



# Cable and Aerial Logging

- Cable yarding
- Balloon yarding
- Helicopter logging



# Cable Yarding

- Was first used in 1881 for logging redwoods in California
  - stationary steam powered drum
  - manila rope as the cable
- Wire rope was introduced in 1883



# Cable Yarding in the Eastern U.S.

- Cable systems were employed extensively in the east up until the 1920-30's.
- Have been rediscovering and applying to limit environmental damages to:
  - sensitive sites and
  - areas where ground-based systems are marginally operable.



# Cable Yarding Systems

- Are unique and differ from skidding and forwarding because of:
  - a stationary power source (yarder)
  - a system of flexible steel cables
- Compared to ground-based systems, cable yarding systems:
  - reduce site damage
  - extend economical yarding distance
  - have higher operating costs
  - are more difficult to move and set-up
  - are only economically feasible when slopes exceed 35-40%



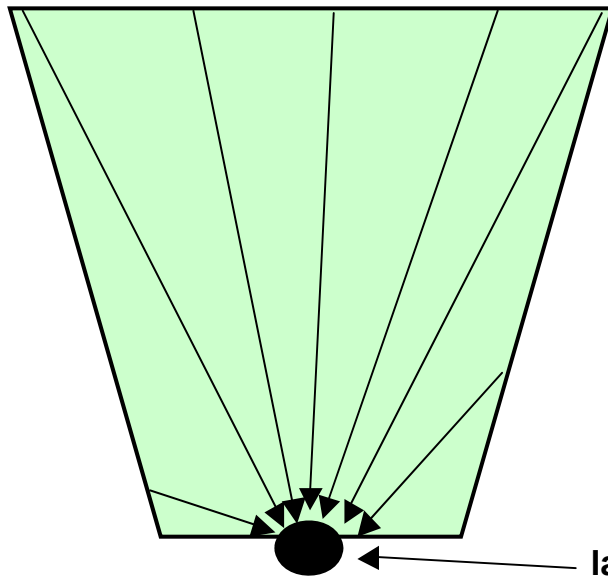
# Cable Yarding Components

- Mobile yarder (diesel powered machine with one or more winch drums)
- Steel tower (or spar tree ranging from 40-110 ft. to provide lift for logs)
- Rigging (system of mainline, skyline, haulback or strawline cables, butt rigging, and chokers)
- Anchoring system (guyline, tail/corner blocks, stumps, rock bolts, etc.)

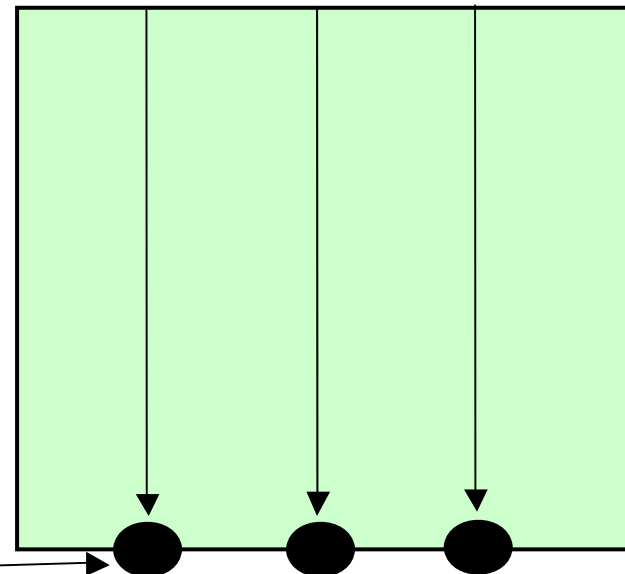


# Cable Yarding Patterns

Radial Skyline Setting



Parallel Skyline Setting



landings



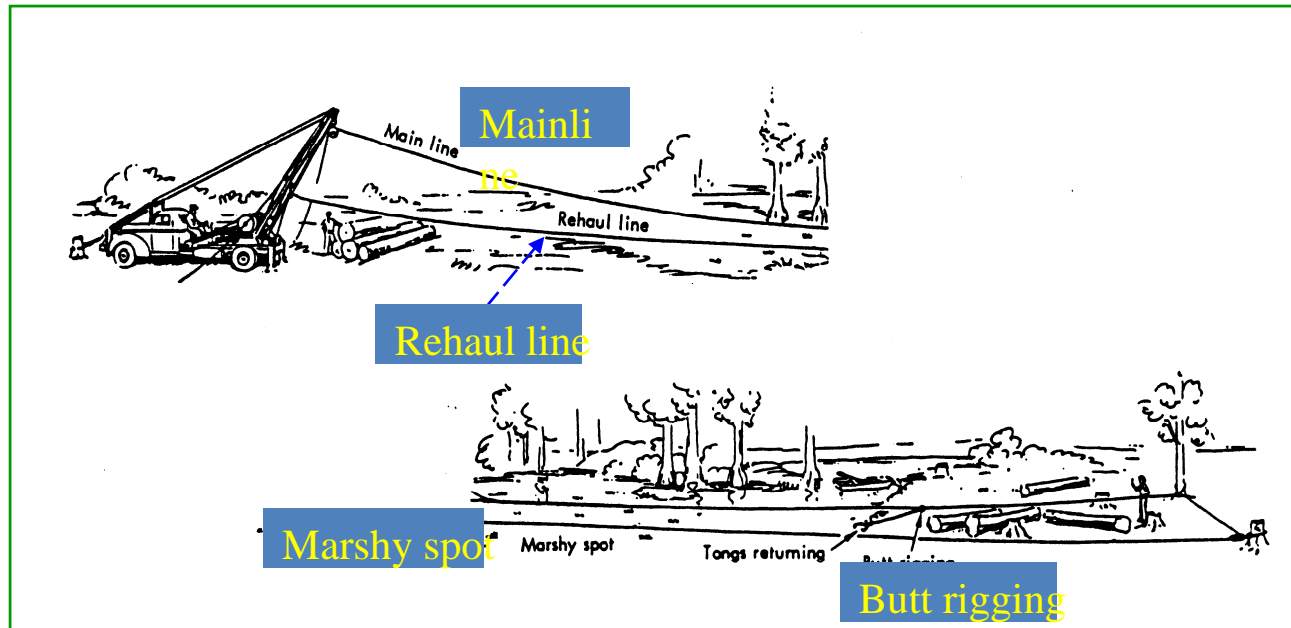
# Cable Yarding Systems

Three general types of cable yarding systems:

- Ground-lead (also called cable skidding)
- High-lead
- Skyline



# Ground-lead System



- the least complicated
- pulling logs over the ground
- without the benefit of any lift of the logs

- typically cause excessive amounts of soil disturbance or “channeling”
- are used infrequently today.



