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Long Log Harvesting

by Harvesters and Combination Forwarders

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Structure

1 Objectives

- Forestry administrations confronted with demand for long logs by sawmills in southern Germany
- FVA was requested to investigate influences on productivity, costs and stand damages caused by mechanized harvesting methods providing long logs

2 Materials and Methods

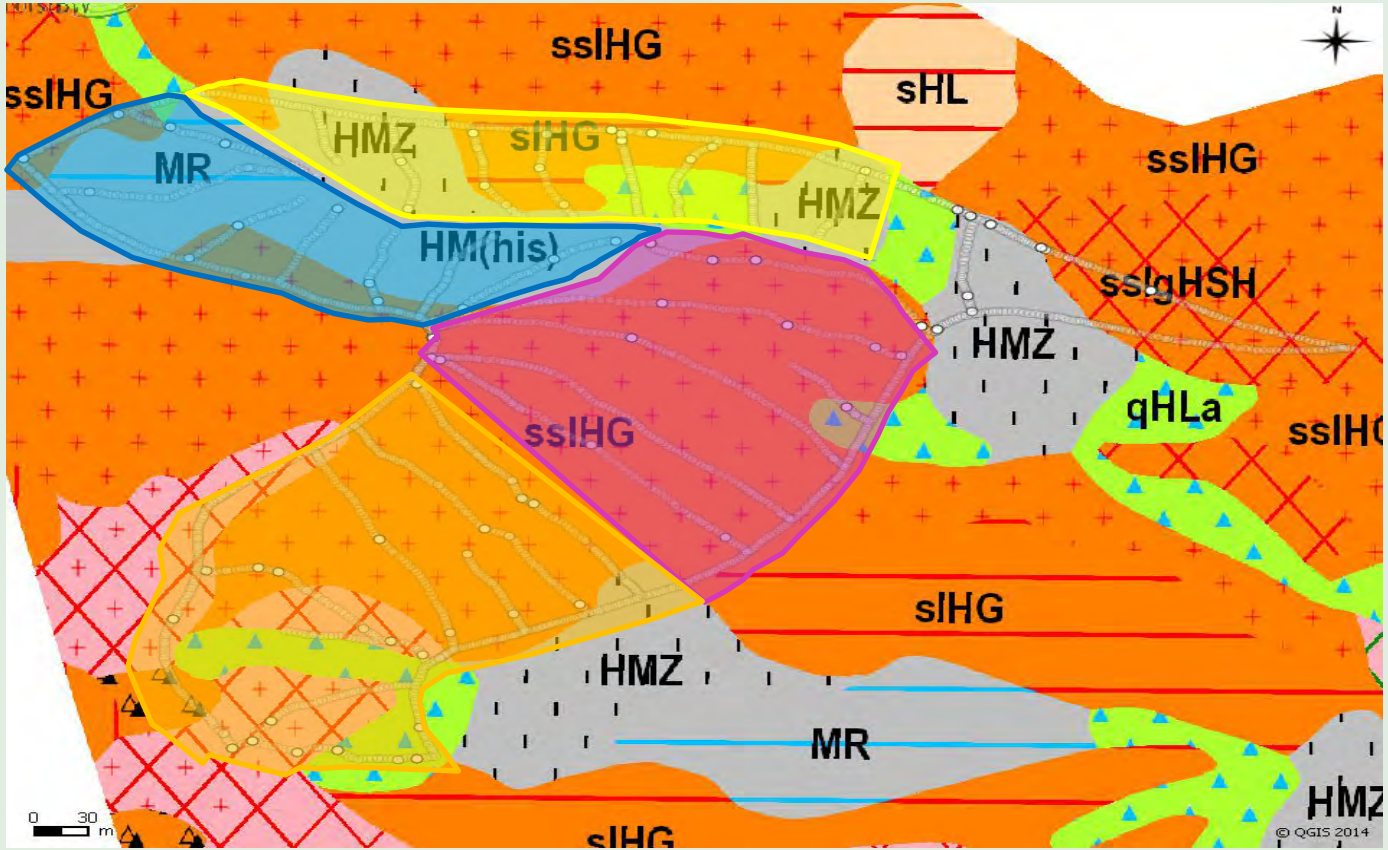
2.1 Operating conditions: Study site

- **Altitude**: 1209 m - 1235 m (southern Black Forest)
- **Stand**:
  - Spruce: 27.2 ha
  - DBH: $\bar{x}$ = 33 cm
  - Age: 67-100, $\bar{x}$ = 87
- **Precipitation (mm):**

period/year	July	August	Source
$\bar{x}$ 1981-2010	**110**	**106**	DWD, 2014
2014	**123**	**133**	Climate-data.org, 2014

