

Productivity and Logging Costs

Objectives for Today

- Define harvesting productivity
- Defining harvesting costs

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Productivity

- Dictionaries usually define it as "the quality or state of being productive".
- Mathematically, productivity is simply defined as the volume or number of items produced divided by the time required to produce the items.
- Seeking efficiency and effectiveness

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Know Your Costs

- Caught between the "rock and the hard place"
- Landowner wants top dollar for wood
- Mill wants wood for lowest price
- Better estimates come with experience

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Cost Estimates (\$/mbf)

5(wood procurement) +
500 (stumpage) +
160 (logging) +
25 (transportation) +
250 (milling) +
25 (drying) +
45 (planing) +
10 (marketing) +
30 (transportation) =

How do we derive these average costs?

\$1050/mbf

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Fixed versus Variable Costs

- Fixed – costs incurred whether or not anything is produced
 - Depreciation
 - Interests on payments
 - Liability insurance
- Variable – costs linked directly to production
 - Labor
 - Fuel & oil
 - Workmen's comp. insurance

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Why is this important?

The Meaning of Costs:

A Case Study

- Comparing 47 logging operations
- Cost associated with felling and moving (not loading or hauling)
- Big issue is cost per unit of production
 - Example: Purchase price divided by number of units skidded over life of skidder

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Logging Systems

- (6) horse(2-person) – tree length, thinnings, selection, clearcuts
- (5) mini-tractor(2-person) – 12-48HP, tree length poles from thinnings
- (8) crawler tractor(2-person) – 42-78HP, thinning hardwoods and softwoods
- (10) cable skidder(3-person) – 60-125HP, tree length, various silviculture, diameter limit
- (9) grapple skidder(3 or 4-persons) – 90-152HP, mechanized whole tree chipping
- (9) small cable yarder(3-7 persons) (2 jammers, 4 skyline)

Important Factors:

location, terrain, silviculture, volume, species, products, yarding distance, crew size

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Productivity Issues

- Cover VC short-term; FC long-term
- Financing, level of debt, interest rate
- Risk emanates from high capital (Fix) costs
 - Horse: high VC, but low FC
 - Grapple: low VC, but high FC
- Access to markets
- Logging chance
- Terrain – versatility of system

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Time

- *Scheduled Operating Time* (SHr) is the time during which equipment and/or labor is scheduled to do productive work.
 - 8hr/day @ 250days/yr = 2000 scheduled hours
- *Productive Time* (PHr) is that time, part of scheduled operating time, during which a machine or labor is actually doing productive work.
- The difference between the two can be accounted for by the concepts of *availability* and *utilization*.

Availability

- Availability is the percentage of scheduled operating time that the machine is mechanically fit and capable of doing productive work.
- Availability accounts only for lost time due to mechanical failure and service time (unavailable time). Generally, a well-built machine will be available 90+% of the time.
- Actual availability achieved by any one machine depends on a number of factors:
 - (1) the maturity of design, (2) the mechanical components used, (3) parts and service availability, and (4) preventive maintenance.
- Important to maintain records

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Maturity of Design

- New machine with problem that escape manufacturer testing
- Potential problems increase with departures from tradition
- Sophistication of managers
- Successive model changes improve reliability

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Mechanical Components

- Only good as sum of its parts
- Several levels of quality and price
- Engineering of components
- Serviceability designed in

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Mechanical Availability

- Normally, a machine's availability is called its *mechanical availability* and is expressed as a percentage of the scheduled operating time:

$$MA(\%) = \frac{\text{Mechanically Available Hours}}{\text{Scheduled Hours}} \times 100$$

Should be above 90%

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Utilization

- *Utilization* is the percentage of scheduled operating time that the machine is productive (i.e., actually working).
- Utilization accounts for inefficiency in the operation.
- Many factors have an impact on utilization:
 - (1) weather; (2) system imbalance (diseconomies); (3) scheduling difficulties (breakdowns of other machines); (4) operator fatigue; (5) personnel delays - unscheduled breaks; and (6) reassignment (e.g., skidder used to pull trucks).
- Utilization varies with equipment type.

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Utilization Rate

- Normally, a machine's utilization is called its *utilization rate* and is usually expressed as a percentage of scheduled operating time:

$$U(\%) = \frac{\text{Productive Hours}}{\text{Scheduled Hours}} \times 100$$

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Sample Utilization Rates

<u>Equipment Type</u>	<u>Utilization</u>
Chainsaw	50%
Knuckleboom Loader	65%
Front End Loader	60%
Cable/Grapple Skidder	67%
Feller-Buncher	65%
Chipper	75%

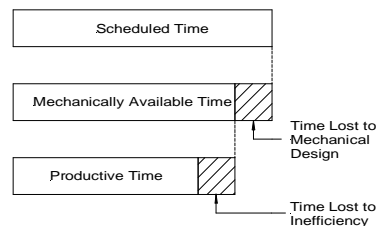
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Relationship Between MA and U

- Utilization is always less than availability since there is always some inefficiency in any harvesting operation.
- The difference between availability and utilization is the percentage of scheduled time that is lost due to system imbalance and labor delays.

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Relationship between scheduled time, available time, and productive time



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Calculating Availability & Utilization

- In order to calculate mechanical availability or utilization requires that we classify machine's scheduled time into four categories of time:
 - time spent doing productive work,
 - time spent in mechanically-caused delays,
 - time spent in system-caused delays,
 - time spent in labor-caused delays.
- We accomplish this classification through some means of time study. (Very Tedious)₉

Time Study

- The first step in a time study is to determine the **elements** of a production cycle.
- Then we observe how long the machine operates in each of those elements.
- We also have to record those times when the machine is not involved in a productive element—when it is delayed.
- Usually, we subdivide the delay time into three classes:
 - mechanical delays, system delays, and labor delays.

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Moving Phase Time Study Skidder Example

Activity	Minutes	Time
Chokering & Load Makeup	20775	Prod. Productive Time
Travel Loaded	16245	Prod.
Travel Empty	10255	Prod.
Pulling Down Hung-up Trees	7150	S.D. System Delay
Load Disposal at Landing	4955	Prod.
Waiting For Work	4550	S.D.
Operator Eating	3250	L.D. Labor Delay
Operator Misc.	2600	L.D.
Operator Restroom	2080	L.D.
Checking Lubricant Levels	1950	M.D. Mechanical Delay
Refueling	780	M.D.
Broken Hydraulic Line	735	M.D.
Broken Winch Line	715	M.D.
Towing Stuck Trucks	650	S.D.
Greasing	520	M.D.
Flat Tire	450	M.D.
Oil Change	210	M.D.
Broken Choker	130	M.D.
Total	78000	

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Skidder Example - Continued

$$MA(\%) = \frac{\text{Mechanically Available Hours}}{\text{Scheduled Hours}} \times 100$$

$$U(\%) = \frac{\text{Productive Hours}}{\text{Scheduled Hours}} \times 100$$

Σ Productive Time = 52230
Σ Mechanical Delays = 5490

Σ Labor Delays = 7930
Σ System Delays = 12350

$$MA = \frac{78000 - 5490}{78000} \times 100 = 92.96\%$$

$$U = \frac{52230}{78000} \times 100 = 66.96\%$$

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