Current practices and efficiency gaps in logging operations from European mountain forests

University of Natural Resources and Life Sciences
Department of Forest and Soil Sciences

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INTRODUCTION

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European mountain forests

- forests cover 41% of the EU mountain areas
- multifunctional role - wide variety of ecosystem services
- high variability in timber harvesting intensity, machinery used, productivity, costs, etc.

Goals

- assess current logging practices
- highlight existing efficiency gaps
- identify opportunities for improving efficiency

METHODS

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- web-designed data collection protocol (questionnaire)
- 7 case study areas (CSA) in EU mountain ranges
- 632 operations: 290 thinning op., 342 regeneration felling op.

CSA	Country	Forest area (ha)	Altitude (m)	Slope (%)	Tree species	FM System
			Mean ± SD	Mean ± SD		
CSA 1	Spain	2654	1422±107	32±21	Scots pine, Pyrenean oak	59CO, 35EA, 6NO
CSA 2	France	5190	1310±189	36±25	Spruce, fir, beech	94UA, 6NO
CSA 3	Austria	579	1523±157	61±21	Spruce, beech, maple, fir	100UA
CSA 4	Slovenia	5016	973±201	22±14	Beech, fir, spruce	29EA, 65UA, 6NO
CSA 5	Sweden	10405	482±68	11±7	Scots pine, spruce, birch	100EA
CSA 6	Slovakia	5130	1057±166	29±14	Spruce, fir, beech	100EA
CSA7	Bulgaria	1737	1580±176	56±52	Scots pine, black pine, fir, beech, spruce	70EA, 30NO

METHODS

- statistic analysis: t-test, ANOVA, correlation tests

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Road network	Transport method	Transport parameters	Accidents in logging operations	
Density roads (m ha^{-1})	Single truck	Loading capacity (t)	Accident quote	
Density skid trails (m ha^{-1})	Truck with trailer	Transport distance (km)	Frequency in harvesting	
Construction costs (€ m^{-3})	Train	Fuel costs (€ $litre^{-1}$)	Frequency in extraction	
Maintenance costs (€ m^{-3})	Others	Transport costs (€ m^{-3})	-	
Harvesting method	Felling and processing	Extraction methods	Productivity	Costs
Whole tree (WT) Tree length (TL) Cut-to-length (CTL)	Axe	Manual	m^3 PSH^{-1}	€ m^{-3}
	Saw	Animal		
	Chainsaw	Tractor		
	Feller-buncher	Skidder		
	Harvester	Forwarder		
	-	Cable yarder		

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Efficiency gaps analysis

- **Scenarios:**

  1. **BAU** – business as usual: current harvesting systems (HS) and road network
  2. **Improved road network & BAU HS**
  3. **Improved road network & NEW HS**

- **Indicators:**

  - road density, extraction distance, HS productivity, HS costs, transport, fuel consumption, CO2 emissions, number of accidents & mean damage stand index.

RESULTS – Current practices

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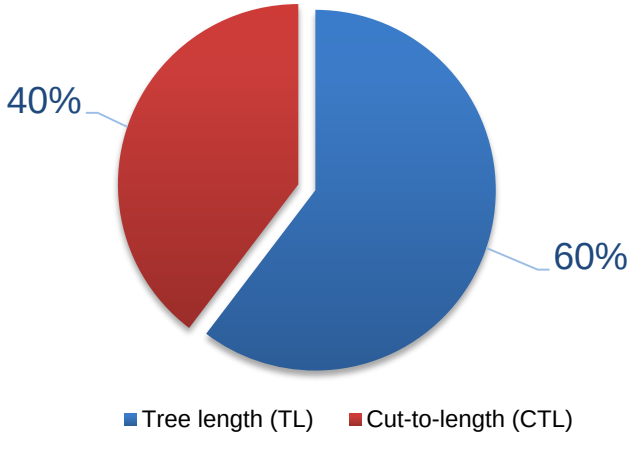
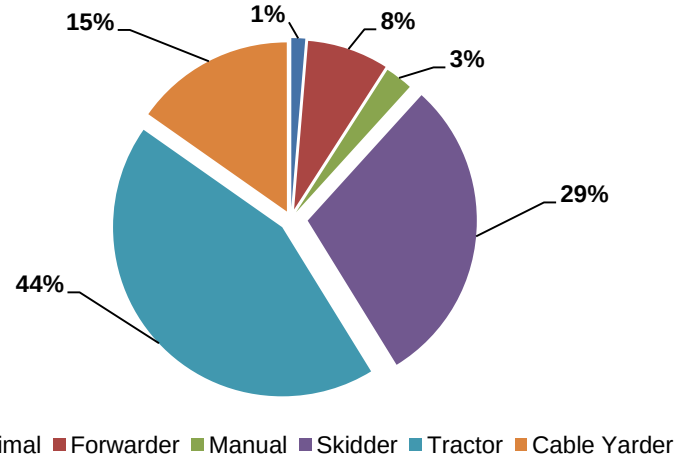
Across CSA