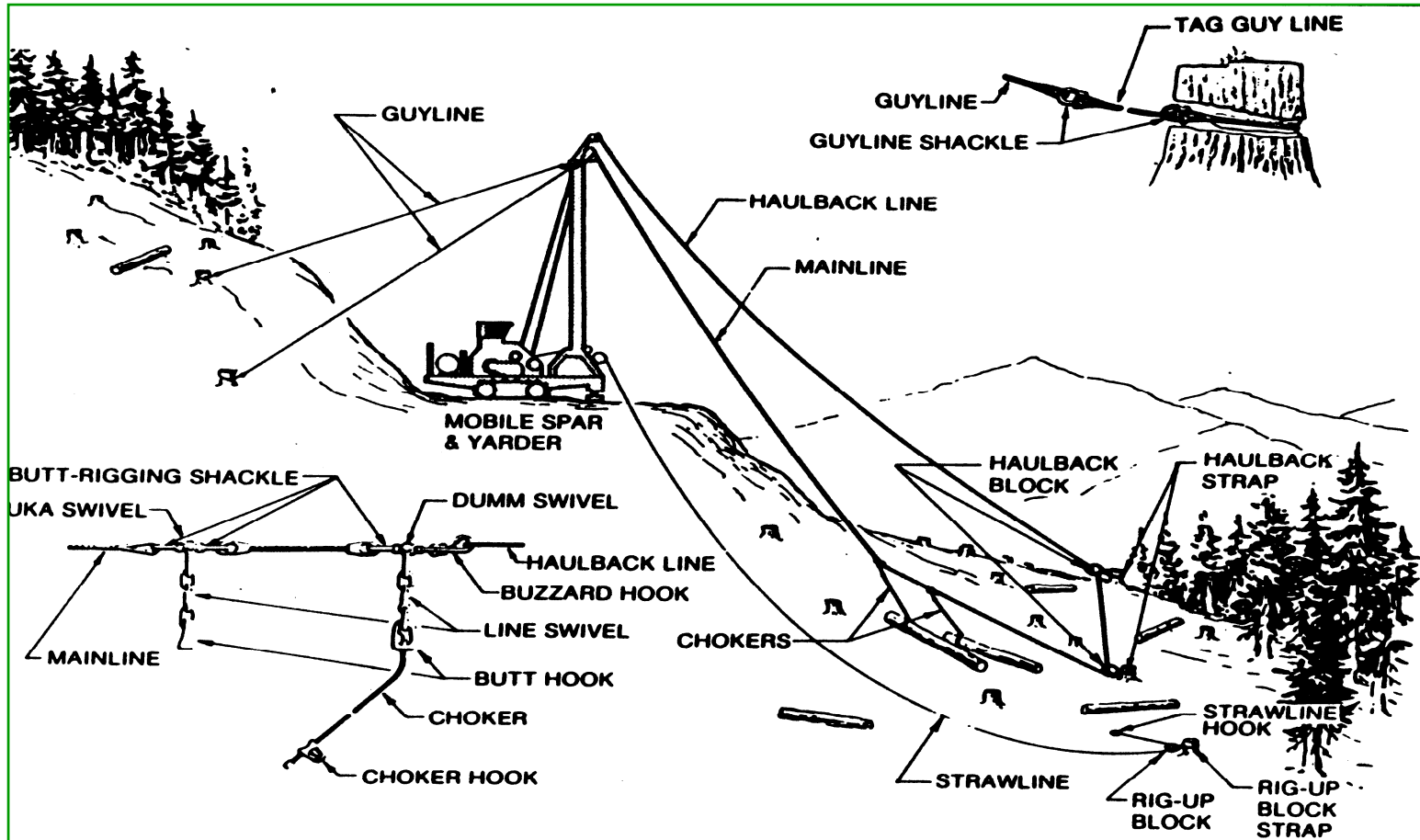


# Jammer



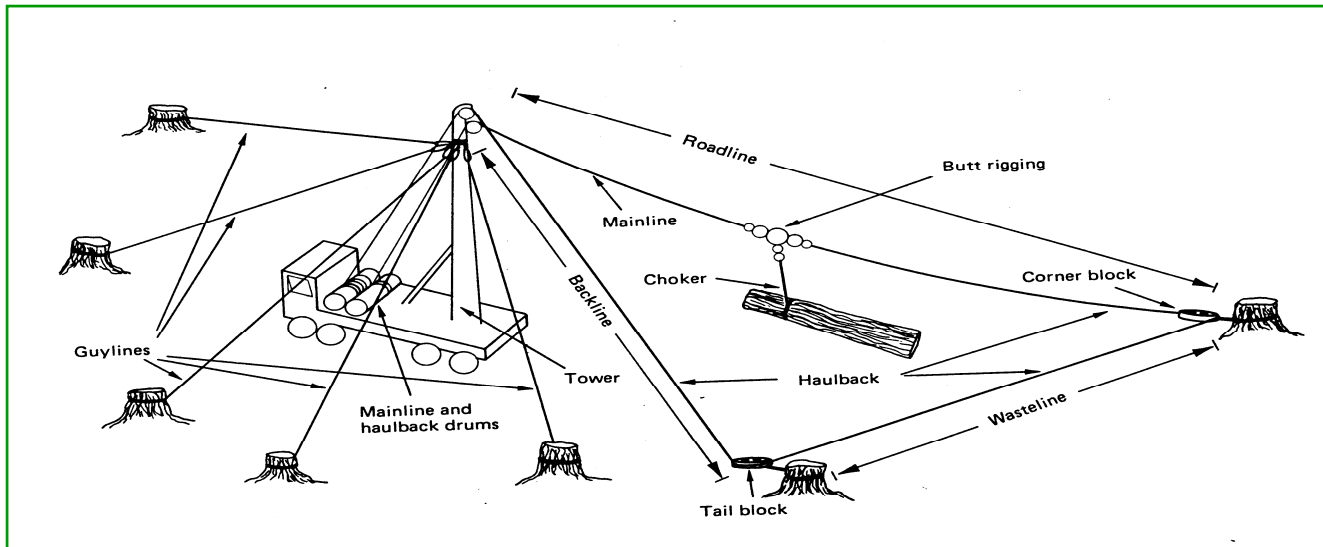


# High-lead System





# High-lead System



- first used in 1905
- the most common cable systems used in the Pacific Northwest because they were
  - simple to rig, reliable, and
  - relatively easy to move from one setting to another

