Cutting Productivity of Windfalls in Finland

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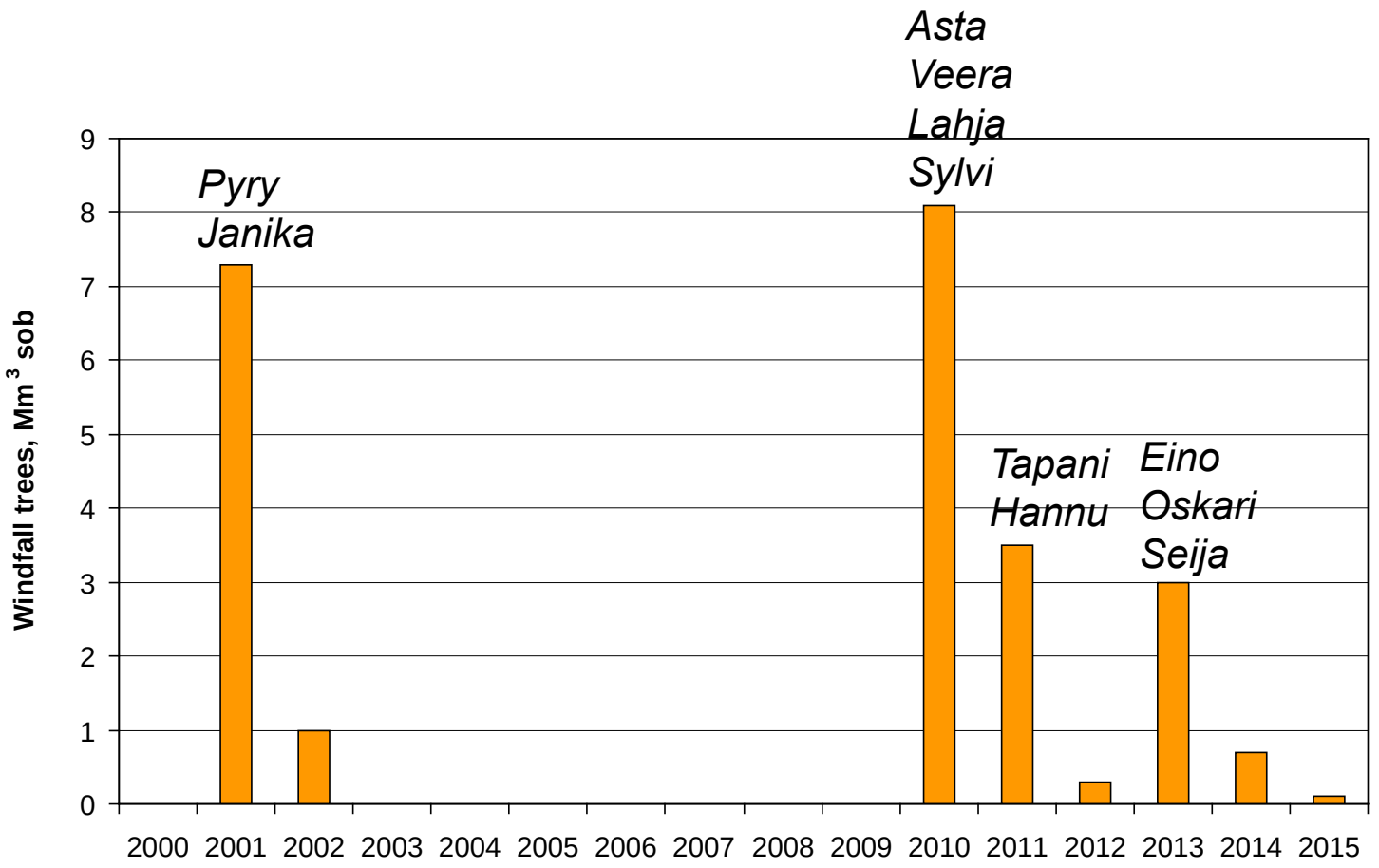
Photos: Tuomas Anttonen.

Reasons for Our Study

1) *Damages caused by big storms for Finnish forests during the 2000´s*



Sources: Finnish Forest Research Institute, Finnish Forest Centre.

Reasons for Our Study

1) Damages caused by big storms for Finnish forests during the 2000's.
2) No studies of windfall salvaging in Finland.

   Many windfall salvaging studies internationally, e.g.

   in Switzerland by Hagauer
   in the Czech Republic by Dvořák
   in Italy by Magagnotti et al.
   in Poland by Szewczyk et al.
   in Norway by Talbot et al.
   in Sweden by Bergkvist and Sondell.

Reasons for Our Study

1) Damages caused by big storms for Finnish forests during the 2000's.
2) No studies of windfall salvaging in Finland.
3) The Trade Association of Finnish Forestry and Earth Moving Contractors: Wood harvesting costs of windfalls **typically 30–70% higher** than from normal loggings.

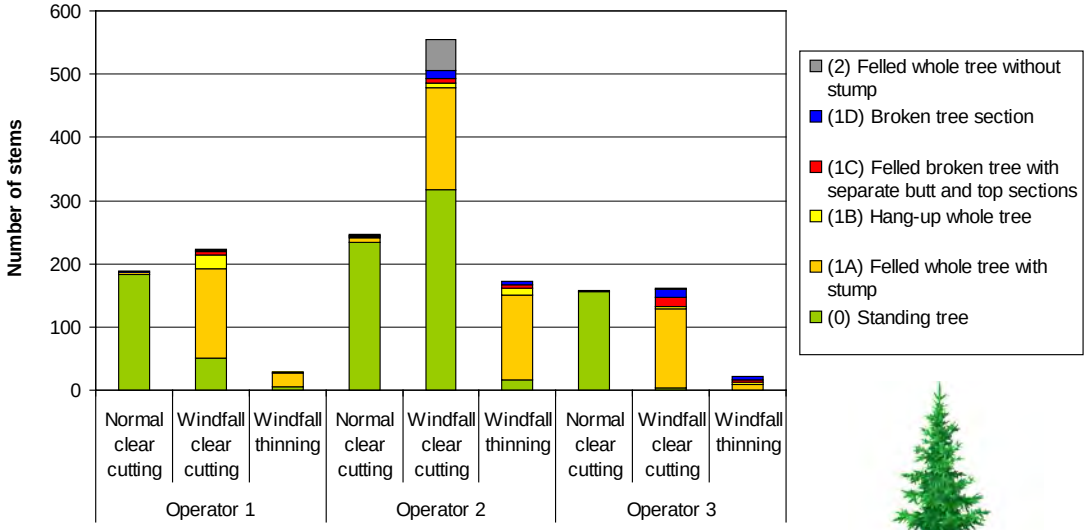
M&M (1/2)

- Time-study data collecting in December 2013 after the Eino and Seija storms.
- **Comparative time study**:
  - Three harvesters (John Deere 1270D/H414, Logset 8H/TH 75X and Ponsse Ergo/H73), as well as three harvester operators.
  - The same harvesters/operators cut **also normal standing trees of clear cuttings**.