- **Slope inclination**: 10 – 20 % / partially 30 %
- **Skid trail distances**: ~ 40 m
- **Cutting intensity**: 81 m³/ha

2.1. Operating conditions: soil types



- In all critical areas for the harvesting trial the soil types provided stable conditions for machine operations
- Only the CTL trial area was partly influenced by weak soil conditions

2.2 Harvesters and forwarders used

Tracked harvester:

Name: Königstiger Kern 30 TSS
Engine power: 251 hp
Weight: 34 t
Crane reach: 15 m
Net lifting capacity: 800 kg (15 m)
Harvester head : Kesla 30 RH
Weight harvester head: 1.4 t
Felling diameter: 670 mm

Wheel Harvester:

Name: John Deere 1470 E IT4
Engine power: 255 hp
Weight: 24.2 t
Net lifting capacity: 120 kg (9.7 m)
Crane reach: 9.7 m
Harvester head : John Deere H 480 C
Weight harvester head: 1.2 t
Felling diameter: 680 mm

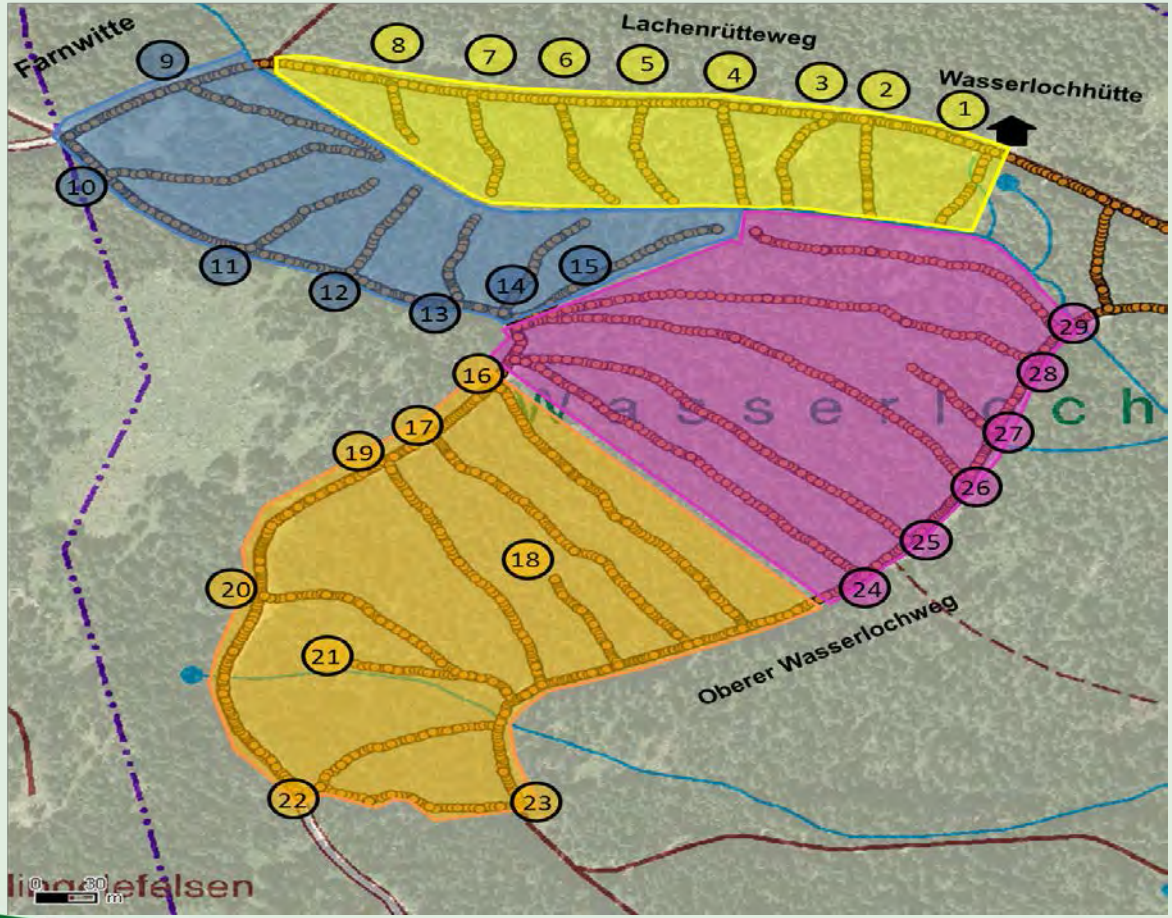
Combination Forwarder (as clambunk skidder):