Harvesting methods



Extraction methods



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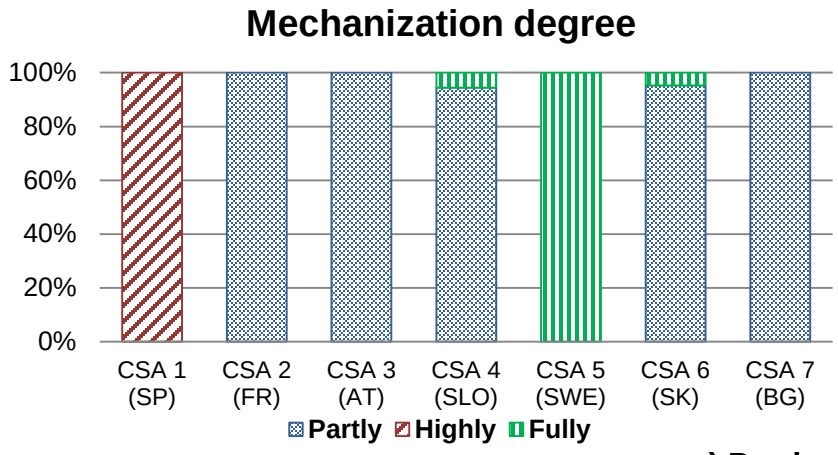