M&M (2/2)

- Cutting work was recorded on video, and the time study was carried out **by analyzing the video material** by a new tool developed by Ari Laurén.
- **Damage type** was attached for all stems processed in the time study.
- Final study material for stem processing modeling was **1,088 trees**.
- Stem processing time was modeled by applying non-linear regression analysis with the stem volume and windfall dummy as the independent variables.

Total Data (1,751 trees) by Operator, by Cutting Method and by Damage Type



(2) Felled whole tree without stump

(1C) Felled broken tree with separate butt and top sections

(1B) Hang-up whole tree

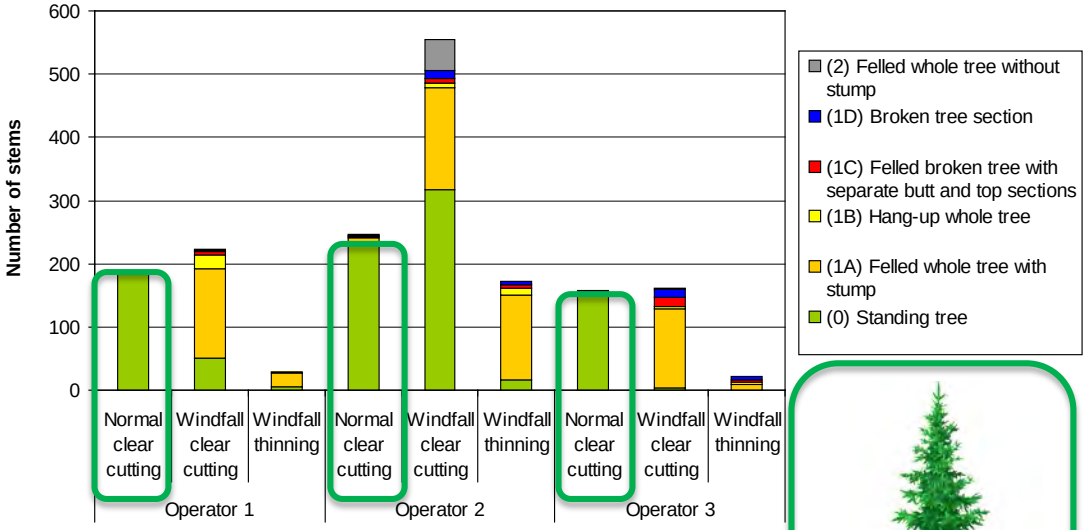
(0) Standing tree

(1A) Felled whole tree with stump

Tree drawings: Laura Noponen.

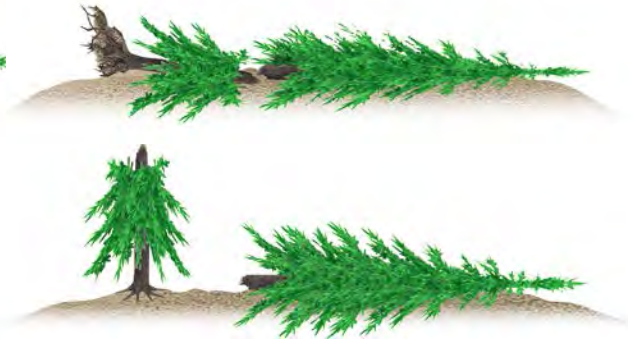
Total Data (1,751 trees) by Operator, by Cutting Method and by Damage Type

Modeling stem processing time in normal clear cuttings:



(0) Standing tree

(2) Felled whole tree without stump



(1C) Felled broken tree with separate butt and top sections

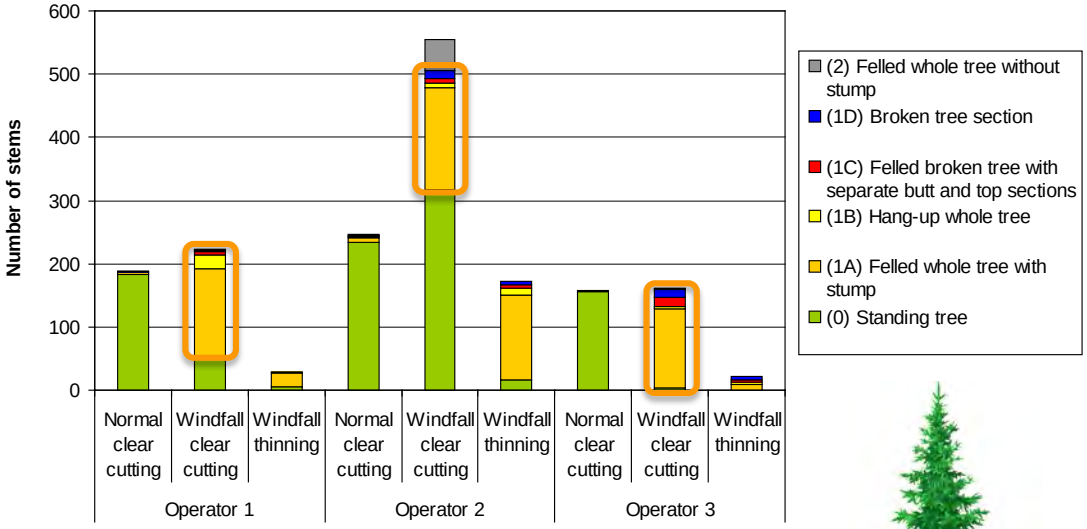
(1B) Hang-up whole tree

(1A) Felled whole tree with stump

Tree drawings: Laura Noponen.