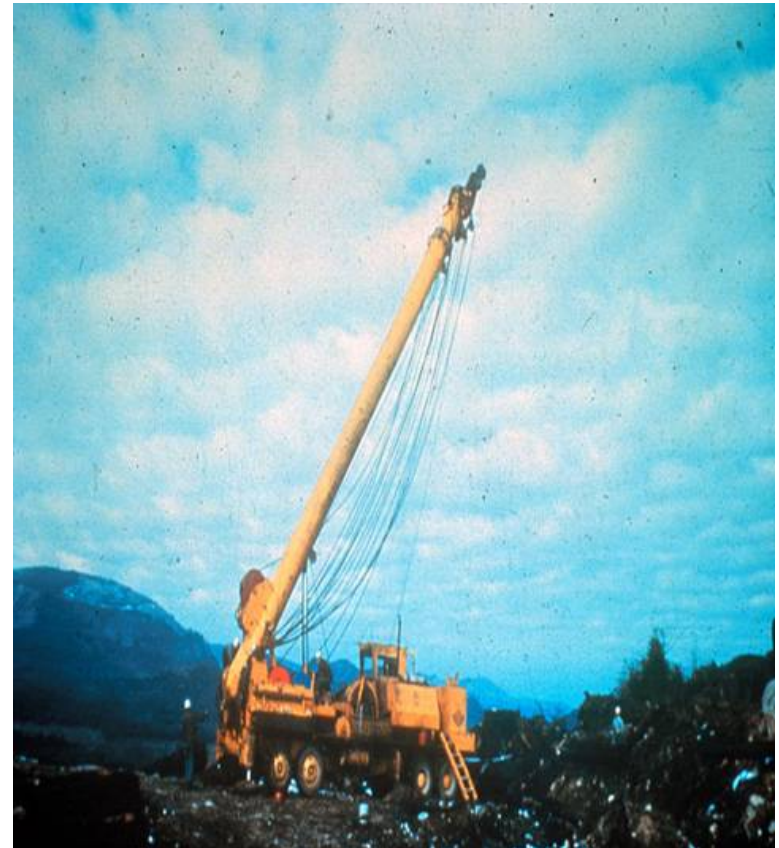


# High-lead Systems

- Rarely used in the east.
- High-lead yarders are designed to yard uphill for short distances (700 – 800 ft.)
- Typically for clearcutting.
- Not suitable for use in partial cuts because the capability of yarding laterally is limited.



# Large Telescoping Tower – Trailer Mount (Steel Spar)





# Small – Trailer Mount Tower





# Small – Trailer Mount Tower





# Swing Boom Mobile Yarder









# Mobile Yarder/Tower





# Skyline Systems

- Were first introduced around 1908 in the west.
- Are generally more versatile than high-lead,
- But are complicated to rig and costly to operate.



# Skyline Systems

- Almost all skyline systems employ:
  - “skyline” cable suspended between two points
  - “carriage” that rides along the cable and supports and lifts the load of logs as they are yarded.
- Most yarders used with skyline systems require **at least three winch drums** to handle the extra cable.



# Skyline Systems

Although many variations exist, skyline cable systems can be classified as:

- Standing skylines
- Live skylines, or
- Running skylines

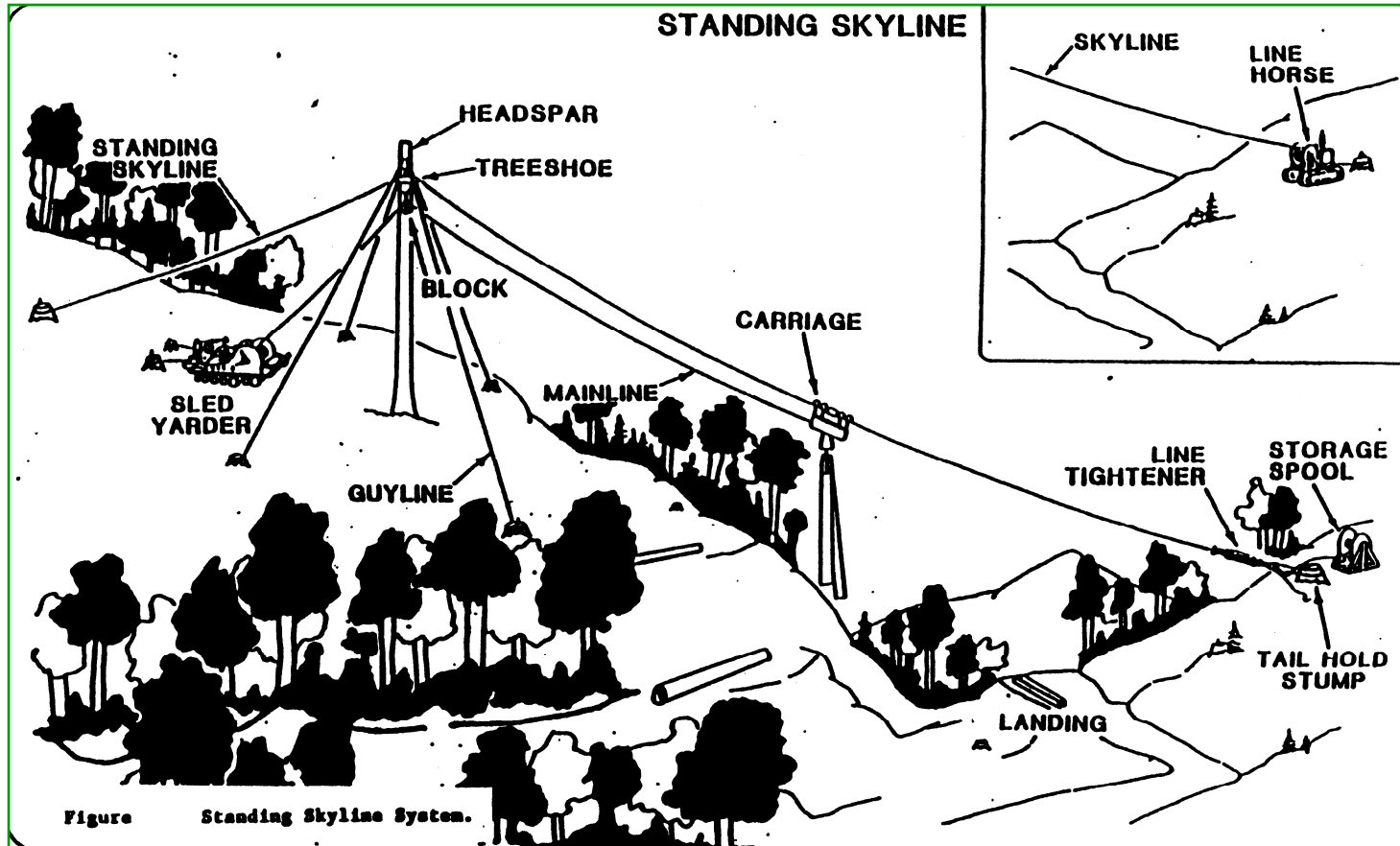


# Standing Skyline

- Also called “tight skyline systems”
- Utilizes a skyline cable that remains fixed or anchored at both ends
- When logs are choked,
  - yarder operator winches in the mainline cable
  - logs are lifted free to the ground as they travel to the landing.



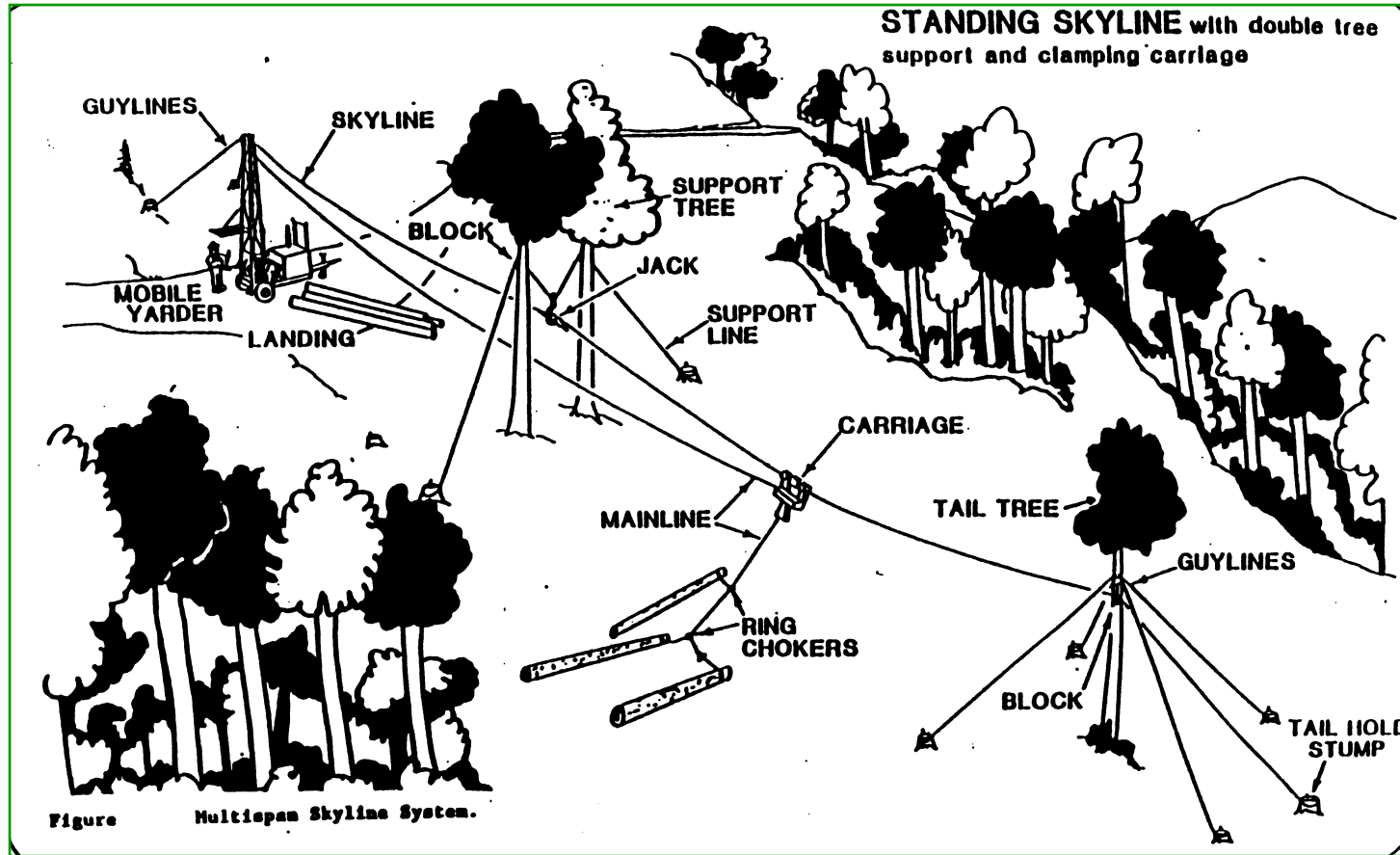
# Single-span Standing Skyline



(Source: Greene and Reisinger 1995)



