

## Emerging harvesting technologies and sector analysis

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Or, what effect does some sectorial circumstances have on harvesting technologies?

And the other way around

What effect have the harvesting technologies on forest sector analyses?



## The forest machine sale as an indicator for analyses

A Swedish example



#### In total 2.053 billion m<sup>3</sup> solid volume under bark of saw logs and pulpwood was harvested in Sweden during 1975 to 2012





### In total 12602 forwarders was sold in Sweden during 1975 to 2012









14

### The number of forwarders solid for each million m<sup>3</sup> of saw logs and pulpwood harvested during 1975 to 2012





14

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What general effect will low energy prices have on the harvesting technique?

1 Systems with a high productivity, but with an even higher energy consumption will be favoured.

2 The rate of recovery will be low since it will not be economic to utilize any energy assortment

Examples...



The productivity in helicopter logging is high, perhaps 40-60 m<sup>3</sup>/hour if the trees are big



However, the fuel consumption Is also big, up to 3m<sup>3</sup> of fuel per hour, or 50 – 75 l of fuel for each m<sup>3</sup> of wood harvested in many cases This vehicle is the whole time located at the landing, and a new vehicle comes before it is totally empty



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# What effect will low labour cost have on the harvesting technology?

Low labour cost will give a low level of mechanization, and there is often also a high correlation with bad working conditions

#### A forwarder in South Africa, what is strange with this machine?



#### No loader on this forwarder, and it is built on a dump truck. How load the logs on the truck then?



### For some years ago loaded by hand, but now with a cheap machine that "God has forgotten"



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#### They are still produced, and it is possible to buy a 2016 year model if you want!



#### In such a situation with extremely low salaries, what could be the economic reason for the in fact ongoing mechanization?





The reason is lack of labour. About 33% of the working force is HIV positive, and this is also a possibility for female workers to get more qualified (and better payed) work.

The experience is that female workers less often than male workers get lost due to AIDS.



On the other hand:

What effect will a combination of a high wood demand, high salary levels and high energy prices have on harvesting technologies?

Utilization of all kind of forest biomass, automation and robotisation



## To start with, the demand for harvesting in steep terrain increases

### A thinning operation in real steep terrain. The harvester is anchored with a purpose built winch



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#### The forwarder on its way to go down the same strip road, also anchored



#### A stable anchoring tree should be chosen!





Technique will be developed to utilize the today not utilized types of forest biomass

![](_page_29_Picture_0.jpeg)

#### **Automation and robotisation**

#### **Example: Flying drones**

![](_page_29_Picture_3.jpeg)

![](_page_30_Picture_0.jpeg)

A map of a storm damaged area created by overlapping photos from a flying drone.

Wind thrown trees marked as well as areas for clear felling.

This map is then transferred into the GIS/GPS system of the harvester Similar technique is also needed in automation and robotisation of harvesting machines

#### **ROBOTIC VISION**

#### Terrestrial Laser Scanning technology Used in pre-harvest timber measurement operations

![](_page_31_Picture_3.jpeg)

![](_page_32_Picture_1.jpeg)

![](_page_33_Picture_1.jpeg)

![](_page_34_Picture_1.jpeg)

![](_page_35_Picture_0.jpeg)

![](_page_36_Figure_1.jpeg)

![](_page_37_Picture_1.jpeg)

![](_page_38_Picture_1.jpeg)

![](_page_39_Picture_0.jpeg)

#### My conclusion is:

Sectorial circumstances have on effect on harvesting technologies chosen

But....

Harvesting technologies are not constant and can for sure have on important effect on forest sector analyses

And...

## SLU Current situation: More and more wood in Europe!

![](_page_40_Figure_1.jpeg)

**Figure.** Growing forest stock in Europe, excluding former Soviet Union, from 1980 to 2010.

## SLU Current situation: More and more wood in Europe!

![](_page_41_Figure_1.jpeg)

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![](_page_42_Figure_1.jpeg)

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SLU

# The End

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![](_page_45_Figure_0.jpeg)

Forest industries become larger and Larger, meaning that the transportation Distances to industries become Longer and longer

This also mean that the need and Importance of terminals is growing

#### An example on a terminal at a harbour

![](_page_46_Picture_1.jpeg)

### Storage and reloading on trucks, trains and boats can be done at This terminal

![](_page_47_Picture_1.jpeg)

When possible to use, ground based systems have proven to give better economy than different kind of sky-line or cable systems that traditional has been the only realistic alternative in steep terrain.

![](_page_48_Picture_1.jpeg)

![](_page_49_Picture_0.jpeg)

In the short time perspective: Why bother about harvesting anything that is difficult to reach when the supply appear to be infinitely? (economically, technically, environmental, political).

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In the long time perspective: The raw material base for a new bioeconomy is created just in front of our eyes. If the demand of wooden material increases and harvesting and transportation technique prove to solve utilization with a "good enough" economy and environmental concern, then such an utilization will be political supported.