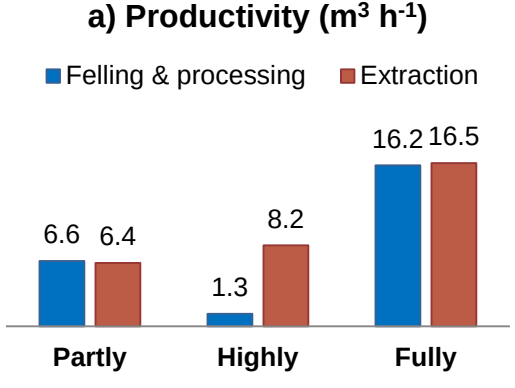

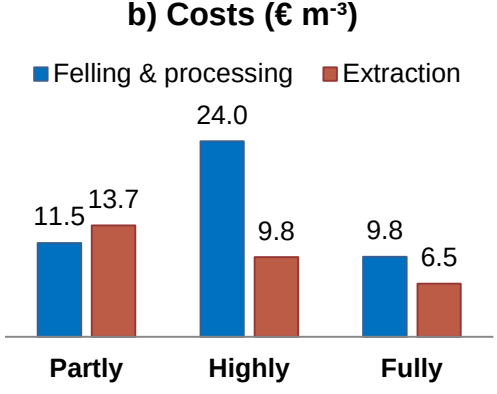

RESULTS – Current practices

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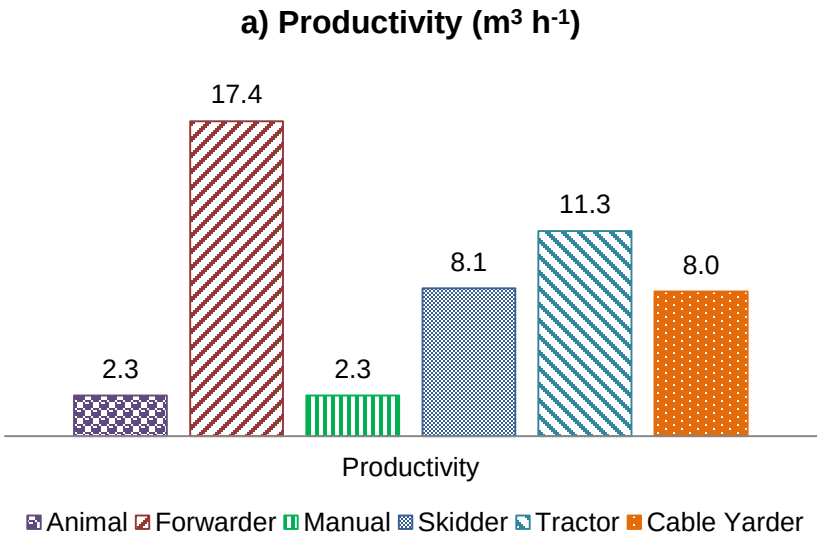
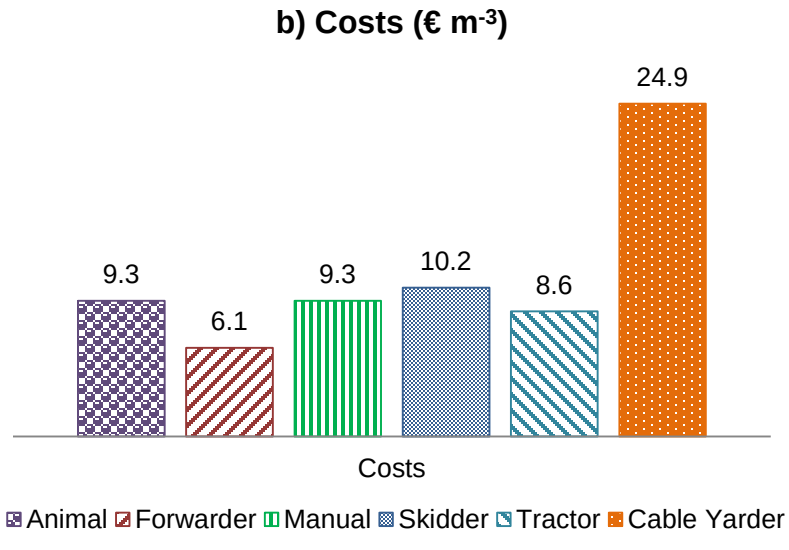
Timber extraction





RESULTS – Efficiency gaps

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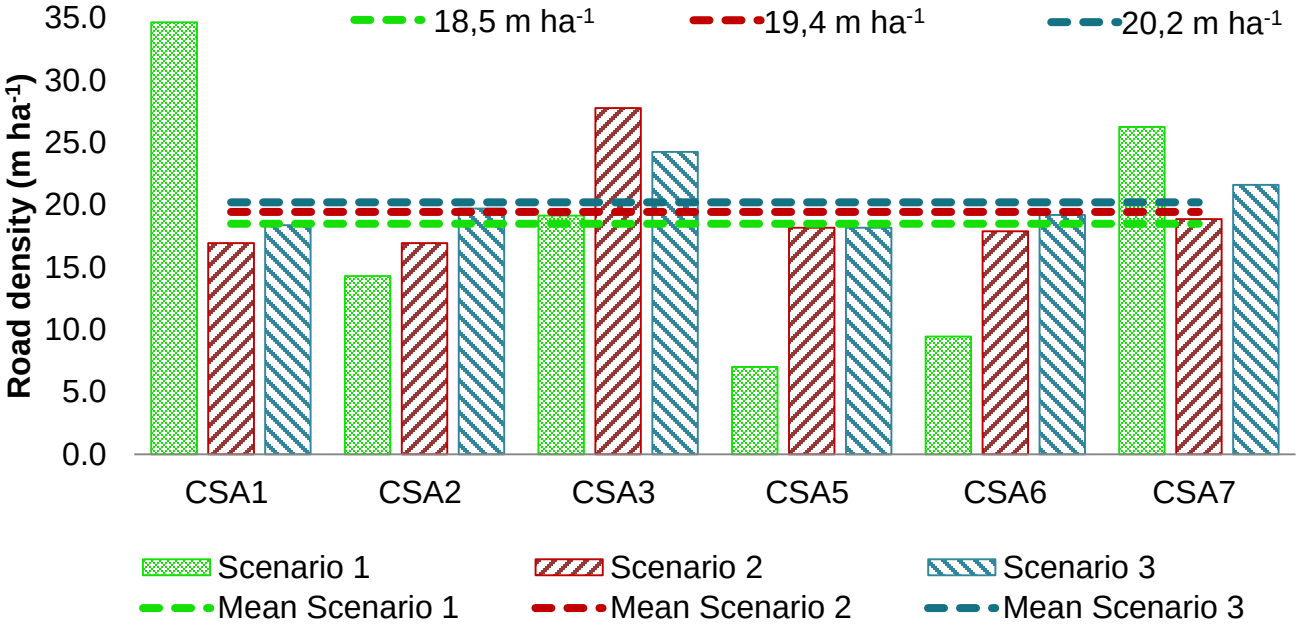
Road network