# Multi-span Standing Skyline







# Intermediate Support Tree Alternatives



Double Tree Rigging

Single Tree Rigging



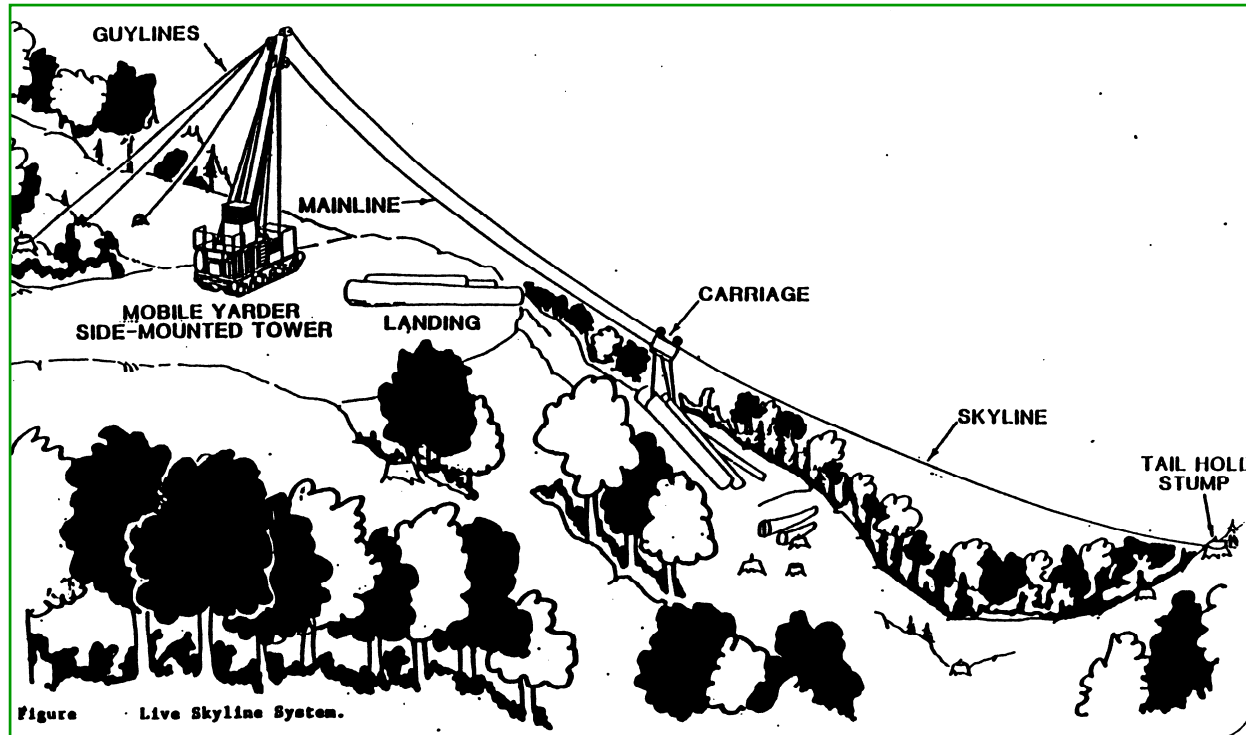


# Standing Skylines

- Typically yard uphill or over terrain obstacles, and
- Can be used in:
  - thinning,
  - partial cut, and
  - clearcut.
- Yarding distance
  - Single-span to yard for short distances (less than 1000 ft.).
  - Can extend as much as 2500-5000 ft. for multi-span skylines.



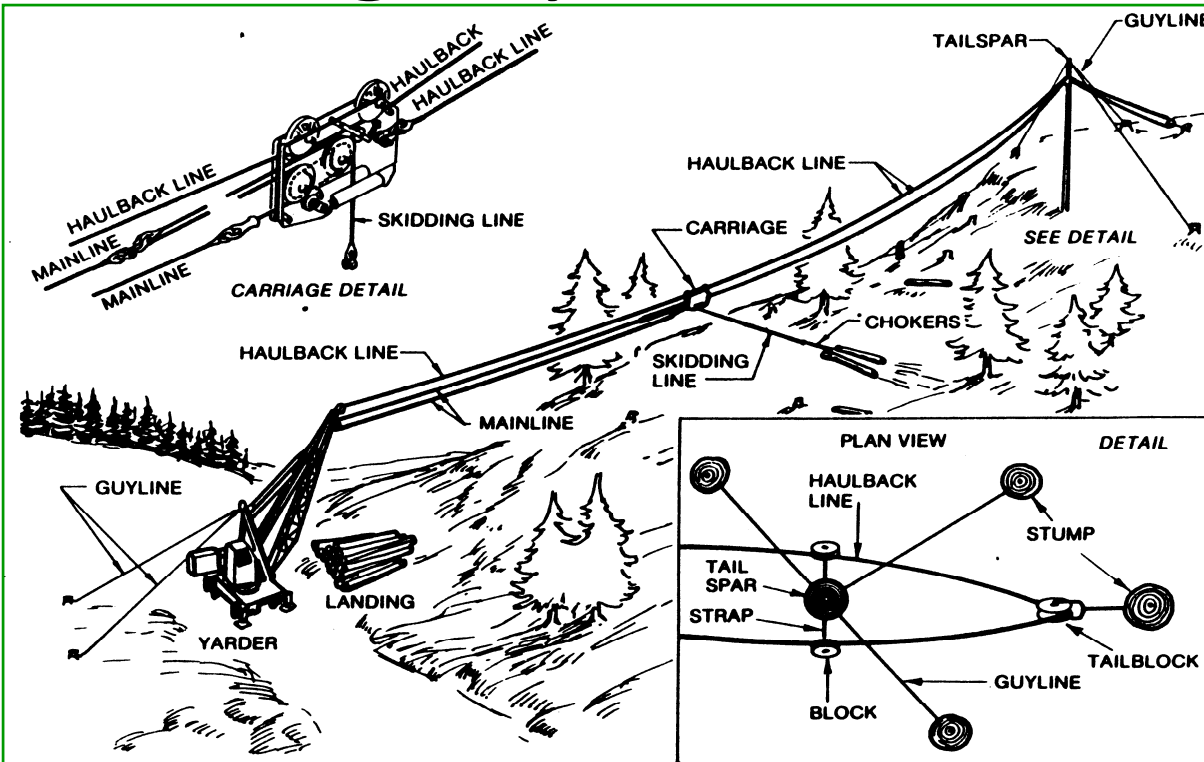
# Live Skyline



- Are typically used for clearcuts
- Yard uphill for distance less than 2000 ft.
- Can be also used for downhill yarding (less than 1000 ft.)

(Source: Greene and Reisinger 1995)

# Running Skylines



- Have two lines that support the load
- Carriage moves in and out traveling over the haulback line

- The haulback cable also functions as the skyline
- Maximum yarding distance is 1000 ft. uphill and 600 ft. when yarding downhill.



# Aerial Yarding Systems

- Are characterized by their ability to fly logs to landings completely free of the ground.
- Are very productive and have the greatest mobility than any other logging systems.



