

# Integration of Wood Fuel Utilization in Forest Management Practice

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# Basic information about Swedish forestry

Annual cut: 85 million m<sup>3</sup> on bark

Dominating species: Norway spruce and  
Scotch Pine

A lot of rough terrain

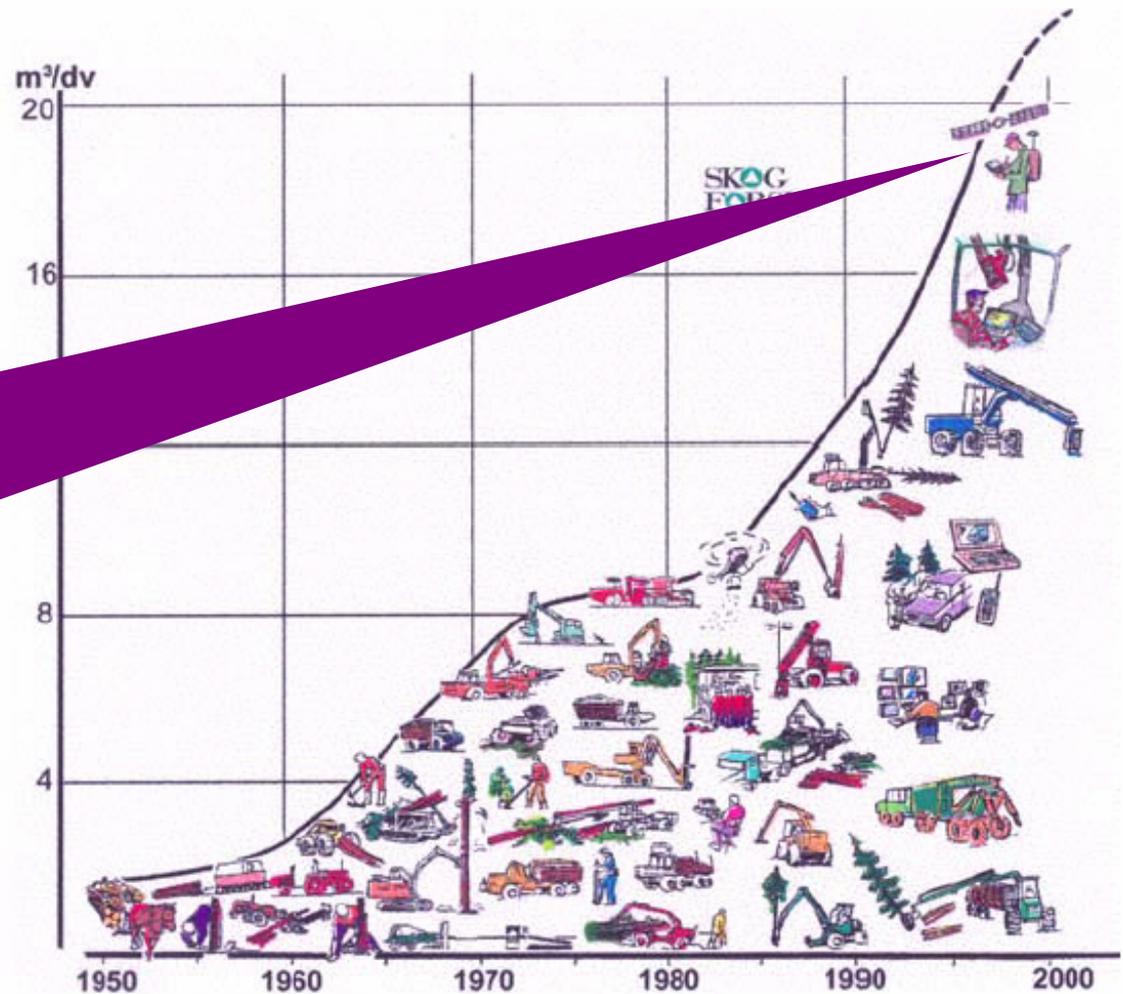
Almost 100 %:

- Cut-to-length system
- Mechanization

Planting is the dominating regen-method

## Productivity and technological development in Sweden 1950-2000

(m<sup>3</sup> per worker day)



Increased productivity 1995 -> is to a large part explained by IT implementation in management planning and wood supply governance

