

Assessment of Winter Harvesting Operation in Mediterranean City of Kahramanmaraş in Turkey

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Table of Contents

- ❖ **Introduction**
- ❖ **Material and Methods**
 - ✓ Study Area
 - ✓ Time Study
- ❖ **Results and Discussion**
 - ✓ Delimiting and Bucking Stage
 - ✓ Debarking Stage
- ❖ **Conclusions**

Introduction

- The demand for wood products has increased in last decades which widener the gap between supply and demand for wood products.
- In order to prevent this gap, volume loss should be minimized by implementing suitable forest harvesting techniques.
- Forest harvesting operations are usually performed between May and October since forest operations can be more difficult in the rest of the year due to sever weather and terrain conditions.

Introduction

- The forest harvesting activities conducted between October and May are called as *winter (or late) harvesting operations* in Turkey.
- It has been reported that amount of annual industrial wood production potentially increase from 0.7 million m³ to 2.4 million m³.
- Winter harvesting operation might provide various important benefits and earnings for forest ecosystems.



Introduction

- Forest operations are completed before regeneration period begins.
- Harvesting operations performed on snow surface minimize damages on young generation and soil.
- The amount of volume loss during harvesting and processing periods decreases.
- The physical endurance and quality of forest products extracted during winter season increases.
- Insect damages on forest products dramatically reduce.
- Forest products are not affected by fungus damage in winter harvesting.
- Besides, workforce are utilized for whole year.

Introduction

In this study, winter harvesting operations performed in a Mediterranean city of Kahramanmaraş were evaluated considering productivity. In this concept, tree felling, delimiting and bucking, and debarking activities were analyzed.

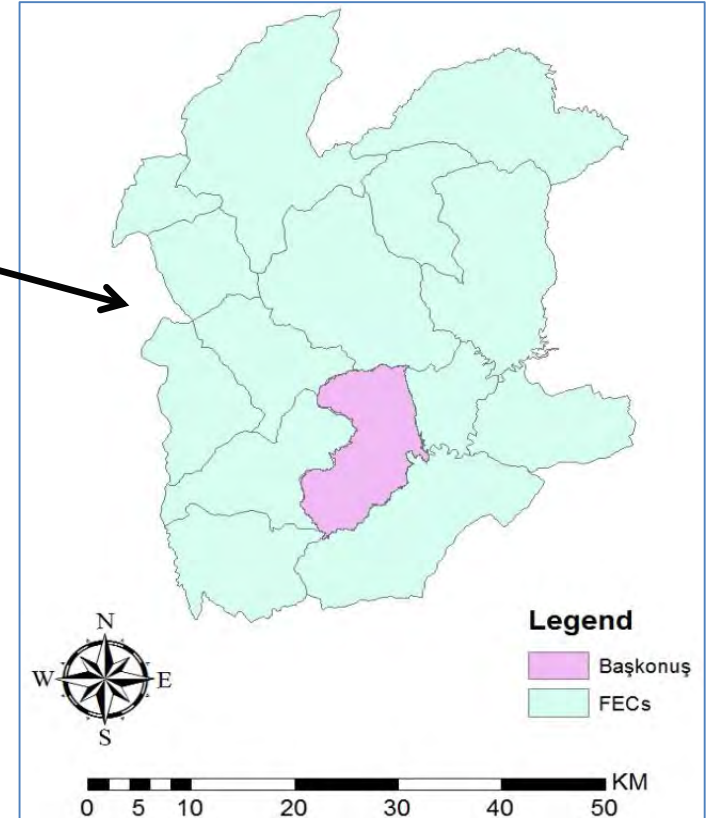


Material and Methods

Study Area

- The study area was selected from Başkonuş Forest Enterprise Chief (FEC) of Kahramanmaraş Forest Enterprise Directorate in Kahramanmaraş Forest Regional Directorate.
- The total area of FEC was 34015 ha in which 18867 ha was covered by forests.
- The dominant species was Brutian Pine.
- In the field studies, harvesting operations including felling, delimiting and bucking, and debarking were evaluated within two harvesting units (e.g. the number of units; 235th and 513th) in Başkonuş FEC.