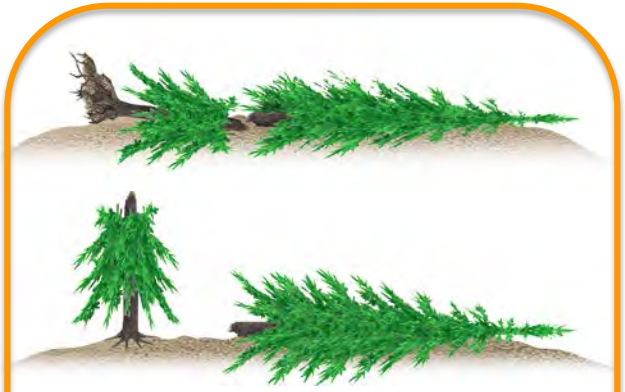
Total Data (1,751 trees) by Operator, by Cutting Method and by Damage Type

Modeling stem processing time in windfall clear cuttings:



(2) Felled whole tree without stump

(0) Standing tree



(1C) Felled broken tree with separate butt and top sections

(1B) Hang-up whole tree

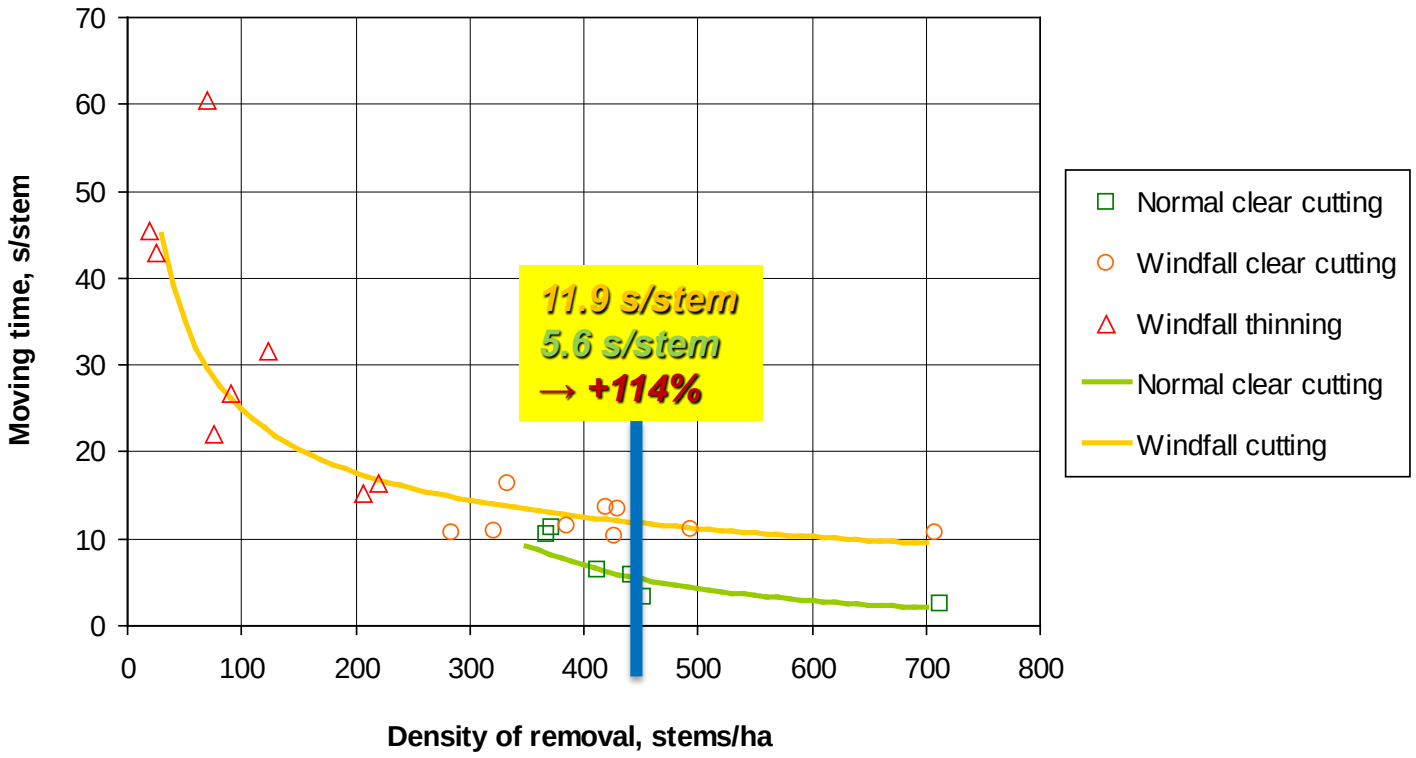
(1A) Felled whole tree with stump

Tree drawings: Laura Noponen.


Highlights of the Study

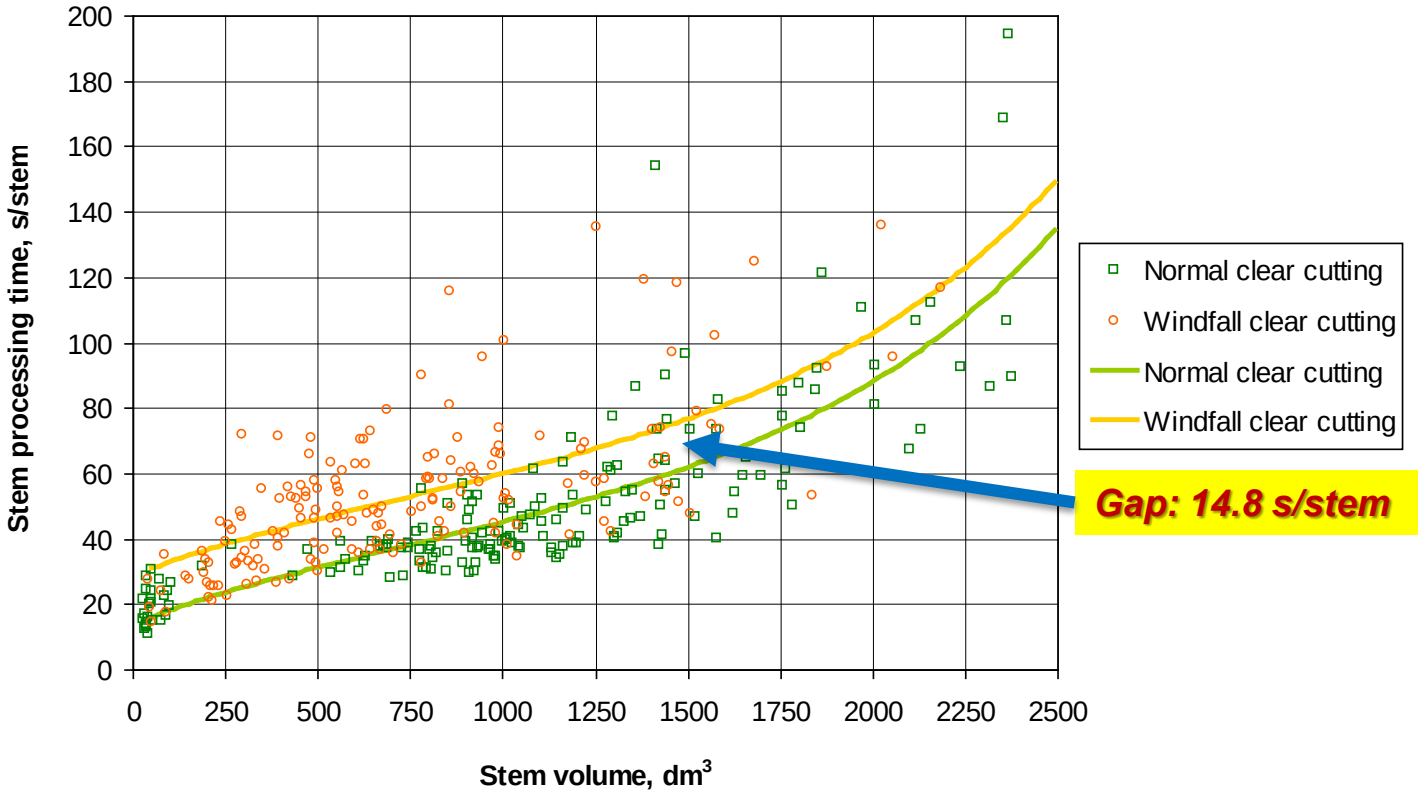
Time Consumption in Cutting of Windfalls