Source: Skogforsk

Note: m<sup>3</sup>/dv = m<sup>3</sup>/worker day

# *Continuation: Basic information...*

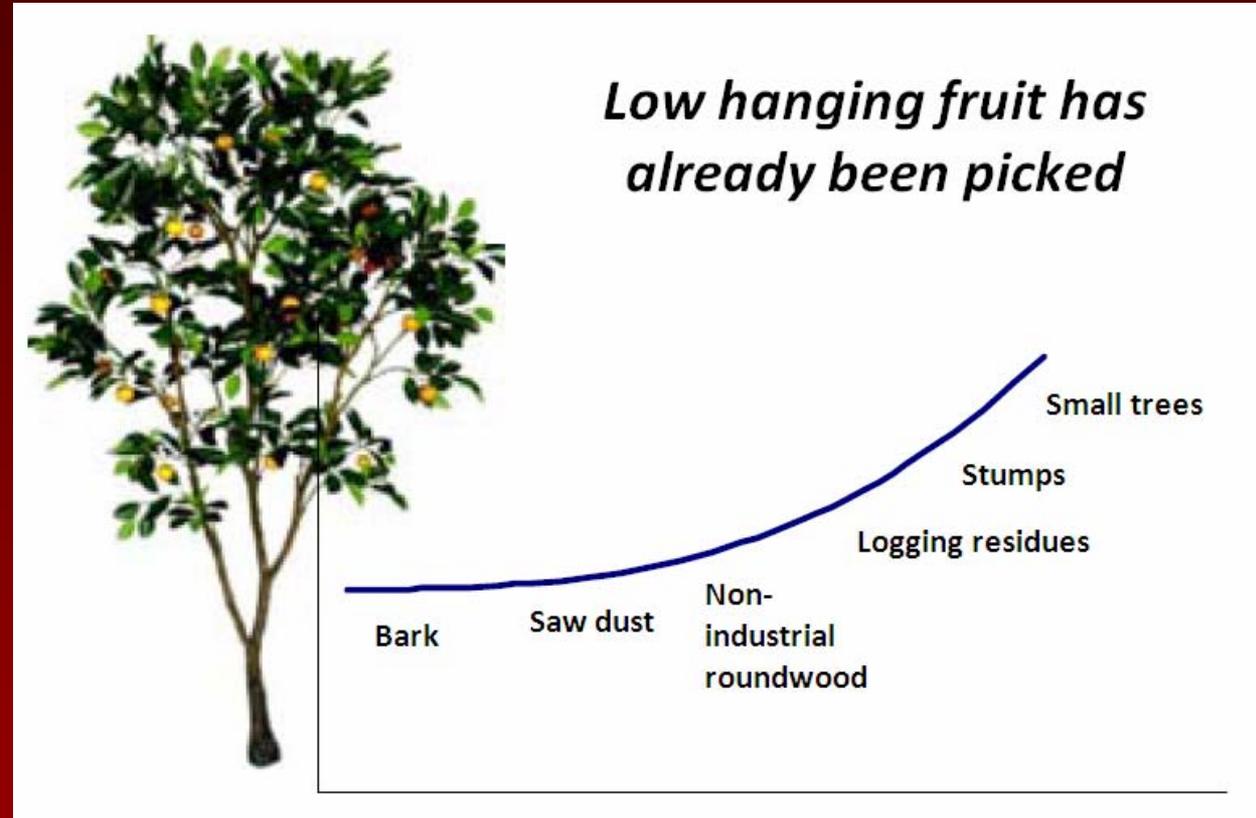
## Owner structure:

- 50 % private (a lot of these people have strong emotional ties to their properties)
- 25 % state
- 25 % corporations

As private ownership is so common wood procurement organizations are dependent on their wood and they compete with service besides prices.

# Development of utilization

- Low hanging fruit (mill residues, low quality roundwood etc.) has already been picked
- Large quantities
- The lowest cost among primary wood fuels
- Silvicultural benefits