Material and Methods



Stand characteristics

Unit	Silvicultural Technique	Elevation (m)	Aspect	Slope (%)
235	Natural Regeneration	800	North East	30
513	Natural Regeneration	920	South West	30

Başkonuş Forest Enterprise Chief (FEC)

Material and Methods

Time Study

- Winter harvesting operations were conducted by total of 20 loggers who were working in three shifts.
- The time study data were recorded in tables which also contained information about the study area, operation technique, and logging equipment.
- In order to prevent any bias, data were collected during regular work performance.



Work stages

Material and Methods

Time Study

- The operation was followed from a location where work stages could be easily monitored and controlled.
- The time study was done by using repetition method in which chronometer was run for each work stage separately.
- For each operation, the cycle time and work stages data were recorded from randomly selected 30 trees.



Material and Methods

Tree felling operation: Cycle time begins when felling crew starts moving from the closest road side to stump. The work stages evaluated during time study were listed below:

General preparation time: *Time spent on getting ready before walking into the stump*

Walking time: *The time spent on walking from road side to stump*

Preparation time: *The time spent on clearing the tree's base and escape routes*

Undercut time: *The time spent on undercut to control felling direction*

Cutting time: *The time spent on cutting tree from opposite side of undercut*

Felling time: *The time starts with felling and ends when tree top hits the ground*

Rooting time: *The time spent on cutting roots*



Material and Methods

Delimiting and Bucking: After felling the trees, delimiting was done by using chainsaw. Then, trees were measured and bucked at the specified sections. The work stages were:

Delimiting time: The time spent on delimiting stage

Measuring and marking time: The time spend on measuring and marking the trees prior to bucking

Bucking time: The time spent on bucking the trees and cutting tree tops



Material and Methods

Debarking: Once cutting, delimiting, and bucking the trees, debarking work stage was usually applied in Turkey, especially on coniferous trees.

- *The debarking work stage included debarking time (i.e. the time spent on debarking and turning the trees) and delay time (i.e. the time spent during unproductive time period).*



Results and Discussion

Felling stage

- The average productivity for felling stage was computed based total cycle time and timber volume.
- The average productivity was 19.19 m³/hr and 11.30 m³/hr for unit 235 and 513, respectively.
- It was found that felling time increases as tree diameter increases.
- However, increased timber volume results in higher production rate.

Results and Discussion

Summary table of felling operation at unit 235

Variables	Unit	Average	Min.	Max.
Ground slope	%	35	30	60
Walking path slope	%	22.5	15	30
Walking distance	m	42	173	11
d ₁₃₀ (diameter)	cm	36	22	58
Timber volume	m ³	1.820	0.190	2.760
Time Study Data				
General preparation time	min	0.61	0.17	2.67
Walking time	min	1.04	0.27	4.33
Preparation time	min	0.72	0.17	2.25
Undercut time	min	1.46	0.42	4.75
Cutting time	min	1.21	0.33	4.42
Felling time	min	0.28	0.08	0.75
Rooting time	min	0.38	0.20	1.47
Total time	min	5.69	3.05	15.18

Results and Discussion

Summary table of felling operation at unit 513

Variables	Unit	Average	Min.	Max.
Ground slope	%	30	15	45
Walking path slope	%	15	10	20
Walking distance	m	41	10	110
d ₁₃₀ (diameter)	cm	32	20	56
Timber volume	m ³	0.731	0.192	2.364
Time Study Data				
General preparation time	min	0.54	0.17	1.17
Walking time	min	0.68	0.17	1.83
Preparation time	min	0.56	0.25	1.25
Undercut time	min	0.85	0.25	2.75
Cutting time	min	0.80	0.17	0.25
Felling time	min	0.19	0.09	0.30
Rooting time	min	0.27	0.17	0.17
Total time	min	3.88	9.42	2.07

Results and Discussion

- The most time consuming stage at unit 235 and 513 was undercut (25.57%) and cutting stages (20.35%), respectively.
- The main reason for that was the average tree diameter was higher at unit 235.
- When considering average time values of two units, felling (4.69%) was the least time consuming stage, followed by rooting (7.21%) and general preparation (11.99%).