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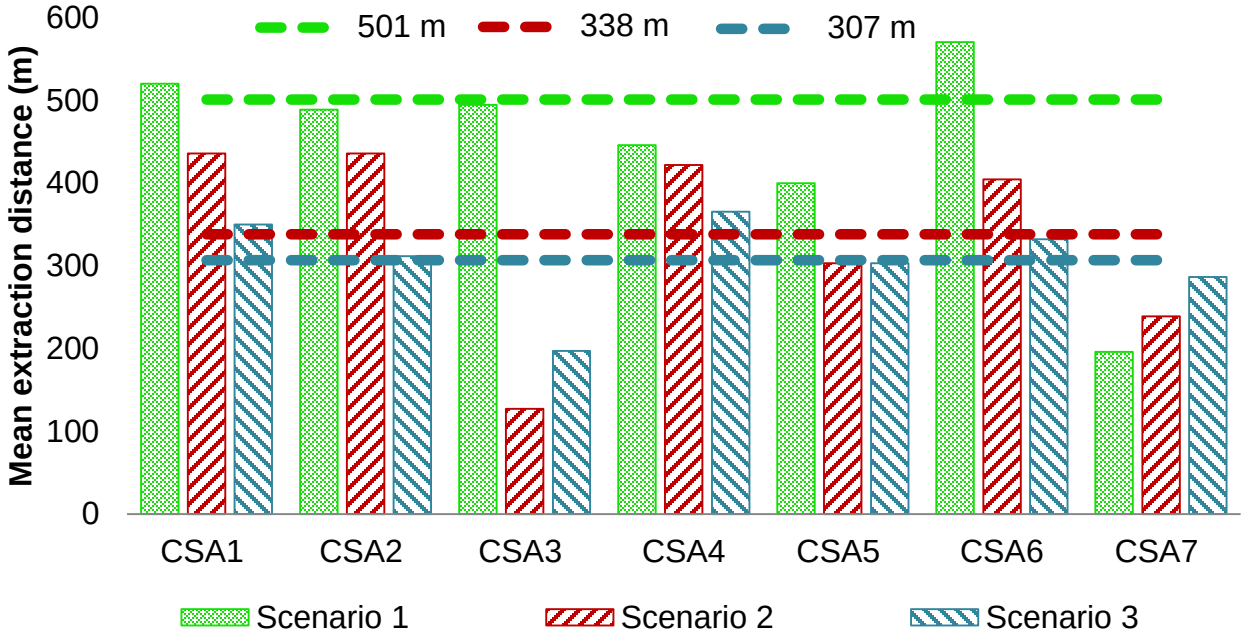
Extraction distance