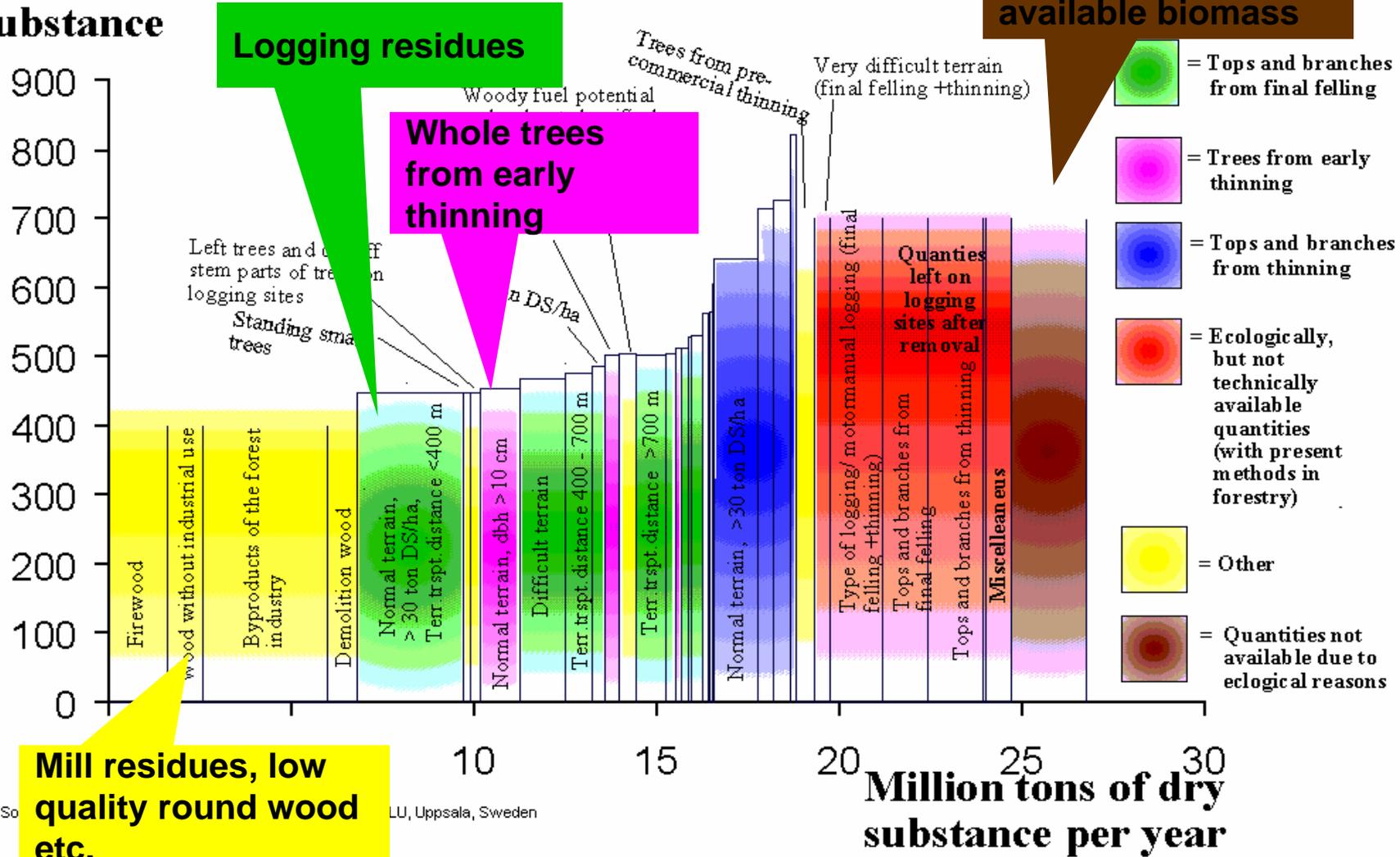
Picture: Rolf Björheden,  
SkogForsk

# Potential Wood Fuel Supply

SEK/ton dry substance

(diagram is from 1998)