# Aerial Yarding Systems

- However, they are used infrequently, because they:
  - are the most expensive systems to own and operate,
  - require higher investment in excess of \$1.5-2 million,
  - require large landings and support crews, and
  - are sensitive to inclement weather.



# Aerial Yarding Systems

- Use of these systems are only under two conditions:
  - Certain environmental concerns
  - Desire to log the timber inaccessible to conventional logging systems
- These systems can only be employed economically in
  - high-value timber stands,
  - salvage operations, and
  - wetland or other sensitive sites



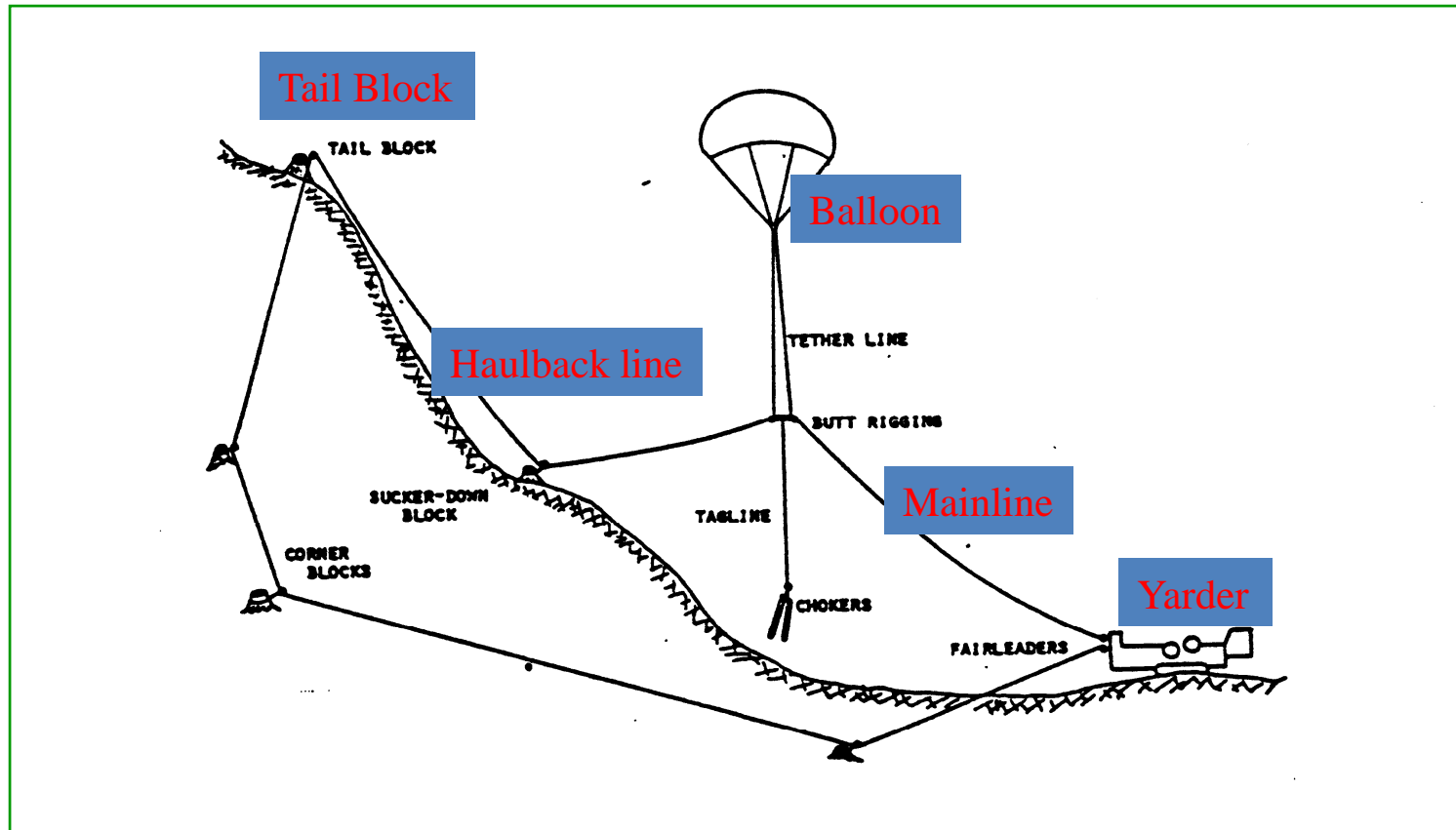
# Aerial Yarding Systems

- There are two types:
  - Balloon yarding
  - Helicopter yarding





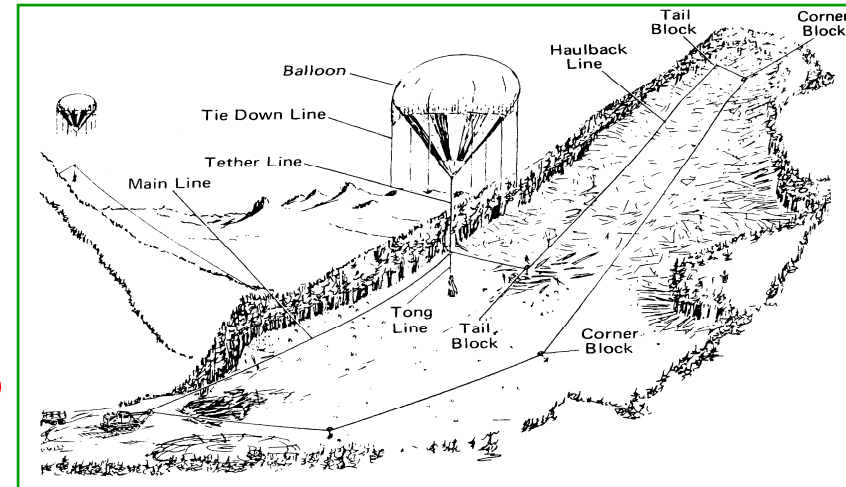
