) sawmilling they can further **double their income**
- In other words : without engaging in forest harvesting there are only limited effects on livelihood improvements

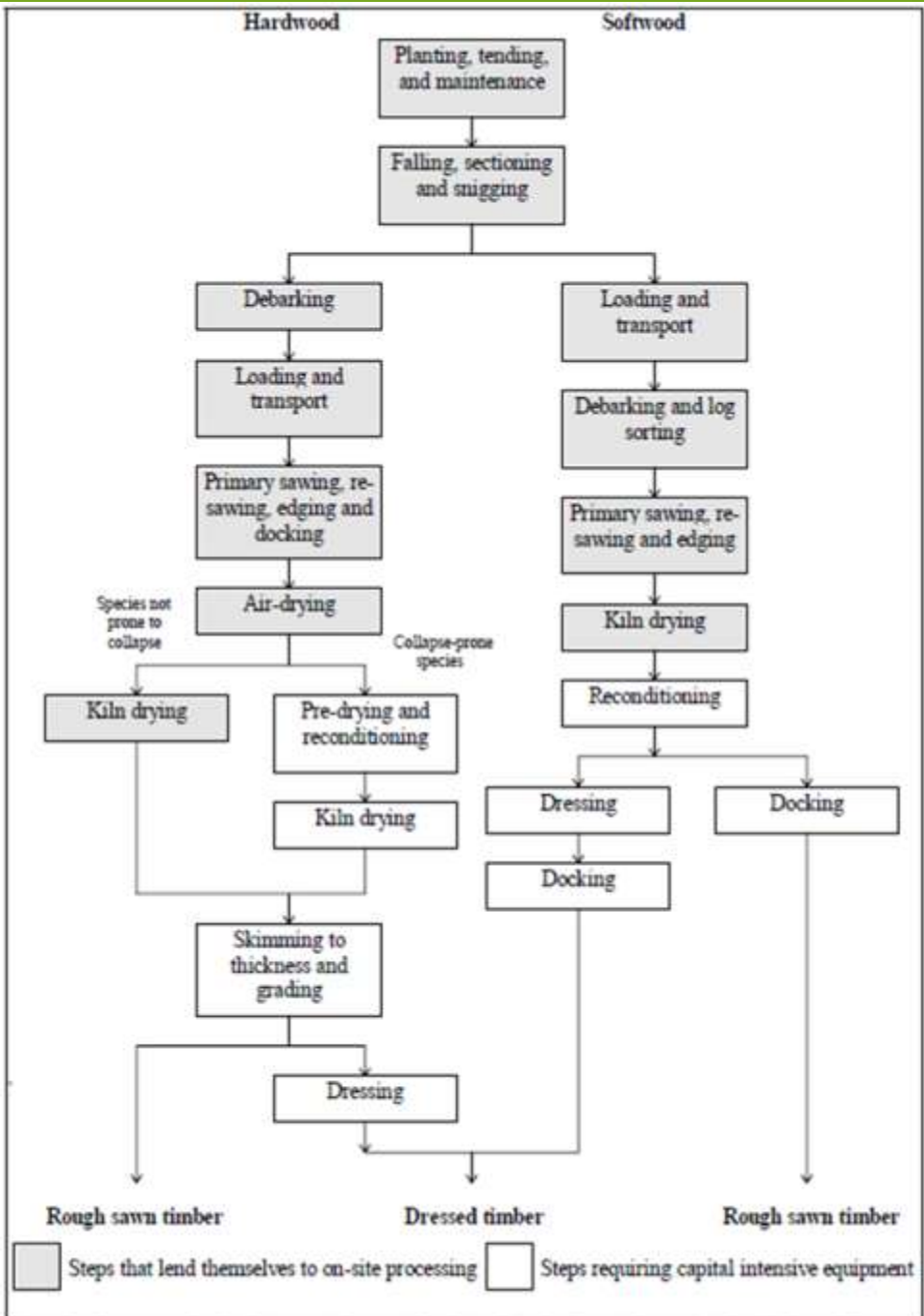
Balance between manual labour and technology