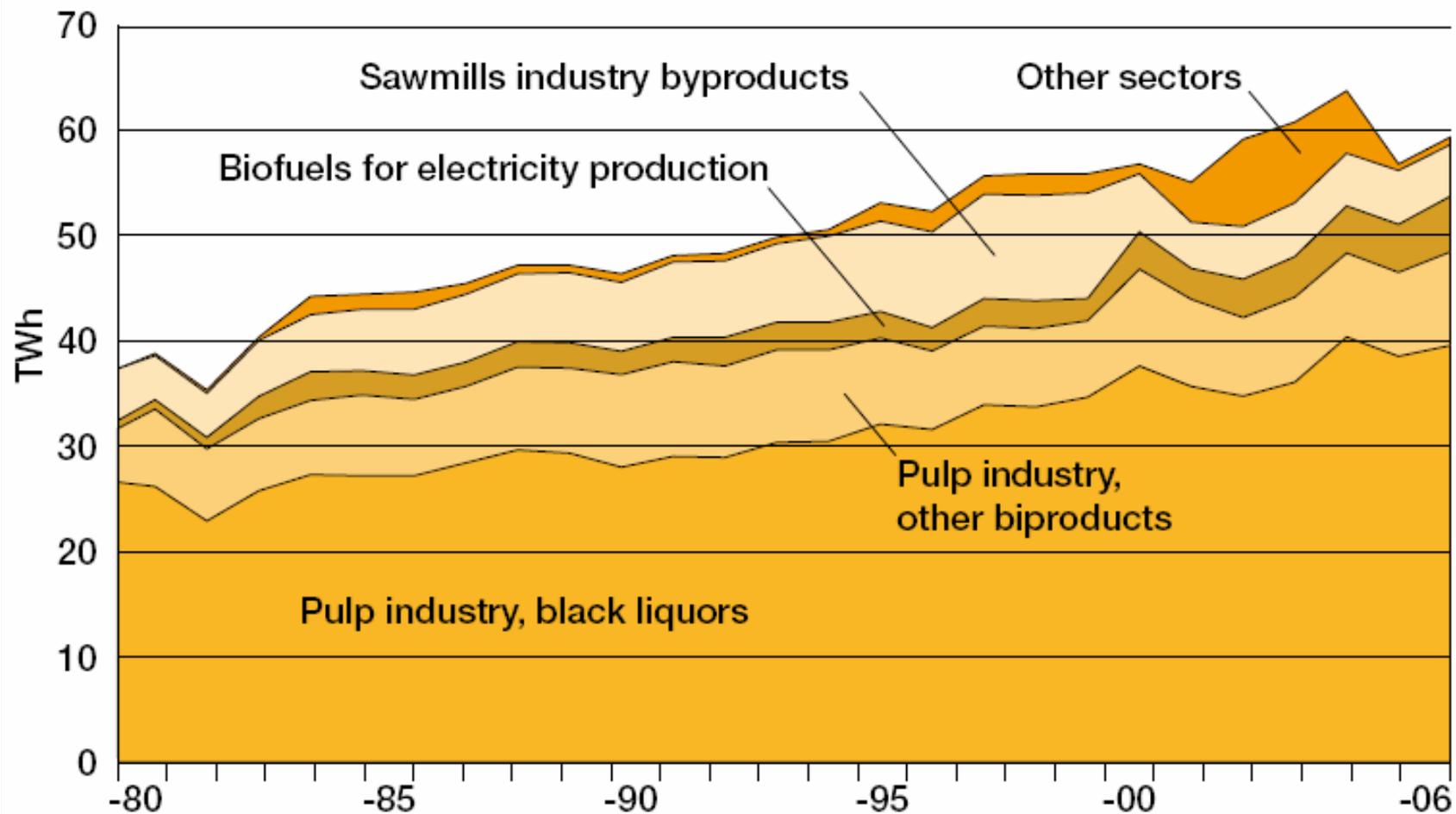
Ecologically non-available biomass



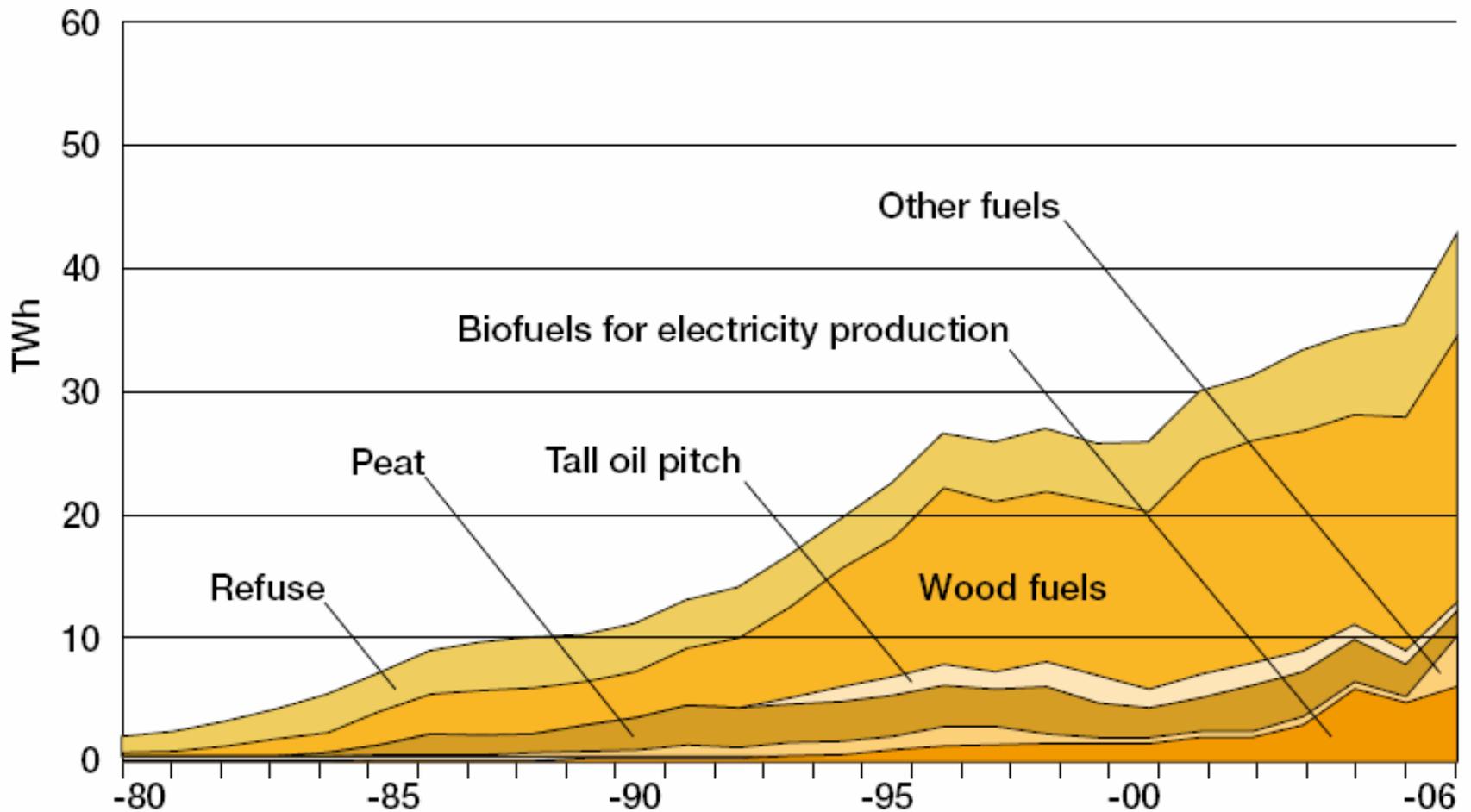
Mill residues, low quality round wood etc.

Source: [unclear], LU, Uppsala, Sweden

