Productivity of Logbear F4000 forwarder on soils with low bearing capacity

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## Research sites

<table>
<thead>
<tr>
<th>Type</th>
<th>Area, ha</th>
<th>Dominant species</th>
<th>Stand formula</th>
<th>Age in years</th>
<th>D1.3, cm</th>
<th>H, m</th>
<th>Stock, m³ ha⁻¹</th>
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<tbody>
<tr>
<td>Extreme conditions</td>
<td>9.8</td>
<td>Birch</td>
<td>4B41 3S51 2Ba41 1Ash41</td>
<td>46</td>
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Soil bearing capacity (extreme conditions)
Logbear F4000 forwarder
Specifications

- Price in basic setup 150000 €, harvester version 190000 €.
- Width 2.05 m, length – up to 7.2 m, height 2.75 m, weight 4.98 tonnes, load capacity – 4 tonnes (5.5 m³).
- Crane length 6.1 m, distance between stacks adoptable, max. 3.8 m.
Summary of study results

- Duration of monitoring – 700 hours
- Average fuel consumption – 4.93 ± 0.26 L per hour (0.7 L m\(^{-3}\)).
- Average load (data on 848 m\(^3\)):
  - full loads of sawlogs – 4-4.3 m\(^3\);
  - full loads of pulpwood and firewood – 3.6-3.7 m\(^3\).
- Average driving speed – 2.7 km h\(^{-1}\).
- Results of time studies (in extreme conditions):
  - average load – 3.4 m\(^3\);
  - forwarding distance – 270 m;
  - consumption of productive time:
    - loading in – 15.5 min. per load (4.56 min. m\(^{-3}\));
    - loading out – 4.7 min. per load (1.38 min. m\(^{-3}\));
  - productive time – 84%;
- Average productivity – 7 m\(^3\) per work hour.
Comparison with average productivity figures in state forests

- Average forwarding productivity of companies providing service to JSC “Latvia state forests” in 2015 (at least 50% of logs extracted in bad & extreme conditions) – 6.8 m³ per hour, average forwarding distance 620 m;

- Productivity of Logbear F4000 in the same conditions - 5.2 m³ per hour.
Prime cost of forwarding

- Average cost of forwarding in 270 m distance is 6.8 € UB m⁻³. Prime cost is heavily affected by the conditions of central strip-roads.
- Average cost of forwarding (with no reference to conditions) in thinning in Latvia in 2015 was 6.14 € UB m⁻³.
- Operational costs were increased in 2016 due to unexpected damages of tracks (12000 €).
Factors affecting forwarding cost

![Graph showing the relationship between forwarding distance and roundwood production and delivery costs.](image)

![Graph showing the relationship between productive hours worked annually and cost.](image)
Another opportunity to reduce costs – load transfer at a stand side or use of trailer

Impact of load transfer on forwarding cost, € m⁻³

Forwarding distance, m

Forwarding cost, € m⁻³
Conclusions & recommendations

- Productivity of Logbear F4000 forwarder is by 23% smaller in comparison to average values in thinning due to long forwarding distance. If forwarding distance is below 400 m, the F4000 productivity is comparable with the average values.

- In spite of high operational expenses forwarding cost using F4000 is competitive with average service cost in extreme conditions in JSC “Latvia state forests”.

- Utilization of light harvesters (Vimek 404 or similar) together with Logbear F4000 can lead to significant increase of productivity in thinning without increasing soil damages.

- Transfer of load and additional trailers should be considered to reduce cost in case of long forwarding distance.

- Use of F4000 as rescue solution after unsuccessful operations of wheeled forwarders should be avoided!!!