From FAO 1987



Processing stages of timber



From: Processing trees on Farms , RIRDC 1997

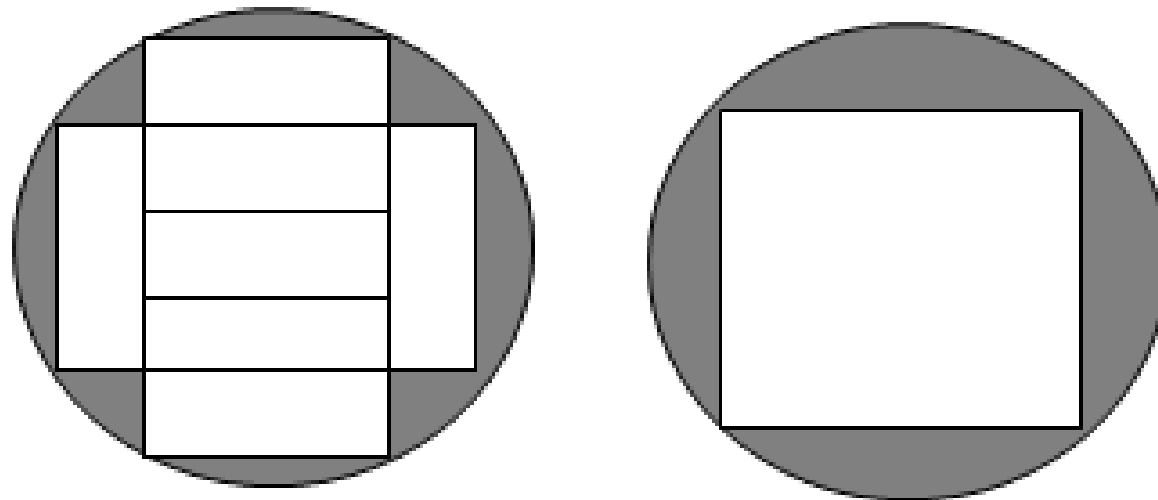


Figure 8: Steps involved in the manufacture of hardwood and softwood sawn timber (Adapted from Thurlow, 1988).

Definitions

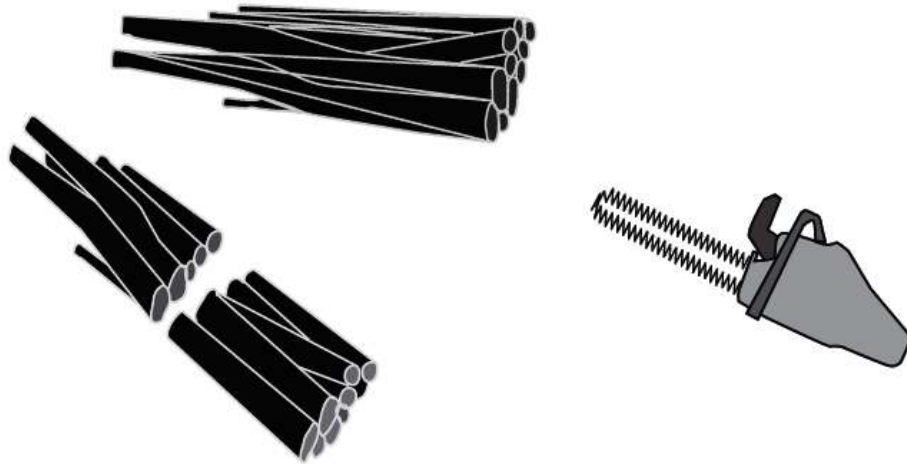
- Extraction routes
- Landings
- Cost categories
- Others

Issue : Conversion/Recovery rates



Need to understand conversion rates along value/processing chains in order to avoid misunderstandings, in many cases totally overlooked

Chainsaw



Investment:

Typically between 500 and 1200 \$ US for quality brands

Cost per hour or day:

1 to 3 \$ US /hr depending on fuel consumption

Performance:

For log production there is a wide range from 5 to 30 m³/day

Fundamental technology in harvesting since about 1950 . In most cases investments in chainsaws pay off quite well if harvesting levels for logs exceed 5 to 10 m³/day

Perceptions on chainsaws????



Hand tool - Log Carrier



Investment:

below 100 \$ if manufactured locally

Cost per hour or day:

below 0.5 \$US /day

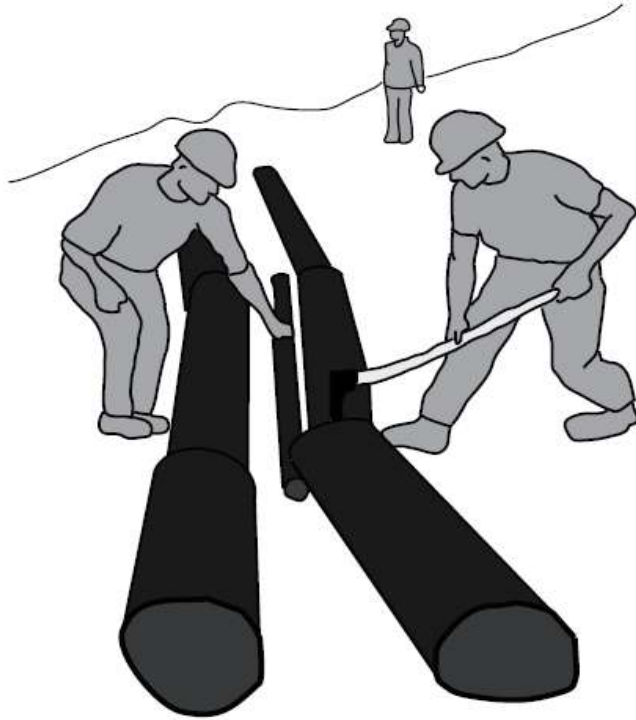
Performance:

1 to 2 m³ /hr over distances up to 100 to 200 m

Maximum loads around 100 kg/ 2 persons

Ergonomically sound tool for short distance logging in flat and downhill situations, however little performance improvement over traditional methods

Manual Downhill Drifting



Investment:

Only sappers , hooks and other hand tools

Cost per hour or day:

Practically no machine costs

Performance:

Around 1 to 2 m³/pers /hr at distances of up to 200 m

Optimal slopes between 35 to 65 %, the system requires considerable training particularly on safety measures

Logging Sulky/Arch



Investment:

Around 400 \$ US if bought from international suppliers, if locally manufactured around 200 to 300 \$ US

Cost per hour or day:

Below 1\$ US /day

Performance:

1 to 2 m³/hr over distances up to 300m

Extremely useful and appropriate tool for short distance logging in flat and downhill situations

Local Horses/Mules



Investment:

For trained mules 1000 to 1500 \$ (4 yrs) , productive lifetime over 30 years. For horses the prices are slightly lower

Cost per hour or day:

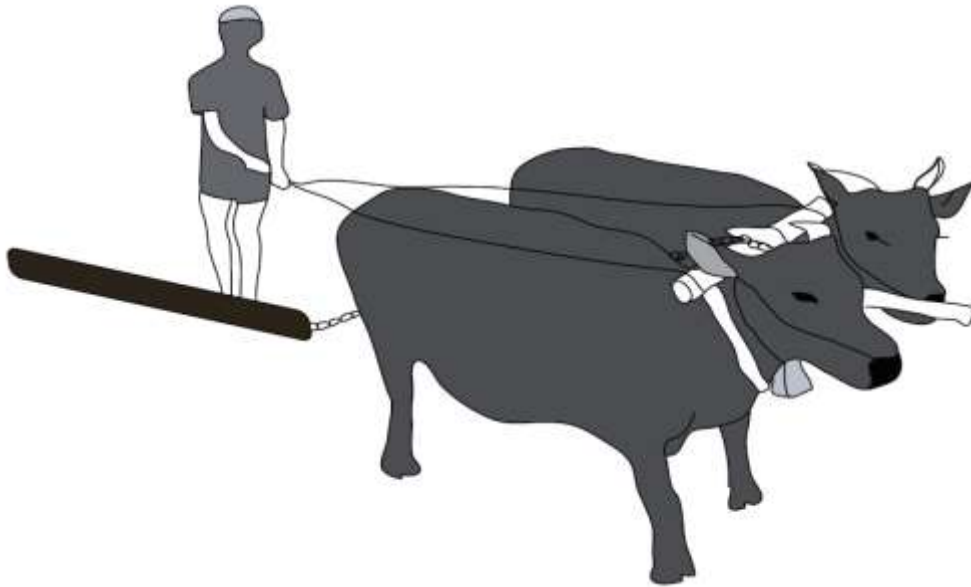
Around 5 to 8 \$ US /day (Greece) , figures for SEA are not available

Performance:

Typically 1 to 2 m³/hr over 200 to 300 m

Horses and mules are superior in performance in downhill extraction. Due to limited work outside forestry, costs may be considerably higher than oxen or buffaloes . Only mules are suitable for hot climates

Oxen/Buffaloes



Investment:

Typically below 500 \$ US per animal incl. training

Cost per hour or day:

Below 2 \$ US since work only part time in forestry , bulk of work in agriculture