**Figure 39:** Use of biofuels, peat etc. in industry, 1980-2006



**Figure 40:** Use of biofuels, peat etc. in district heating plants, 1980-2006



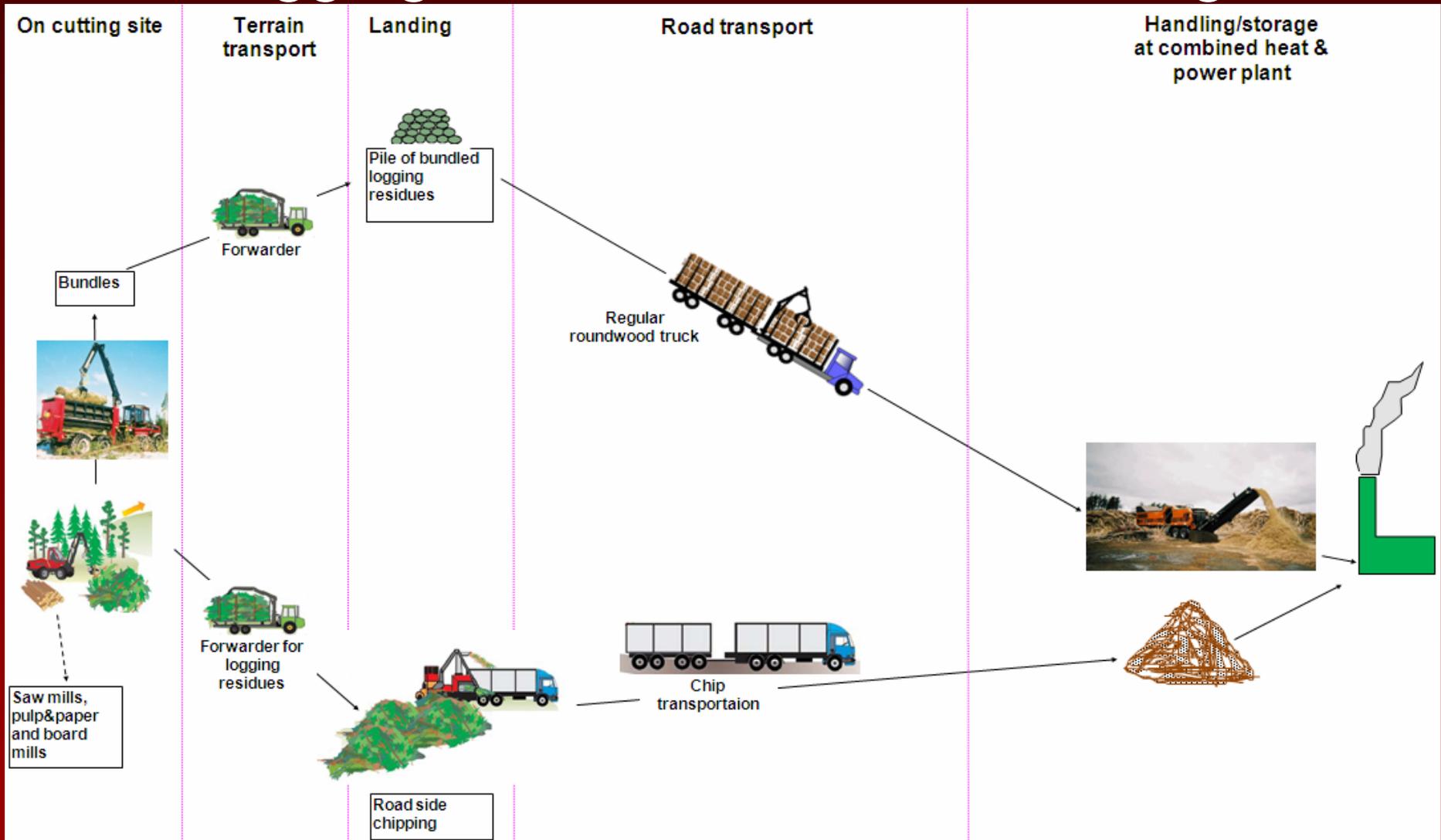
# Extraction of logging residues – an integrated practice in the forest management