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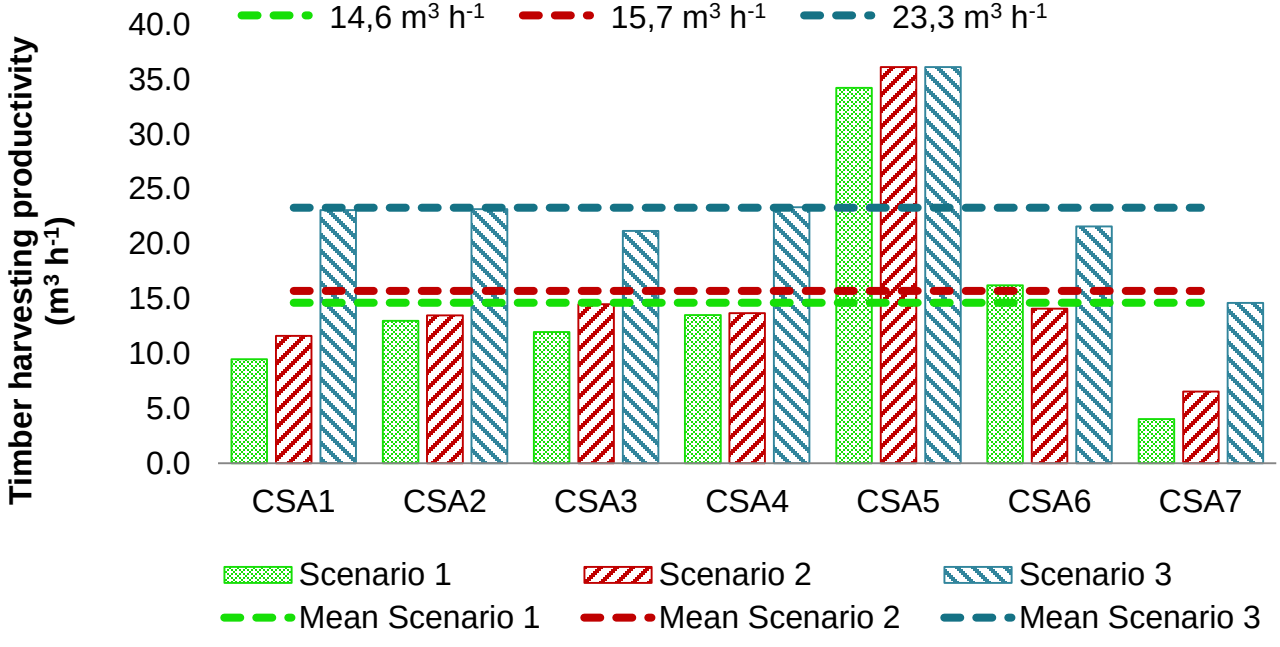
Productivity



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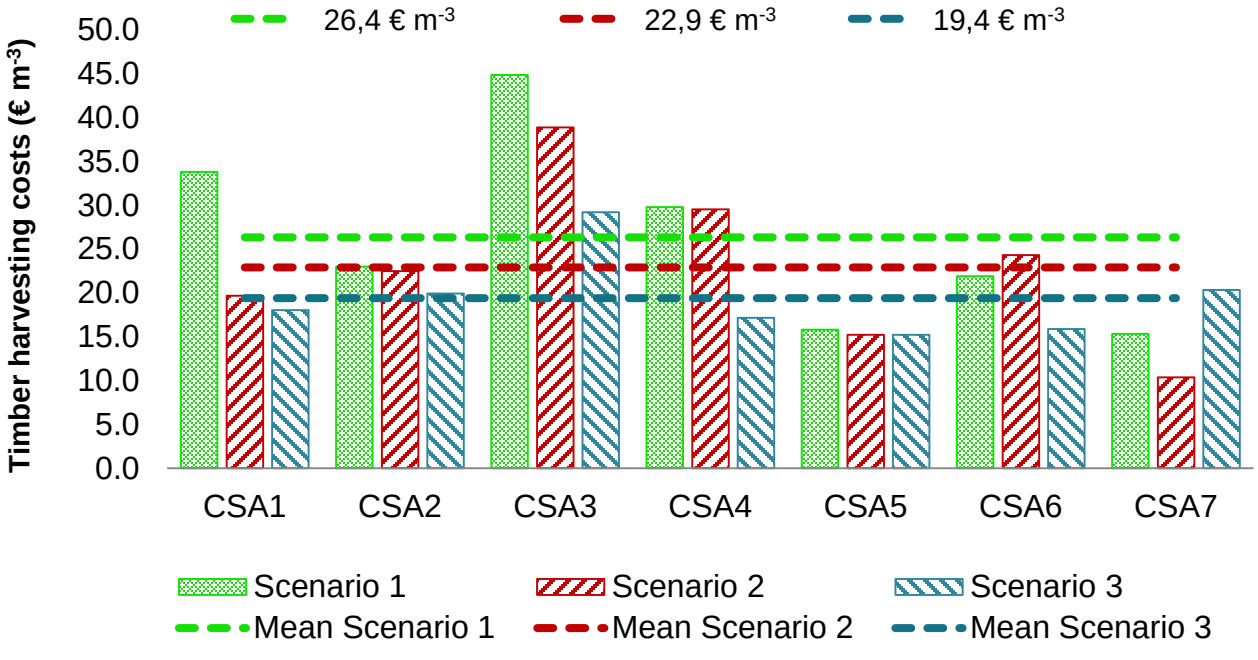
Costs