# Balloon Logging





# Balloon Logging

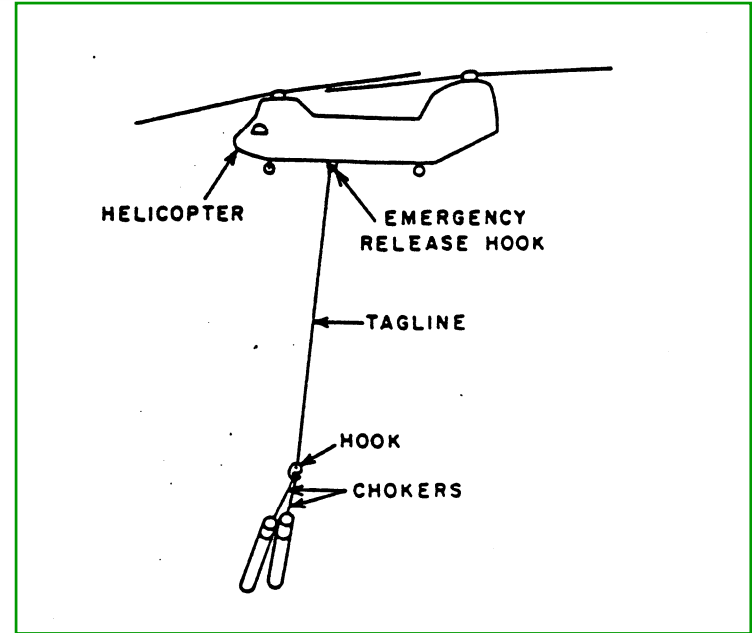
- The advantages are as follows:
  - logs are flown to the landing clear of the ground
  - yarding capability is extended to distance as far as 3500-7000 ft.
  
- Balloon logging in the east:
  - has only been conducted on an experimental basis, and
  - has not been used commercially.





# Helicopter Yarding

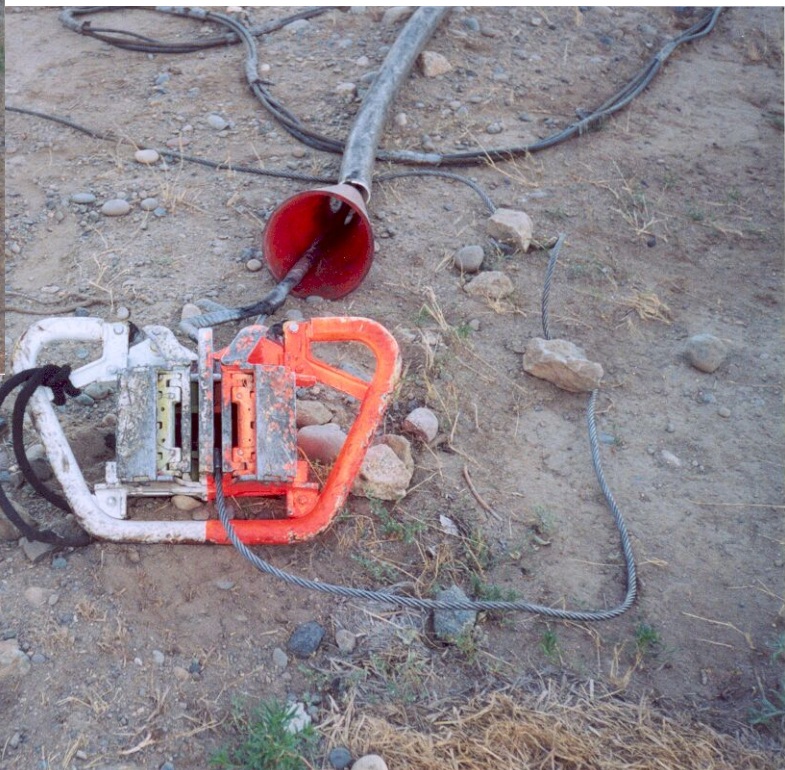
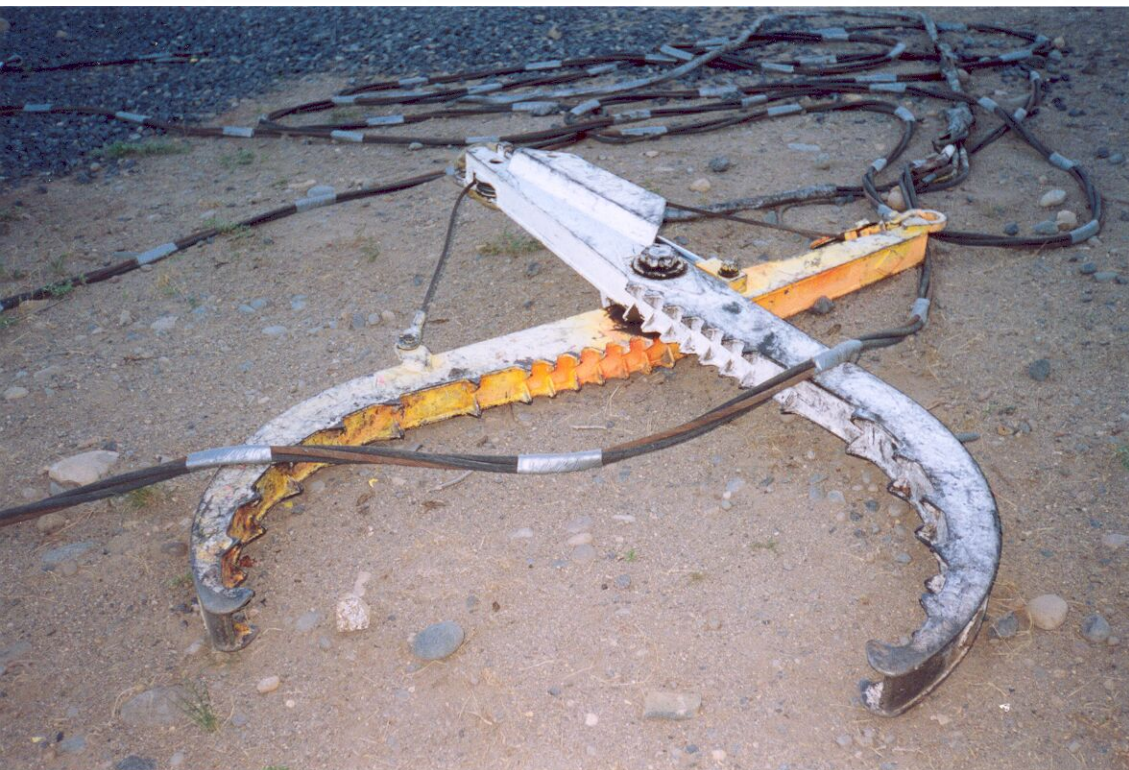
- Theoretically, helicopter systems have an unlimited distance capability.
- But in practice yarding distance is relatively short (between 1300 – 4000 ft.) to keep a higher production on the landing.
- Payloads range from 3,000 – 12,000 pounds depending on the size of helicopter used.