Modeling of moving time



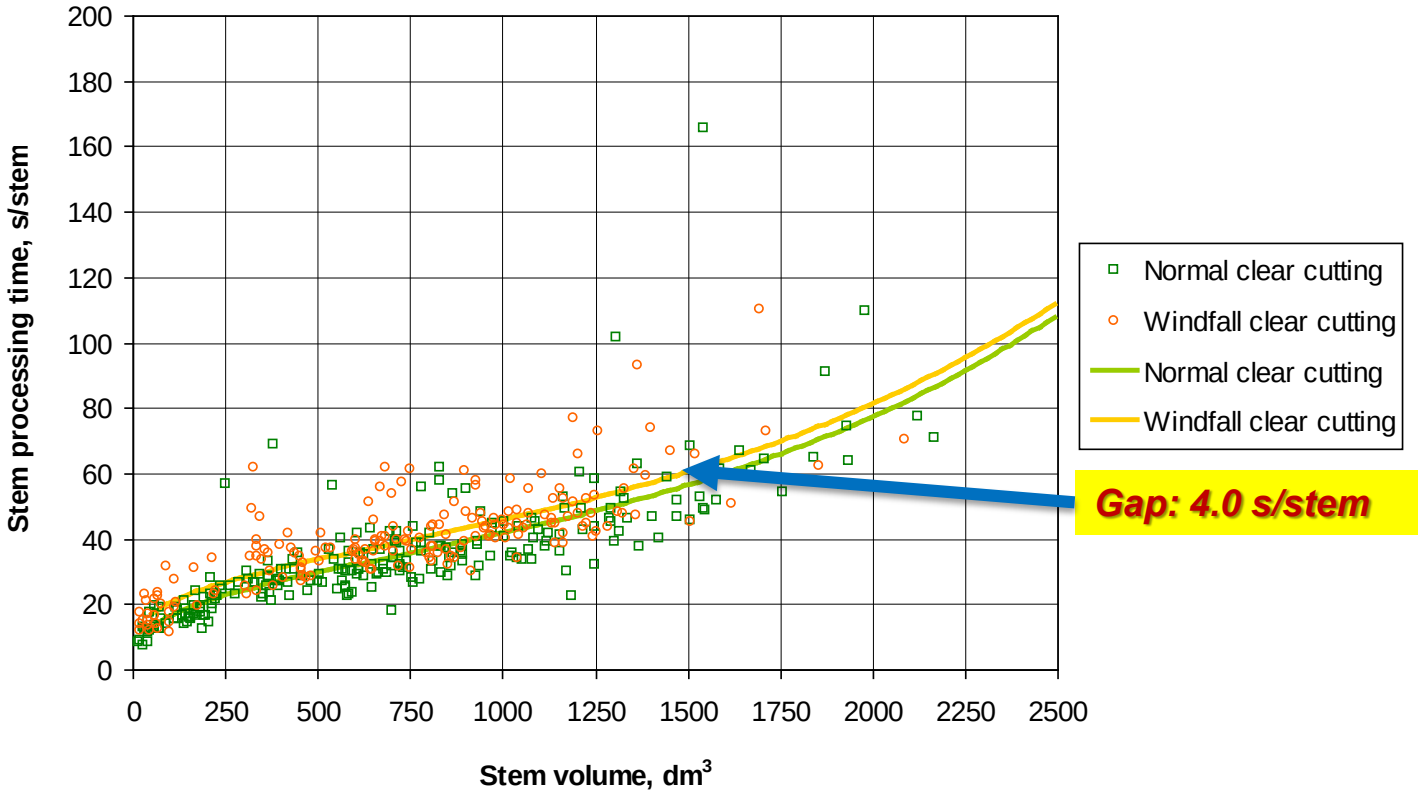
Time Consumption in Cutting of Windfalls