Unit No	Undercut time	Cutting time	Felling time	Rooting time
	%	%	%	%
235	25.57	21.18	4.86	6.60
513	18.03	20.35	4.53	7.83

Results and Discussion

Delimiting and Bucking Stage

- It was found that the average productivity was 5.25 m³/hr and 5.51 m³/hr for unit 235 and 513, respectively.
- It was found that the most time consuming stage at both units was delimiting stage.
- Measuring and marking (23.43%) was the least time consuming stage, followed by bucking (34.60%).
- The results indicated that cycle time of delimiting and bucking increases as tree diameter and branch density increases.

Unit No	Delimiting time	Measuring and marking time	Bucking time
	%	%	%
235	42.73	24.37	32.90
513	41.23	22.48	36.29

Results and Discussion

Summary table of delimiting and bucking operation at unit 235

Variables	Unit	Average	Min.	Max.
Diameter	cm	34	22	46
Timber volume	m ³	0.842	0.252	1.573
Time Study Data				
Delimiting time	min	4.98	2.99	9.65
Measuring and marking time	min	1.67	1.10	2.30
Bucking time	min	2.99	1.80	5.79
Total Time	min	9.63	6.19	17.74

Summary table of delimiting and bucking operation at unit 513

Variables	Unit	Average	Min.	Max.
Diameter	cm	32	20	56
Timber volume	m ³	0.769	0.192	2.364
Time Study Data				
Delimiting time	min	3.46	1.82	8.29
Measuring and marking time	min	1.88	1.03	2.92
Bucking time	min	3.04	1.60	7.29
Total Time	min	8.38	4.92	18.50

Results and Discussion

Debarking Stage

- The average productivities for debarking stage computed based total cycle time and timber volume were 0.88 m³/hr and 0.87 m³/hr for unit 235 and 513, respectively.
- Tree size increased the debarking time which lead to reduction in productivity.
- Thus, productivity of debarking was slightly higher in unit 235.

Results and Discussion

Summary table of debarking operation at unit 235

Variables	Unit	Average	Min.	Max.
Timber Volume	m ³	0.112	0.040	0.241
Time Study Data				
Debarking time	min	7.65	2.68	20.83

Summary table of debarking operation at unit 513

Variables	Unit	Average	Min.	Max.
Timber Volume	m ³	0.120	0.040	0.204
Time Study Data				
Debarking time	min	8.24	3.15	16.75

Results and Discussion

- In the field studies it was observed that forestry workers face difficult and risky work environment due to cold weather and frozen ground surface.
- Thus, they should be well trained for winter harvesting operations in order to improve productivity and prevent accidents.
- Besides, workers should be equipped with necessary protective gears (special boots, helmet, etc.) and warm clothes.

Conclusions

Winter harvesting operations provide important benefits

- Forest operations are completed before regeneration period begins which increases the success of natural regeneration process.
- Harvesting operations performed on snow surface minimize damages on young generation and forest soil.
- The amount of volume loss during harvesting and processing periods decreases since water content within the tree is relatively low in winter season.

Conclusions

- The physical endurance and quality of forest products extracted during winter season increases.
- Insect damages on forest products dramatically reduce since harvesting operations are performed in a time period in which especially bark insects are not active.
- By employing forestry workers for harvesting operations during winter season, workforce are utilized for whole year.
- Since forestry workers encounter difficult work environment during winter harvesting they receive higher salary comparing with regular work season.

Conclusions

- The extra payment for winter harvesting may potentially increase the total timber production costs by about 10%.
- Thus, this extra cost should be taken into account in determination of sale price of the forest products.
- Since winter harvesting has extra production cost and storage cost, winter harvesting operations should be limited with productive stands and stands where winter harvesting is more suitable.

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Thank your for attention.