Name: HSM 208 F Kombi short chassis (8-Wheel)
Engine power: 260 hp
Weight: 20.5 t
Payload: 12 t

Forwarder:

Name: Komatsu Valmet 860.4
Engine power: 197 hp
Weight: 17.7 t
Payload: 14 t

2.3 Variants of logging methods



Wheel Harvester
2.5 ha, short log logging on skid trail 1 - 8

Tracked harvester
2.5 ha, short log logging on skid trail 9 - 15

Tracked harvester
5.5 ha, long log logging on skid trail 16 - 23

Wheel Harvester
5.5 ha, long log logging on skid trail 24 - 29

2.4 Data collection and analysis

- **Time studies based on continous timing method for**
  - motormanual felling (only felling)
  - fully mechanised harvesting (pre-skidding included)
  - skidding
- Calculation of the **productive working hours (PWH_{15})**
- Calculation of the **productive machine hours (PMH_{15})**
- Calculation of the **labour productivity**, the **costs** and the **impact on the residual stand** of the 4 variants

3.3 Roundwood measurement

- Measurements: Length and mean diameter

Fig.1: Long logs in loose stacks on the tracked harvester area before skidding.

Fig.2: Long logs in loose stacks on the wheel harvester area before skidding.

3 Results

3.1 Labour Productivity

m^3 / PMH_{15} m^3 / PWH_{15}	Wheel Harvester		Tracked Harvester	
	short logs	long logs	short logs	long logs
fully mechanised harvesting (pre-skidding included)	27.3	31.4	21.1	27.2
skidding	15.6	20.9	17.7	25.1
motormanual felling (only felling)	9.0	9.0	9.0	9.0
total system	17.3	20.4	15.9	20.4

m^3 without bark

3.2 Costs

€ / m³	Wheel Harvester		Tracked Harvester	
	short logs	long logs	short logs	long logs
fully mechanised harvesting (pre-skidding included)	**6.46**	**5.60**	**8.84**	**6.85**
skidding	**4.96**	**4.75**	**4.20**	**3.94**
motormanual felling (only felling)	**1.92**	**1.92**	**1.44**	**1.44**
total system	**13.34**	**12.27**	**14.48**	**12.23**

3.3 Impact on the residual stand

Impact on the residual stand (%)	Wheel Harvester		Tracked Harvester	
	short logs	long logs	short logs	long logs
ZHB – Procedure	18	25	16	24
Deuschel/F.Sauter – Method (Meng)	19	23	19	26

Removal (%)	23	30	22	28

4 Conclusions

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- **Differences** between the variants in terms of **labour productivity** and **costs** are mainly caused by:
  - **working methods** of the machine operators (especially of the harvester operators)
  - **distribution of the wood quality**
  - **operating conditions**

→ The choice of logging method had only minor influence

- **Differences** between the variants in terms of the impact on the residual stand are mainly caused by:
  - **Sub-process swinging in the long logs** into the skid trails

→ The influence of the logging method was strong, but both methods caused still high damage rates

Thank you for your attention!

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