Modeling of stem processing time; Operator 1



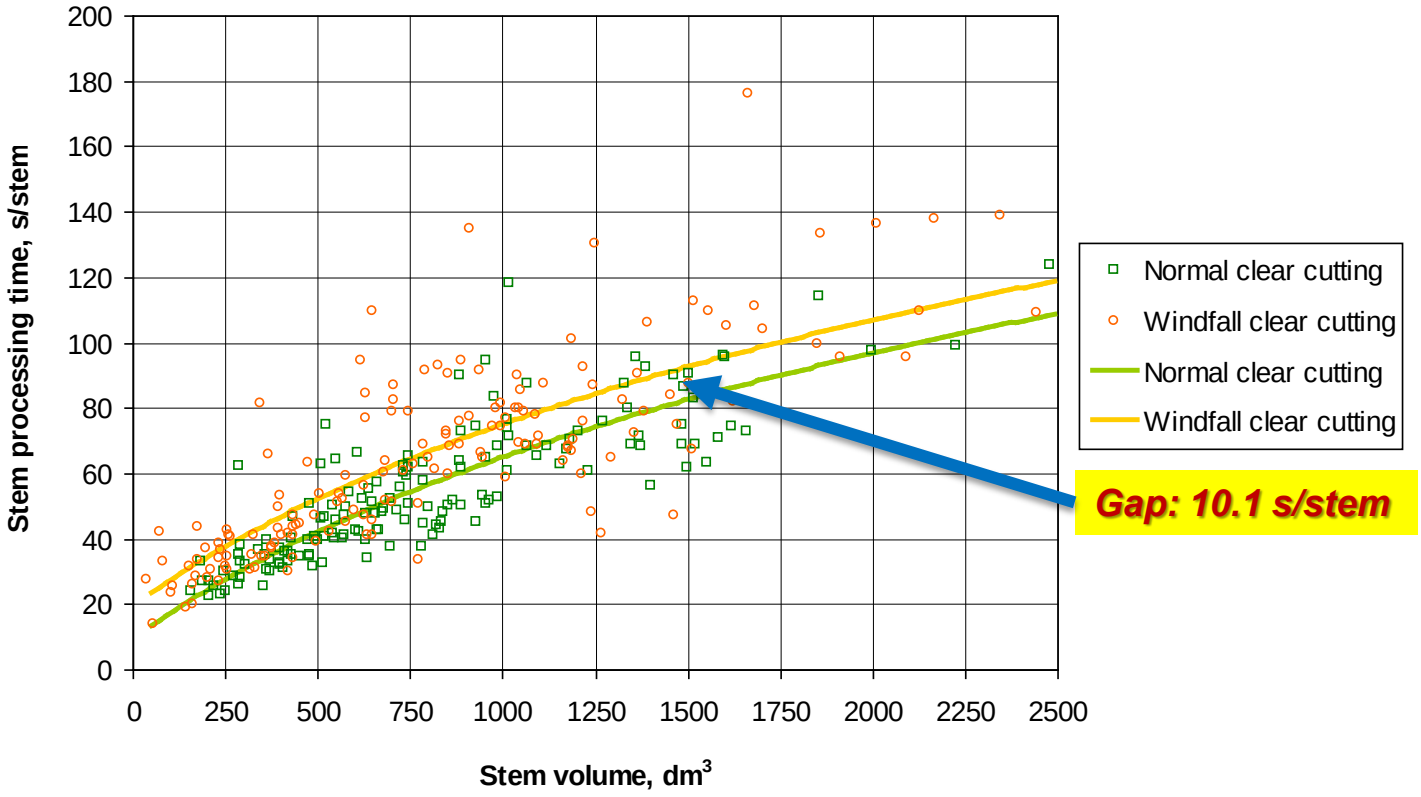
Time Consumption in Cutting of Windfalls

Modeling of stem processing time; Operator 2



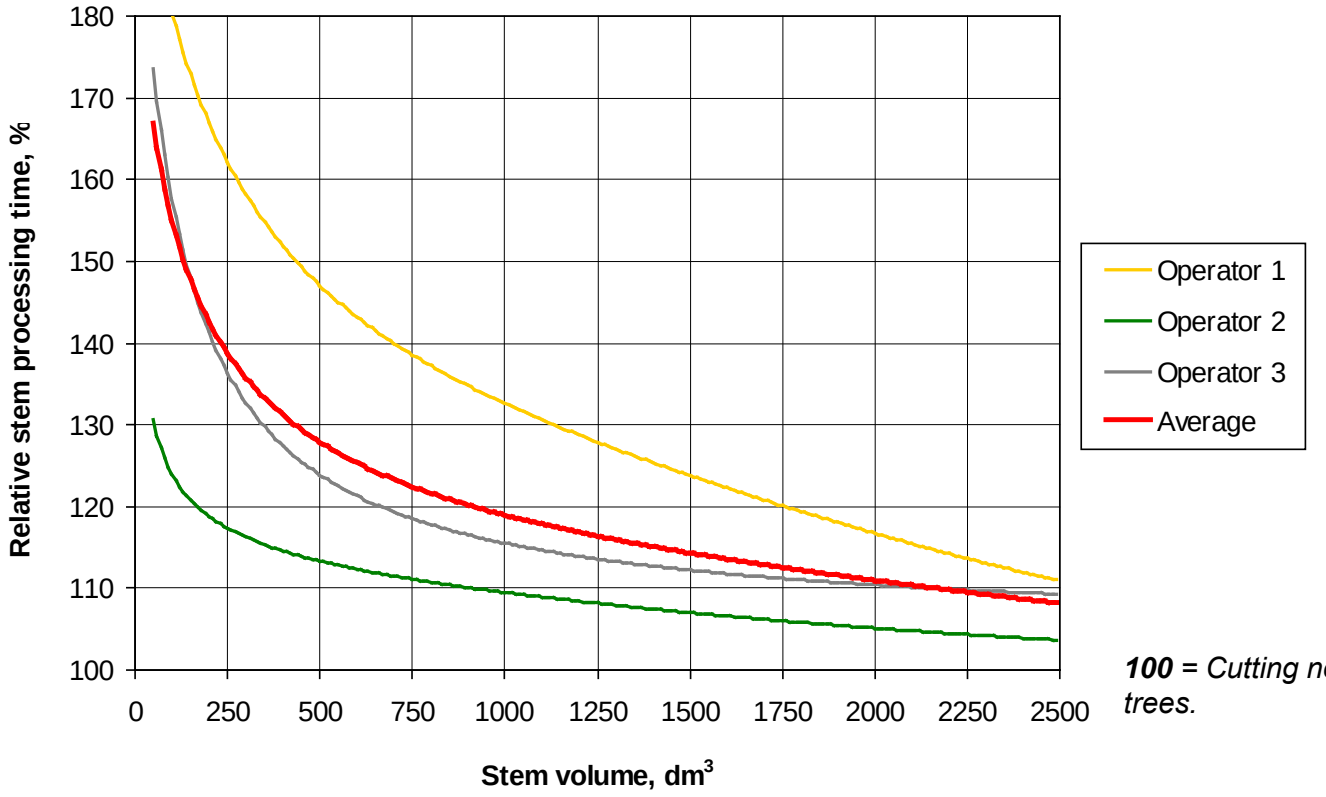
Time Consumption in Cutting of Windfalls

