

Survival test of RFID UHF tags in timber harvesting operations



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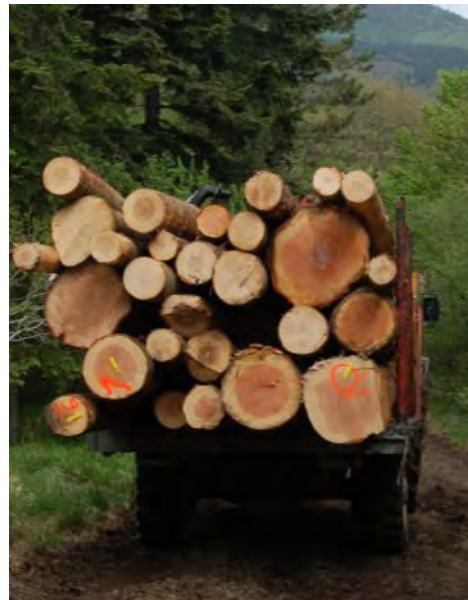
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Rationale of the research



RFID for data transmission and traceability tool in forest operations

- Can they endure forest hauling and logistics?
- Which factors are most crucial for their survival?
- Are remedial actions possible?



Materials



•2 RFID UHF tag models

- Wintag
- Smartrack



RFID tag model	Overall size	Reading range(2 W)	Weight
Unit	mm	m	g
Wintag Flexytag UHF D7040S	64 x 45	2-3	4.9
Smartrack Shortdipole	120 x 25	10	1.1

•2 stapling modality

- single staple
- double staple



WD	SD	SD
Wintag, Double stapling	Shortdipole, Double stapling	Shortdipole, Single stapling



Manual RFID UHF reader

CAEN qID R1240I

Android interface

Potential read range 80 cm, actual read range 40 cm

Methods



Measured parameters	Unit	Description
Tree/log parameters		
Maximum diameter	cm	Tags were applied at the butt of the felled tree or at the main diameter side of logs and the corresponding diameter measured. If this was not accessible measurement and tag application was performed on the minor diameter side.
Length	m	Measured or estimated
Species	descriptor	The tree species were noted
Type of section	descriptor	- Log (processed) - Top (with branches) - Whole tree
Load parameters		
Chocker position	descriptor	- Top of the tree or minor diameter of the log/tree section - Butt of the tree or main diameter of the log/tree section
Hauling distance	m	Distance travelled by the carriage loaded
Concentration distance	m	Distance from the original position to the vertical of the carriage
Type of load	descriptor	- Single item per load - Multiple item per load (two or more trees, sections or logs)
Electronic marking parameters		
Tag type	descriptor	- WD, Flexytag fixed with two staples - SD, Shortdipole fixed with two staples - SS, Shortdipole fixed with one staple

In forest:

- tree marking
- parameters recording



At landing:

- electronic check
- visual control



Areas – hauling operations



	Site 1	Site 2	Site 3
Area	Firenze (Firenze)	Montepiano (Prato)	Firenze (Firenze)
Altitude above sea level (m)	953	843	1079
Average slope (%)	35-45	30-40	40-50
Average mainline height (m)	12	6-8	14
Direction of extraction	uphill	uphill	downhill
Average extraction distance (m)	185	235	215
Average concentration length (m)	12.3	15.4	12.6
Average log/tree diameter (cm)	41	37	42
Main species	<i>Abies alba</i>	<i>Pinus nigra</i>	<i>Abies alba</i>
Maximum log/tree diameter (cm)	56	57	80



- Two forest companies
- Storm damaged stands



Transport



Site 1

- 300 m extraction
- 7 round trips
- 198 logs (86 marked)
- Unloading by tilting



Results



Cable yarding	RFID tag type	Marked	Electronic/visual control			Just visual control	
			Operative	Removed	Destroyed	Not damaged	Not visible
Site 1	SS	19	16	0	0	3	-
	DS	23	20	0	0	3	-
Site 2	DW	16	16	0	0	-	-
	SS	19	19	0	0	-	-
Site 3	DS	18	18	0	0	-	-
	DW	15	14	1	0	-	-
Site 3	SS	23	21	2	0	-	-
	DS	20	18	2	0	-	-
TOTAL		153	142	5	0	6	-
Tractor transport	SS	44	32	0	0	8	4
	DS	42	31	0	0	8	3
TOTAL		86	63	0	0	16	7



Hauling

- 97% overall survival rate
- 91% in Site 3
- combination of chocker position and terrain profile



Logistics operations

- 73% verified by reader
- 92% verified total
- 8 % not visible

Thank you!



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