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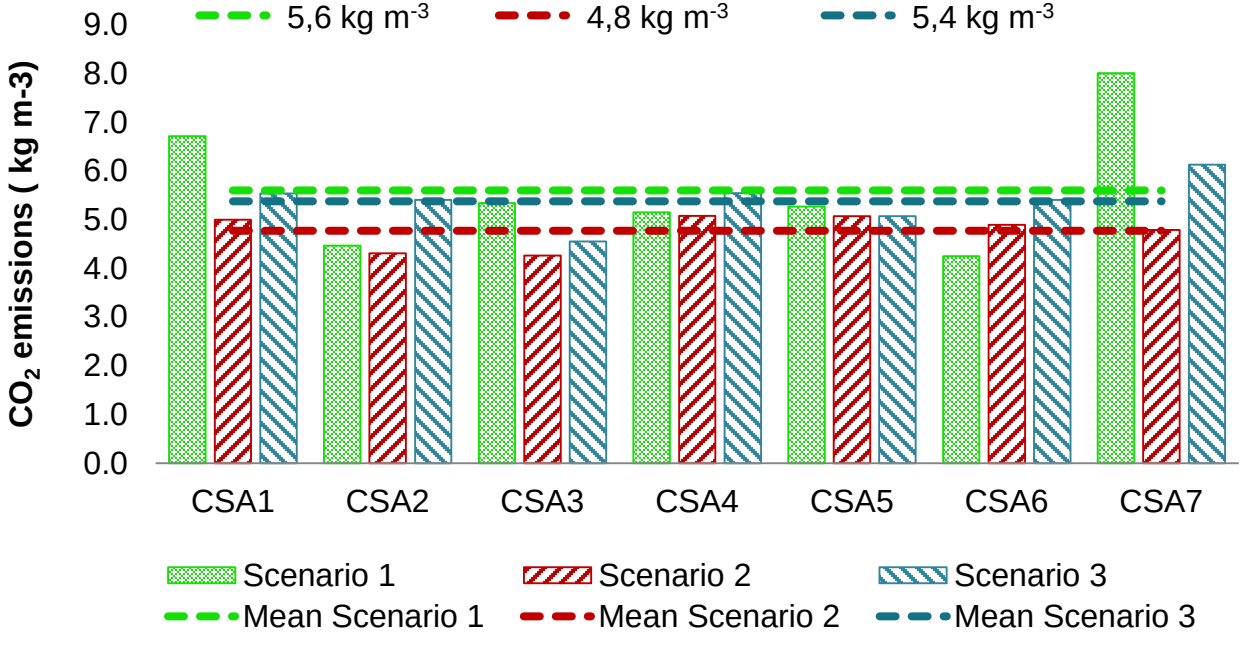
CO_2 emissions



RESULTS – Efficiency gaps

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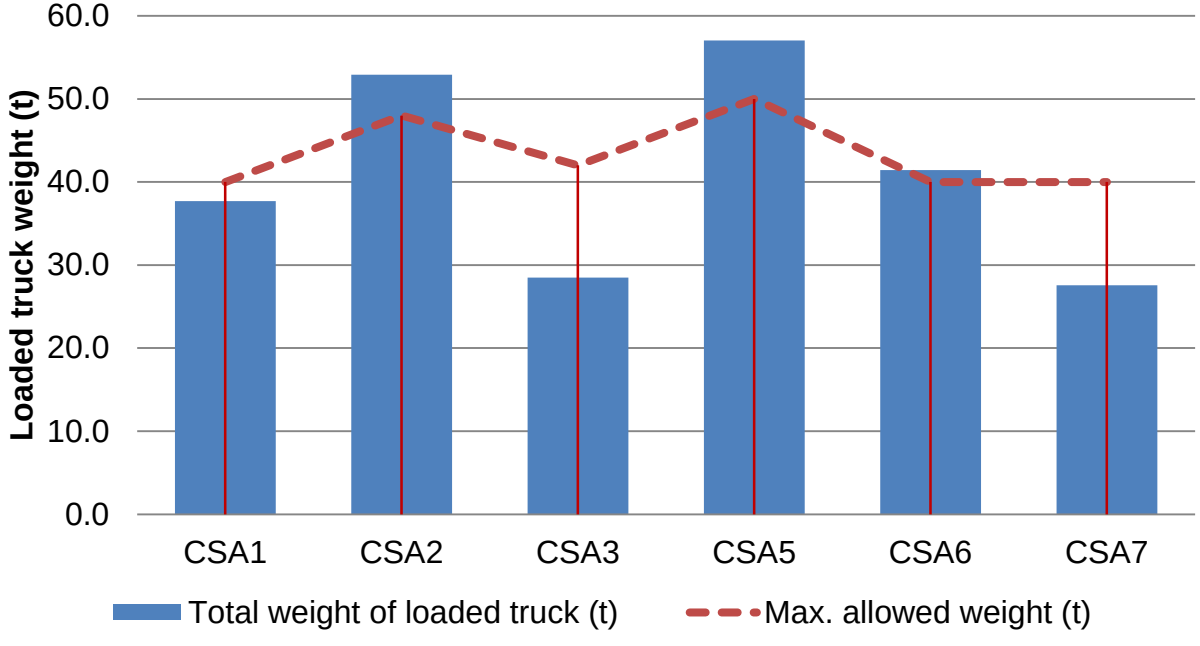
Timber transport (loading capacity)