Modeling of stem processing time; Operator 3



Time Consumption in Cutting of Windfalls

Relative stem processing time by operator

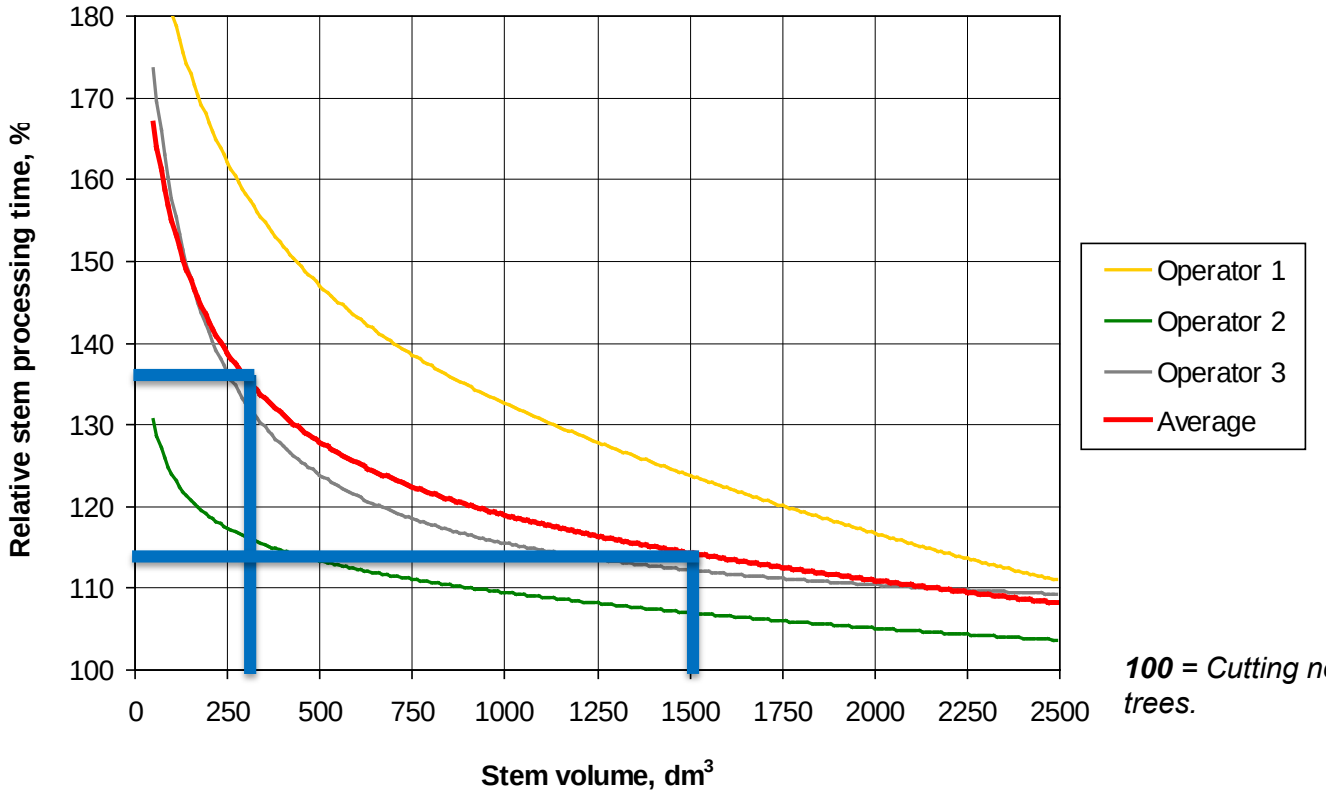


***100** = Cutting normal standing trees.*

Time Consumption in Cutting of Windfalls

Relative stem processing time by operator

+14–36%



***100** = Cutting normal standing trees.*

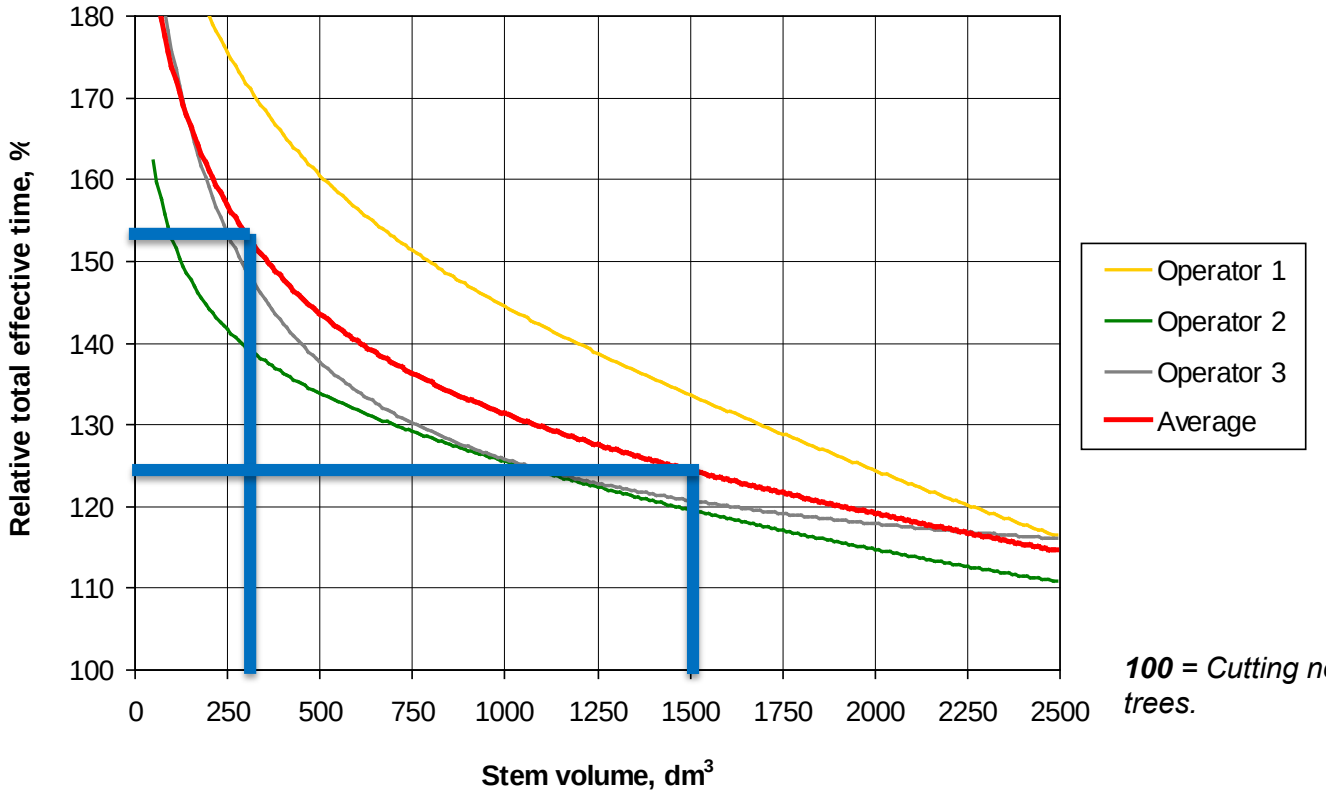
Summary of Time Consumption in Cutting of Windfalls

- **Moving time:** +114%.
- **Stem processing time:** +14–36%.
- **Miscellaneous time:** +147%.
  with cutting windfall stems 3.7 s/stem, with normal standing trees 1.5 s/stem.
- **Total effective (E_0) time:**
  24–53% higher compared to cutting normal standing trees (300–1,500 dm^3).