# Kmax









# Kmax Log Landing

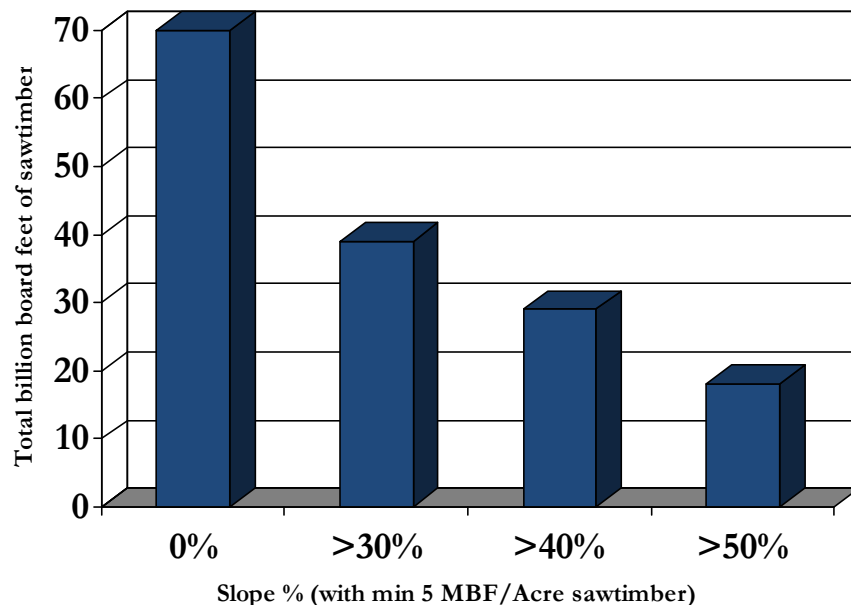




# Appalachian Applications

- Over 38 BBF available on slopes over 30%
- 17 BBF is on slopes over 50%
- A typical yarder can extract approximately 2 MMBF/year
- Potential for approximately 70 yarders (8 current)

(Source: Visser et al. 2002)







# Helicopter Logging



Rebuilt on Boeing Vertol 107  
Payload size 6,600 lbs  
Payload utilization 60%  
Hourly production 5.02 MBF  
Unit cost \$294.8/MBF  
Crew and cycle time ---

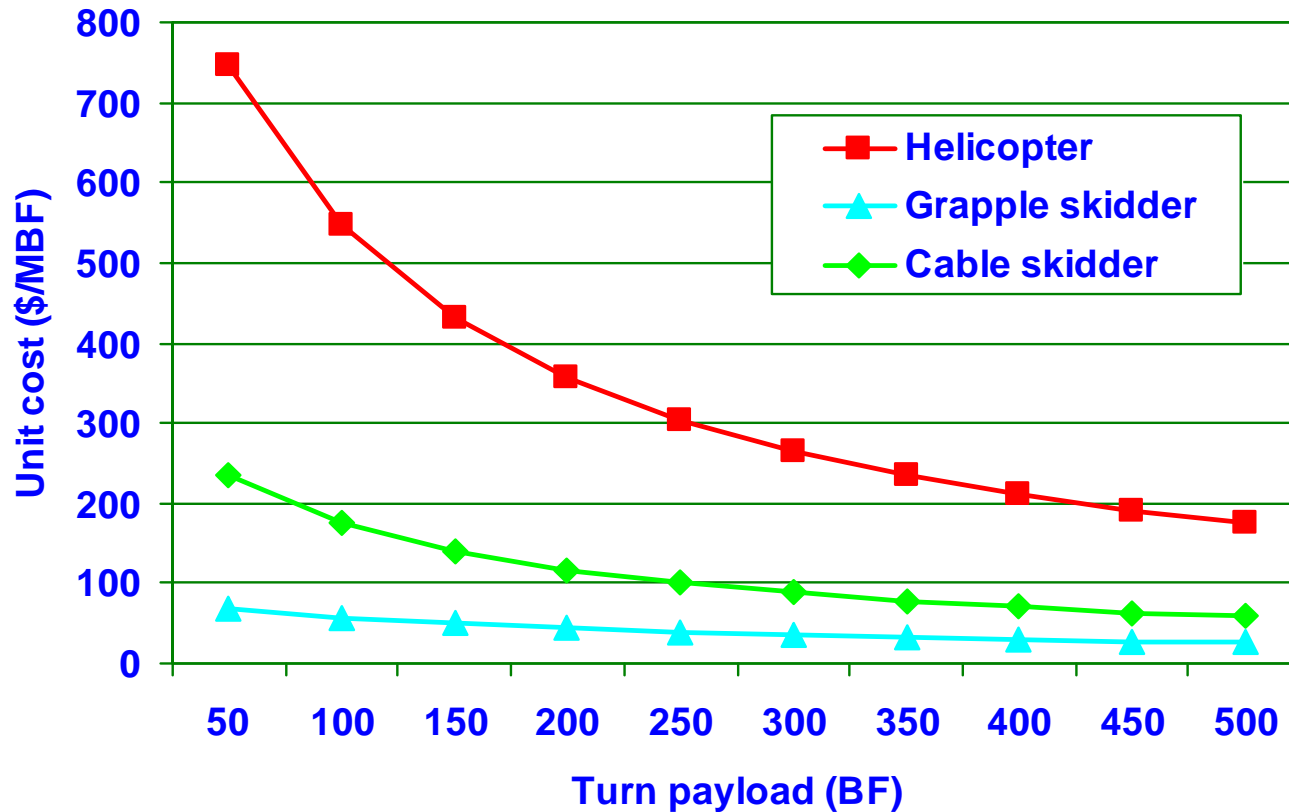


# Helicopter Logging





# Cost Comparisons



Productivity 2-3 times higher

Cost 6-10 times expensive, 2-3 times expensive if considering roads and BMPs

(Source: Wang et al. 2005)