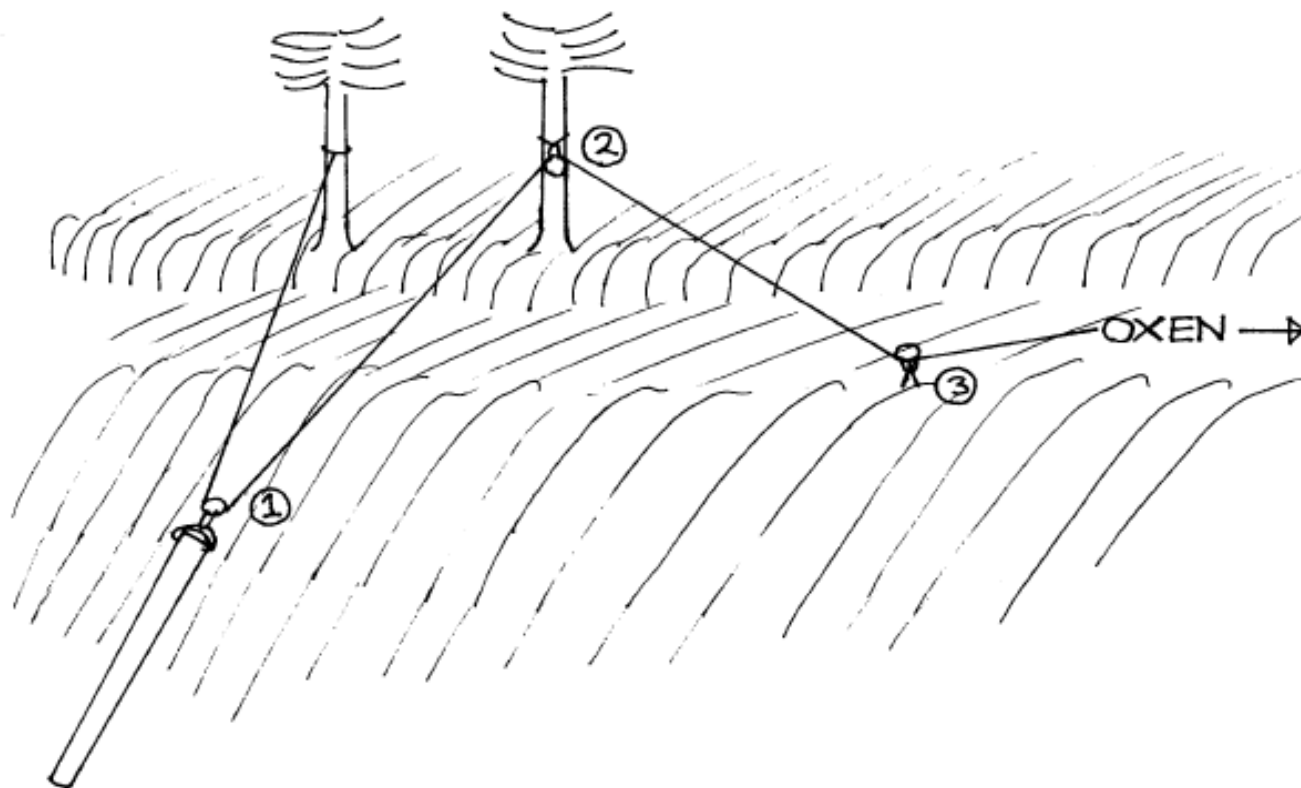
Performance:

Similar to horses/mules

Typically 1 to 2 m³/hr over 200 to 300 m

Oxen's pulling force is generally lower than horses or mules, but they can be trained in skidding logs: training should begin for oxen around 3 years old. The average working life of oxen is 10-12 years. (FAO, 1982)

Up-hill logging with animals on steep slopes



An uphill oxen powered cable logging such as this requires:

- *3 heavy-duty pulleys (20-25 cm diameter)*
- *at least 150 metres of 8 mm cable (wire rope)*

From: APPRODEV, Oxen Logging forest harvesting series, 1993

Tractors with power take off winches



Investment:

Costs for tractor between 8000\$ US (15Kw) and 25000\$US (50 KW) , wiches from 800 to 2000 \$ US

Cost per hour or day:

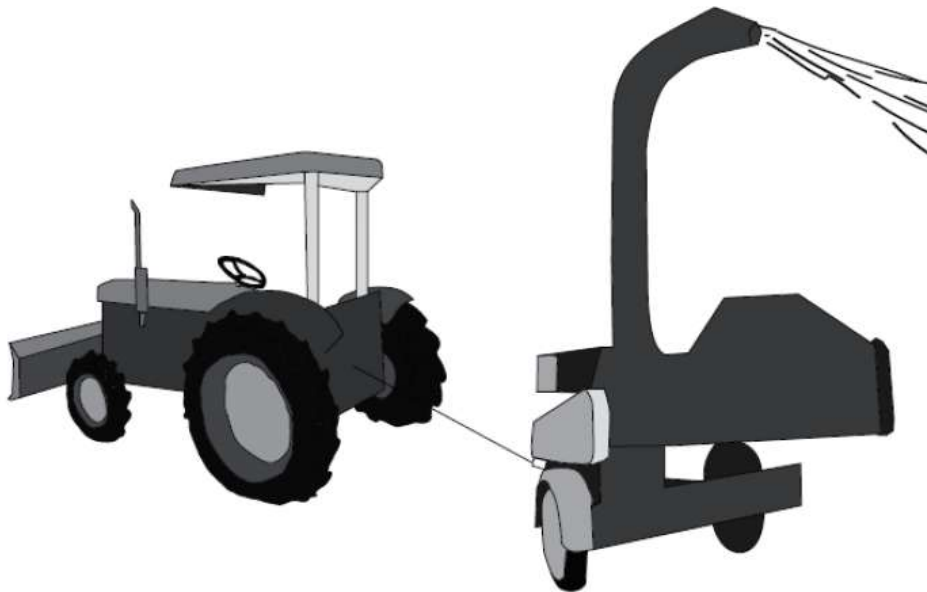
10 to 20 \$US/hr

Performance:

3 to 5 m³/hr

Backbone of small scale forestry in developed countries. Maximum skidding distance for winch 200 m up and down hill forwarding distance up to several km

Tractors with power take off mounted shredder



Investment:

Tractor 8000 to 25 \$ US

Shredder 4000 to 8000 \$US

Machine cost per hour or day:

10to 20 \$US/hr

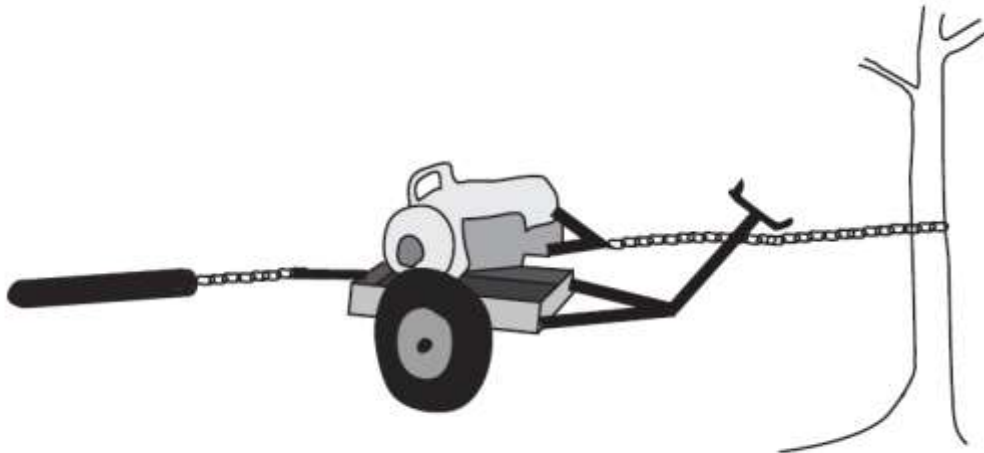
Performance:

10 to 30m/hr for smaller systems

Costs 7 to 8 \$US/m³

Probably the only possible system to produce chips at local level , overcomes the problem of road transport of bulky material (branches, bamboo)

Mobile Self-propelled Winch



Investment:

Between 1000 \$ (locally built)
and 3000 \$ for brand products

Cost per hour or day:

3 to 5 \$US /hr

Performance:

1 to 5 m/hr under distances of
up to 100 m

Can be highly efficient over short distances (below 100 m)

Self-Propelled Hand Operated Mini Skidder (Iron Horse)



Investment:

10000 to 15000 \$US
JONSEREDS Iron Horse
6000 for HONDA HP 500

Cost per hour or day:

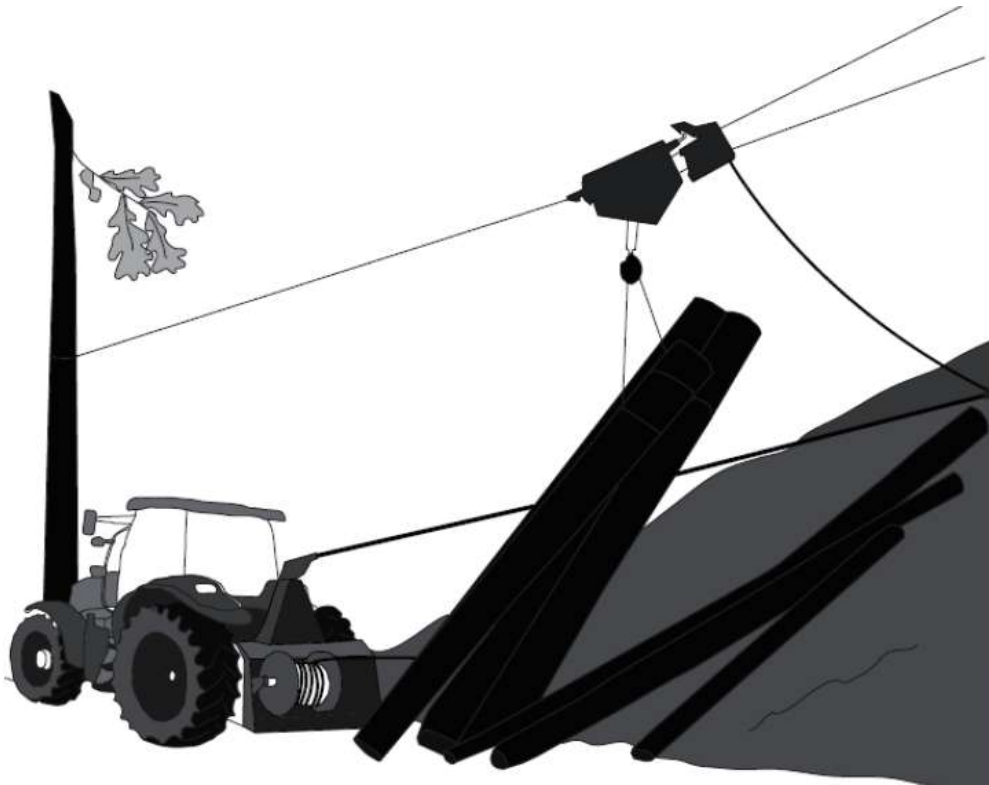
5 to 8 \$US/hr

Performance:

2 to 5 m³/hr up to 300 m down
and uphill distances of over 1
km possible

In many situations a good alternative to animal logging , highly cost effective, needs specialized technical backup service Technical feasibility to combine engine from 2 wheel tractors should be explored under local situations

Mini-Cable Logging System



Investment:

Tractor 8000 to 25000 \$US

Cable logging system: 6000 to 8000 \$US

Cost per hour or day:

10 to 20 \$US/hr

Performance:

2 to 5 m³/hr over distances up to 300 m

Only possible way for uphill logging in steep terrain, high mountain conditions

Manual Loading

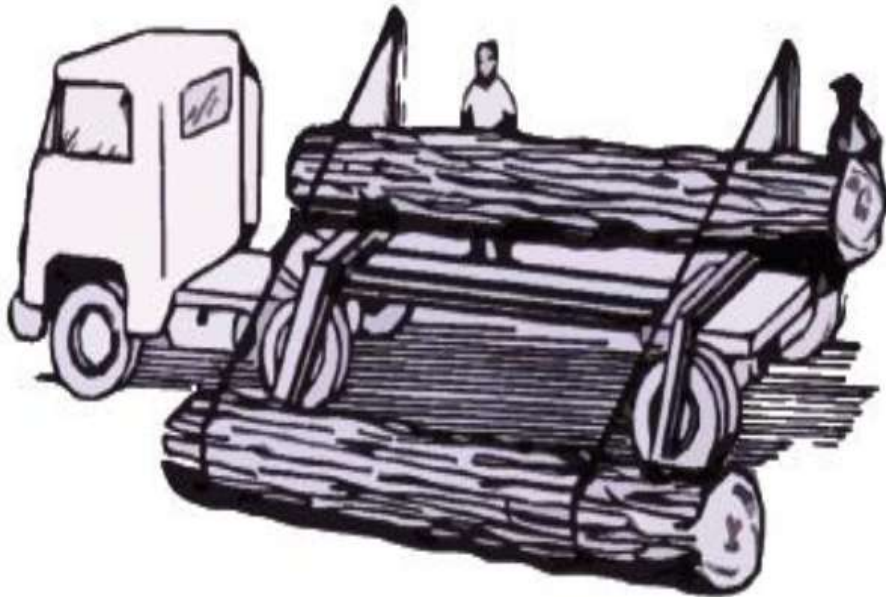


Image adapted from FAO Forestry Paper, "Basic technology in forest operations." (1982)

Investment:

Hand tools , pulleys ropes
chains , typically below 300 to
500 \$US

Cost per hour or day:

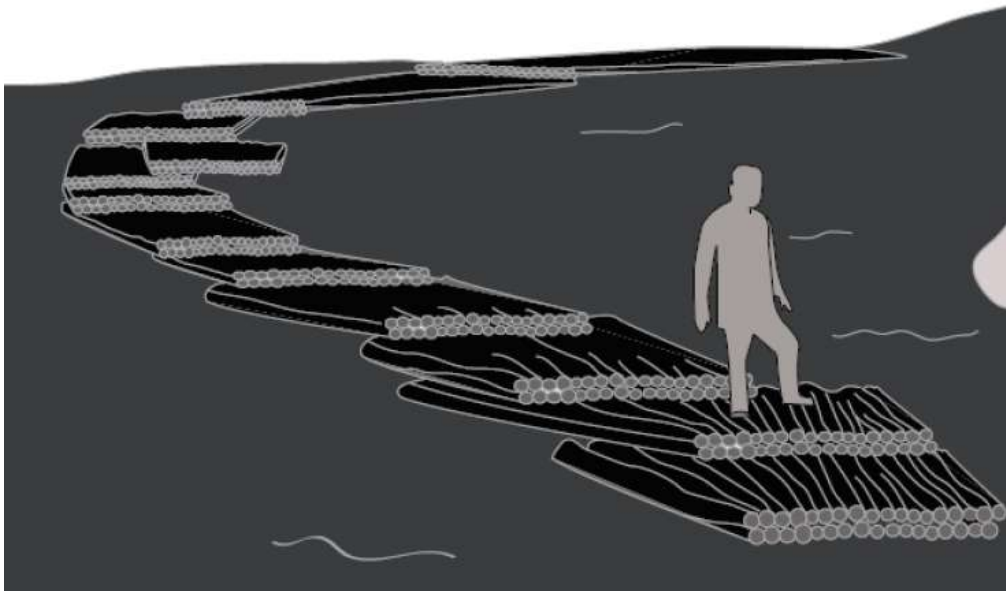
Below 1 \$US/day

Performance:

Highly variable, up to 20
m³/pers/day

Many designs and methods available , basically an alternative to loading cranes
Very often overlooked in VC analysis as a cost factor and additional income
opportunity

River Rafting



Investment:

Only hand tools and ropes in some cases outboard motors for rafting in lakes

Cost per hour or day:

Basically only labour costs

Outboard motors 5 to 8\$US/hr

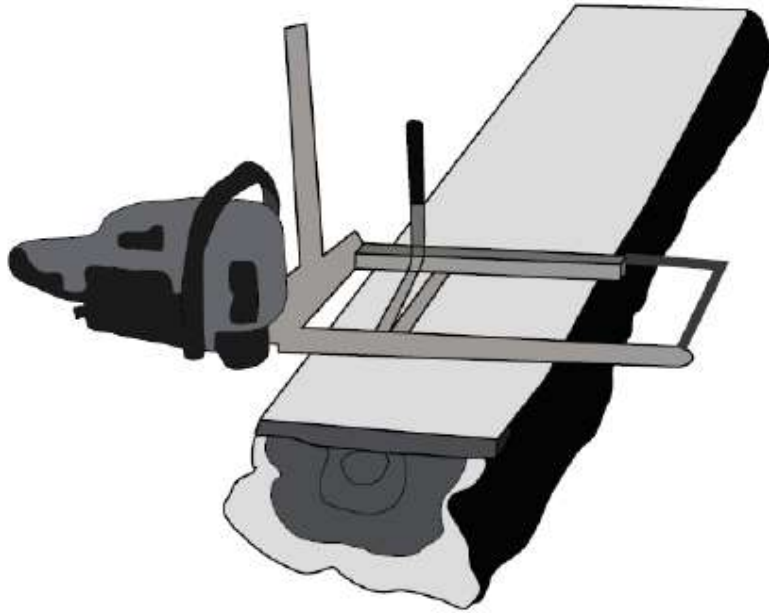
Performance:

4 to 6 t or m³/pers/day over up to 50 km

With outboard motors higher performance on lakes

Plays regionally great role in supply of timber and bamboo (Vietnam, India)
great potential in all tributaries of the Mekong river

Chainsaw Milling



Investment:

Chainsaw 800 to 1500 \$US

Attachment 200 to 2000 \$US
depending on principle design
type

Cost per hour or day:

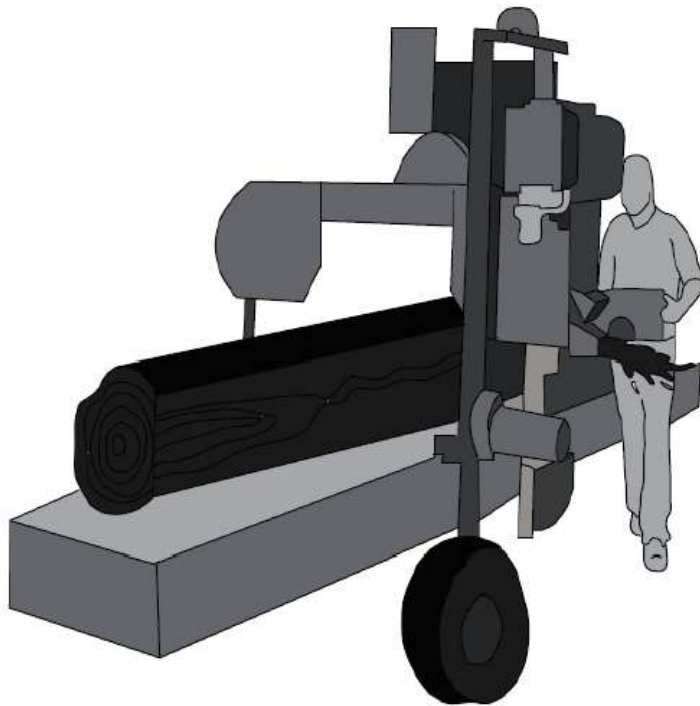
1 to 3 \$US/hr

Performance:

1 to 3 m³/hr in log squaring
below 1 m³/hr in cutting of
boards

Option for on-site processing at felling point, allows utilization of larger sized trees which may otherwise not be used

Mobile Sawmilling



Investment:

Between 4000 and 15000
\$US

Cost per hour or day:

8 to 15 \$/hr (in most cases
cheaper if electrical power
supply)

Performance:

Highly variable depending on
final product

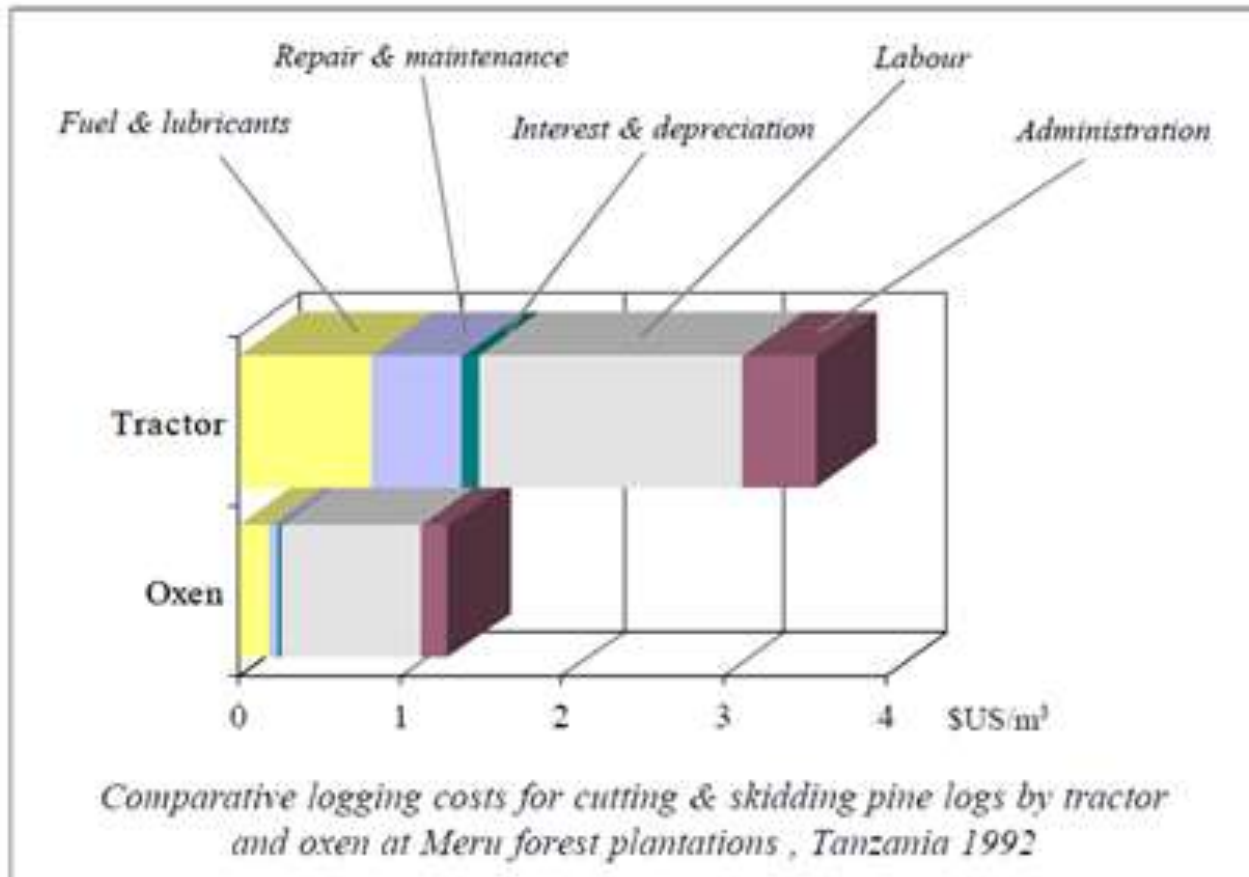
Between 5 and 15 m³/day

Increasing importance all over the world in some regions strong competition to stationary sawmilling in the smallholder CF context. Enables saving on road transport of up to 50 %

Mobile Sawmilling







Comparative logging costs



From APPRODEV Oxen Logging harvesting series 1993

Combination of systems in relation to task and location

Location \ Task	Felling site	Skidding trail	Road \ River	Primary Processing site
Felling				
	\$/m3?	\$/m3	\$/m3?	\$/m3?
Skidding				
	\$/m3?	\$/m3?		
Transport				
	\$/m3?	\$/m3	\$/m3?	\$/m3?
Primary processing				
	\$/m3?	\$/m3	\$/m3?	\$/m3?
Total				

Thank you!