Time Consumption in Cutting of Windfalls

Relative total effective (E_0) time by operator

+24–53%



***100** = Cutting normal standing trees.*

Cutting Productivity and Costs of Windfalls, as well as Harvesting Costs of Windfalls

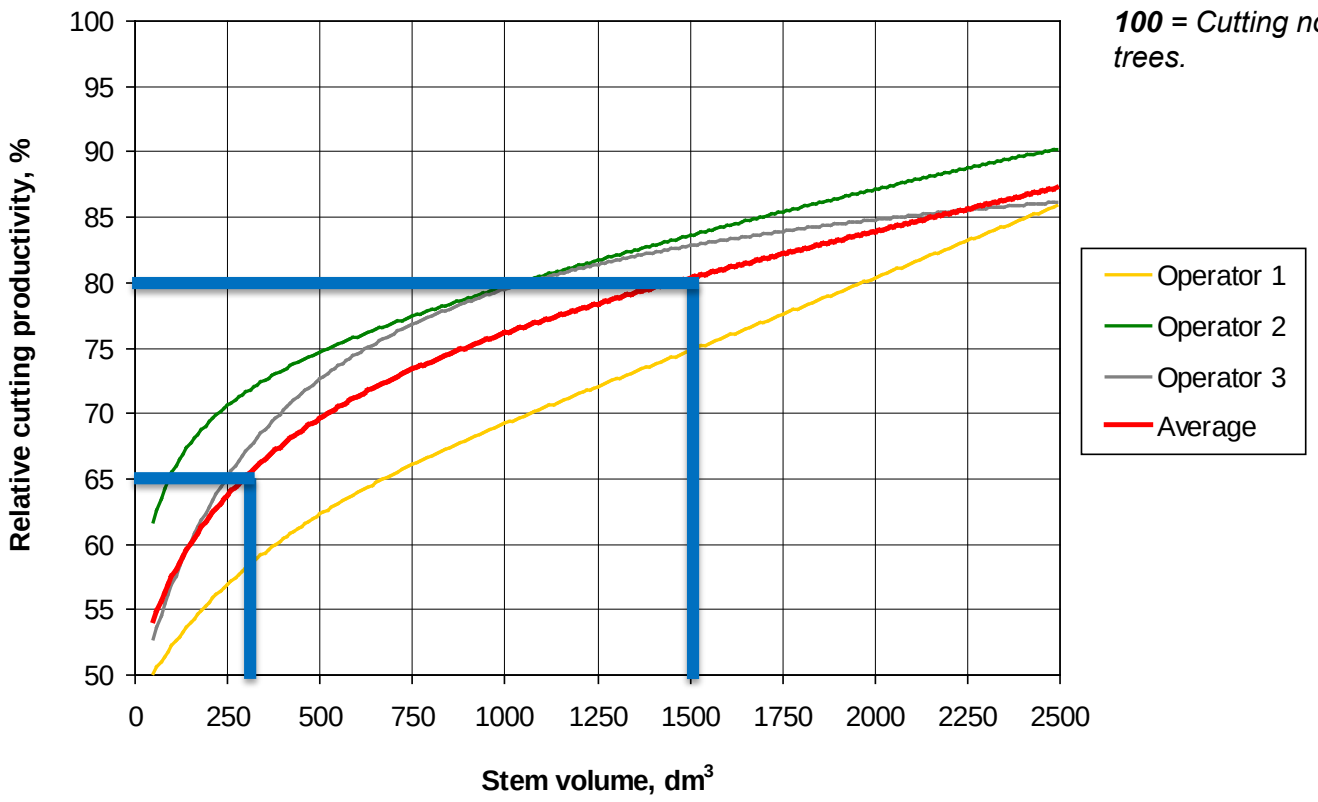
- **Cutting productivity:** -20–35%.
- **Cutting costs:** +31–61%.

  (On the presumption that **operating (E_{15}) hour costs of harvester in cutting windfalls are 5%** higher than cutting normal final fellings).
- **Harvesting costs:** +11–34%.

  (On the presumption that **no effect on forwarding productivity and costs** in forest haulage of windfall timber).