Steps:

- Planning of logging and subsequent operations by help of forest management plan
- Logging: a variant of the cut-to-length method is practiced where the logging residues end up in big concentrated piles
- Extraction of logging residues
- Scarification
- Planting/natural regeneration

*(In the ideal case it should be possible do planting the  
spring after logging has taken place)*

# Example of two types of supply chains for logging residues after clear cutting



The are large synergies to be found  
between:

- wood fuel extraction
- lumber supply
- silviculture

# Why extract logging residues?

Different stakeholders have different interests...

# Forest owner:

- Silvicultural advantages:
  - Logging residues: better regeneration results
  - Stumps: better regeneration results, less root, less pine weevils
  - Trees from thinning operations in young stands: better stumpage when the first "commercial" thinning takes place, allow alternatives in thinning practices, better value development (than not doing any thinning at all...)
- Extra net revenue (which reduces the silvicultural costs)
- (Reduces problems with surplus nitrogen in southwest parts of Sweden)

# Wood purchasing organisations (industrial wood)

Service to the forest owners – a way to  
"secure" the roundwood supply from  
private forest owners

# Wood fuel dealers:

Make business from buying and selling

# Forest industry

## External demand:

- Satisfy the wood fuel demand of the energy sector, so they do not buy potential pulp wood
- Earn money on sales of non-refined wood fuels

## Internal demand:

Integrated production of pulp, paper, “green” electricity, pellets, and vehicle fuels etc. will lead to a need of additional supply of wood fuels

## Environmental image

# Combined heat and power (CHP) companies

- Large quantities, potential increment
- Relatively "price worthy" biofuel: is cheaper and has better combustion characters than purpose grown agrofuels and willow
- Necessity in order to combust very moist wood fuels, eg. bark

# Supply chains for logging residues

# Development

Back to the fruit tree – the higher hanging fruit:

- Stumps
- Small trees from thinning operations

# Stump extraction



# Small trees from thinning operations

- + There are great silvicultural benefits
- The most expensive wood fuel:
  - Small trees are very expensive to harvest
  - This wood fuel assortment has to bear its own harvesting cost



Björn Vikinge, Feb 2008,  
Escanaba

# Summary

- Start with low hanging fruit
- Benefit from the potential synergies in integrating wood fuel extraction, lumber supply and silviculture
- Expansion potential is in primary wood fuels – severer conditions can be counteracted by methods, technology, and system development

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# Methodology for determining potential for primary wood fuels

- National forest inventory data were used
- Determination of gross potential based on an assumed harvest level (final felling and thinning). Thereafter step wise reductions were made.