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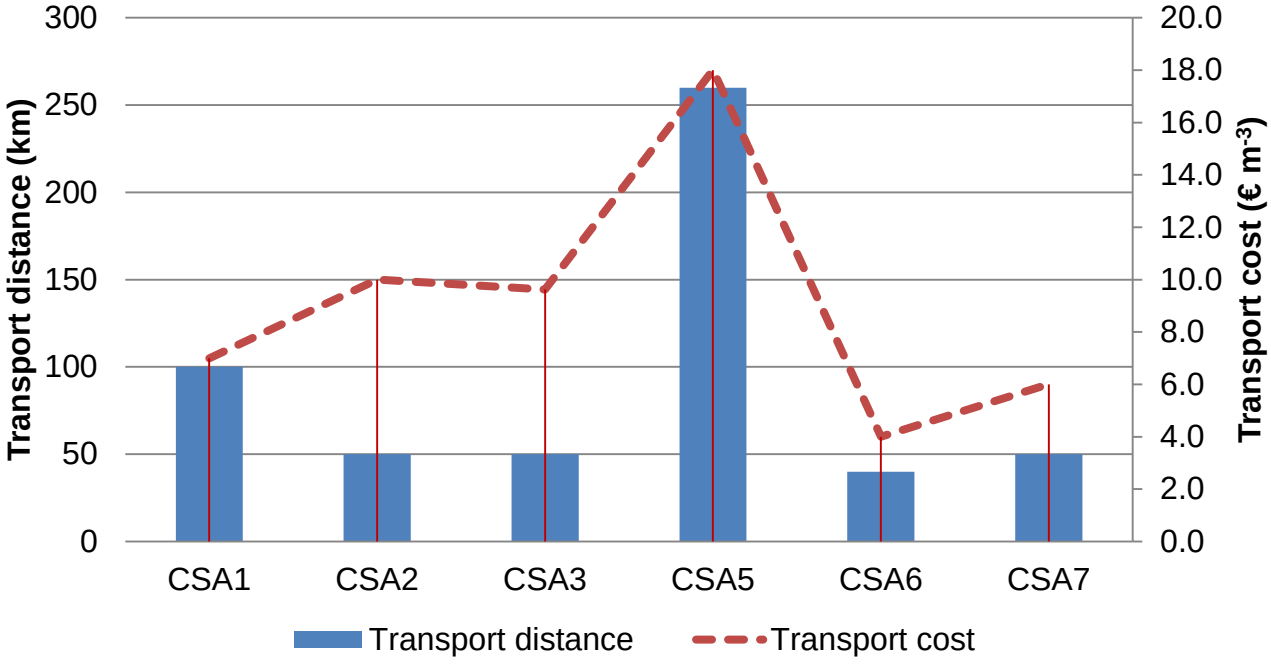
Timber transport (distance & costs)



CONCLUSIONS

Mountain Forests

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- no influence of FM system, terrain topography on selection of HS
- availability and affordability of state-of-the-art HS
- quality of the road network (layout and trafficability)?
- mechanization degree
- transfer of knowledge to practical know-how
- capacity building & training of forest workers

THANK YOU!

Acknowledgments

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