Cutting Productivity of Windfalls by Operator

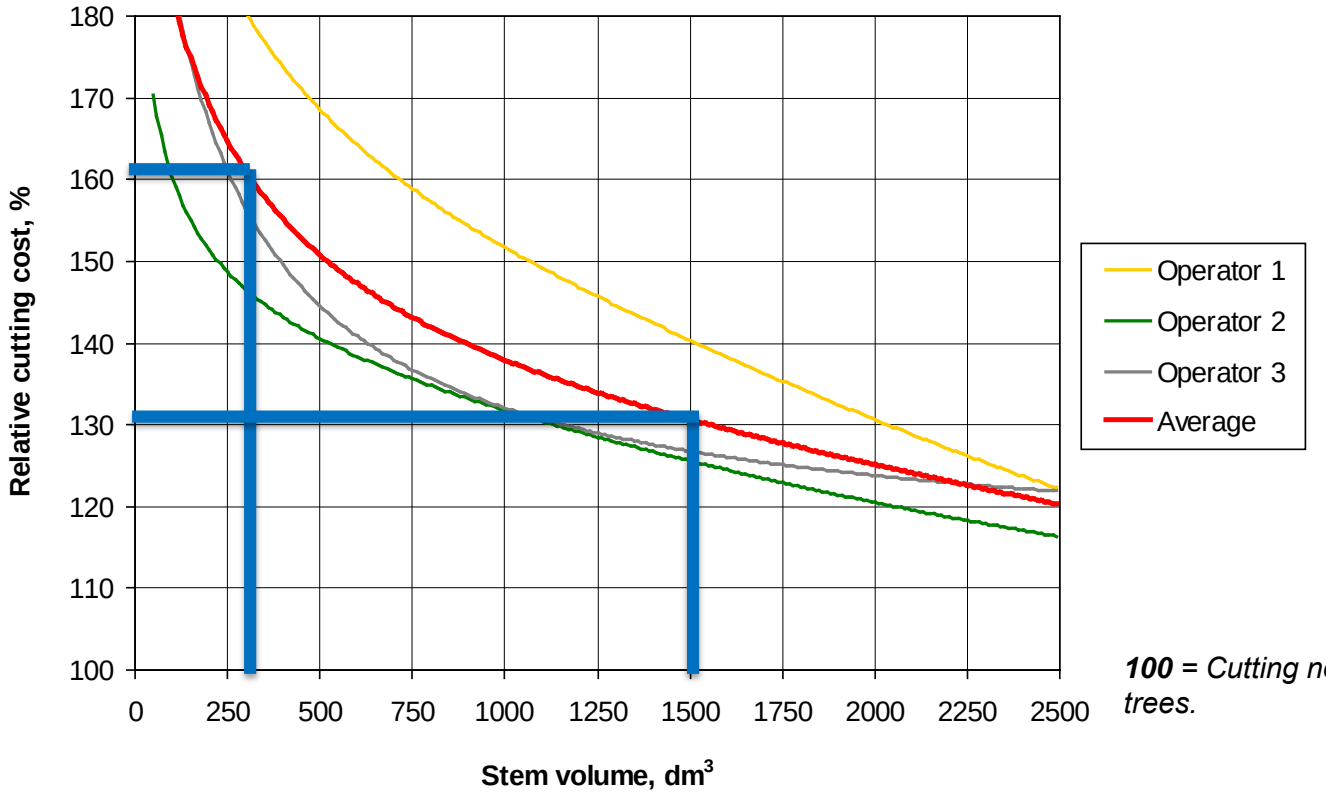
-20–35%



***100** = Cutting normal standing trees.*

Cutting Costs* of Windfalls by Operator

+31–61%

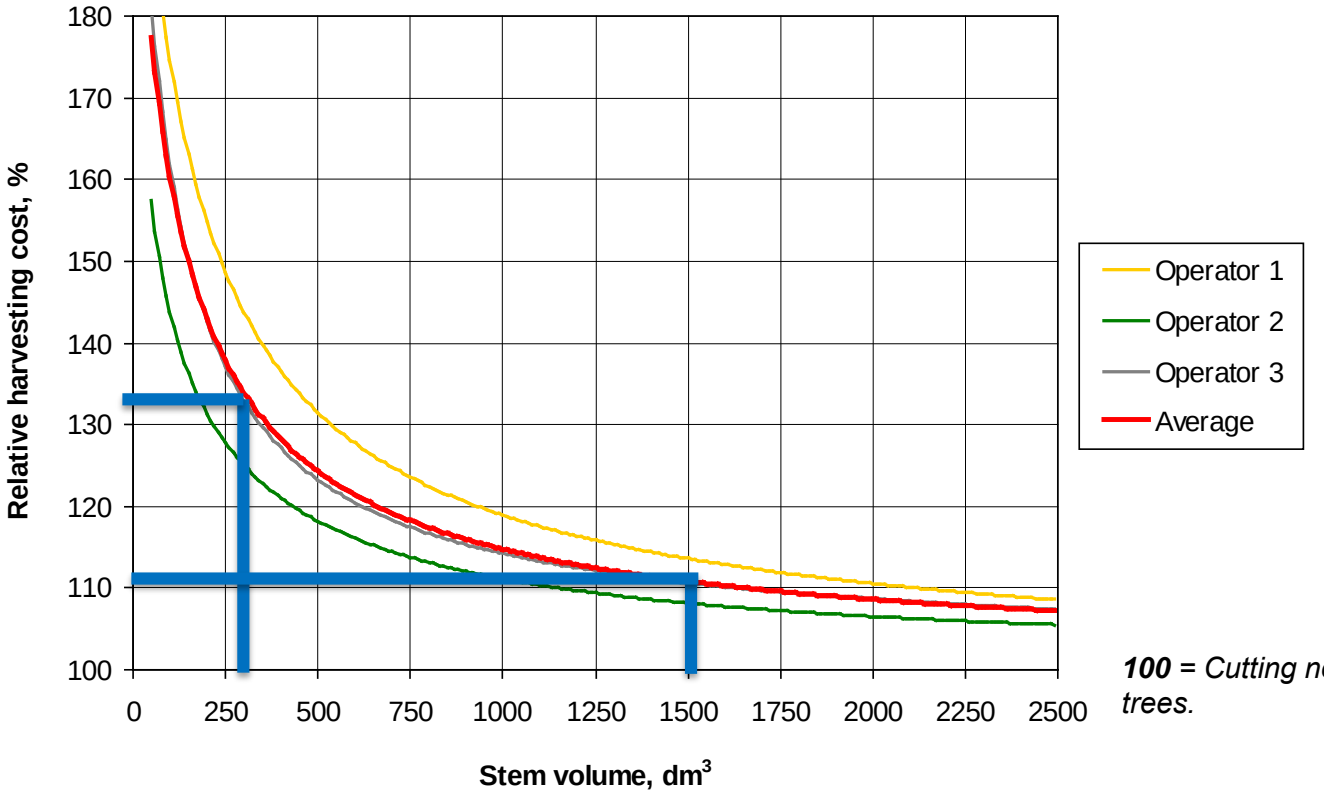


***100** = Cutting normal standing trees.*

) On the presumption that **operating (E_{15}) hour costs of harvester in cutting windfalls are 5% higher than cutting normal final fellings.*

Harvesting Costs** of Windfalls

+11–34%



***100** = Cutting normal standing trees.*

***) On the presumption that **no effect on forwarding productivity and costs** in forest haulage of windfall timber.*

Conclusions

- After the Eino and Seija storms **cutting productivity of windfalls** was, on the average, **20–35% lower** than those of cutting normal standing trees.
- Consequently, cutting costs were 31–61% higher and wood **harvesting costs** were **11–34% higher**.

  N.B. *The Trade Association of Finnish Forestry and Earth Moving Contractors: Wood harvesting costs of windfalls are* ***typically 30–70% higher.***
- More time studies with more operators/harvesters in different harvesting conditions are needed in the future.

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