

Feasibility of Adapting Existing Forestry Practices for Improved Biomass Production

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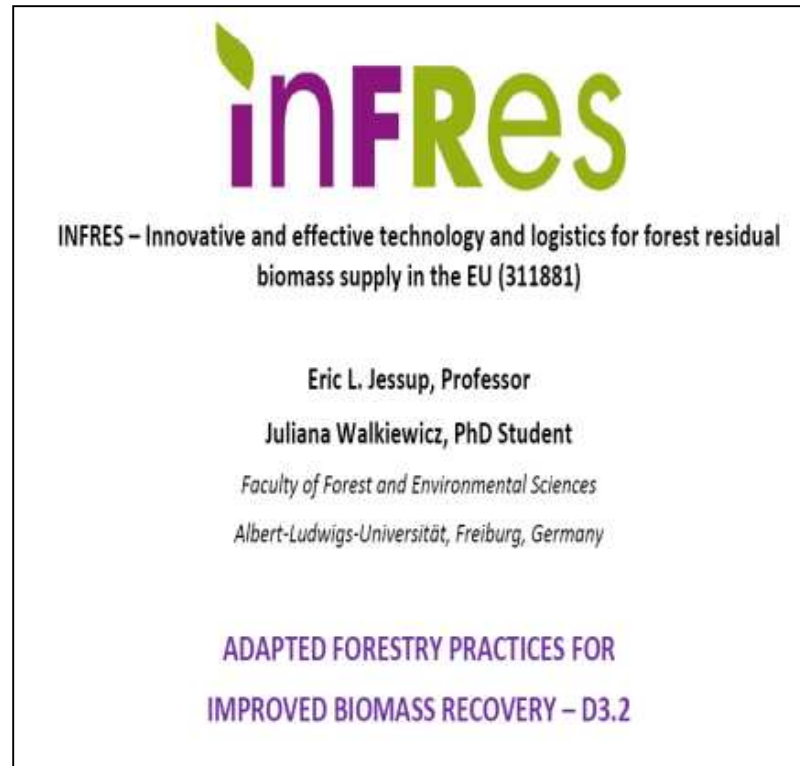


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Presentation is based on Report ...

- ... prepared by Eric Jessup and Juliana Walkiewicz



- ... and available at www.infres.eu

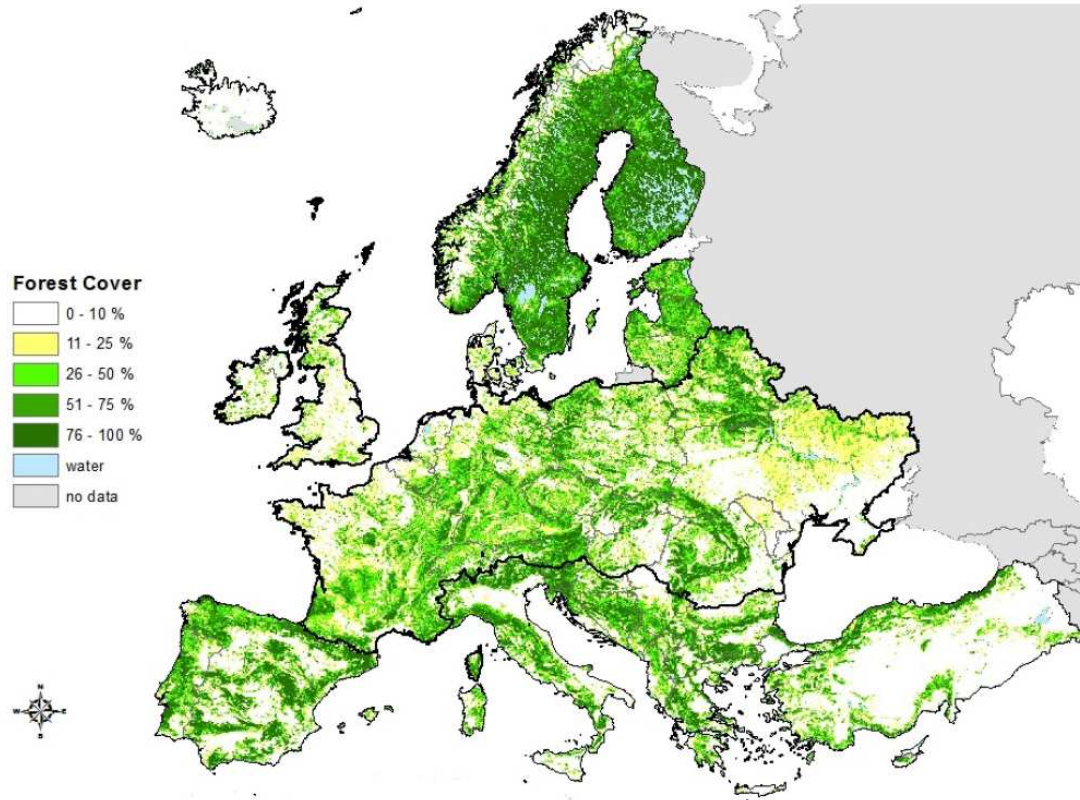
Content

- **Geographic stratification & characterisation of the 3 strata/ regions :
Northern Europe, Central Europe and Southern Europe**
- **Supply chain description & supply chain costs**
- **Surplus potential; potential cost reduction**
- **Cost reduction strategies – harvesting / organisational structures**
- **Summary & conclusions**

Strata characterisation



Strata characterisation



Strata characterisation

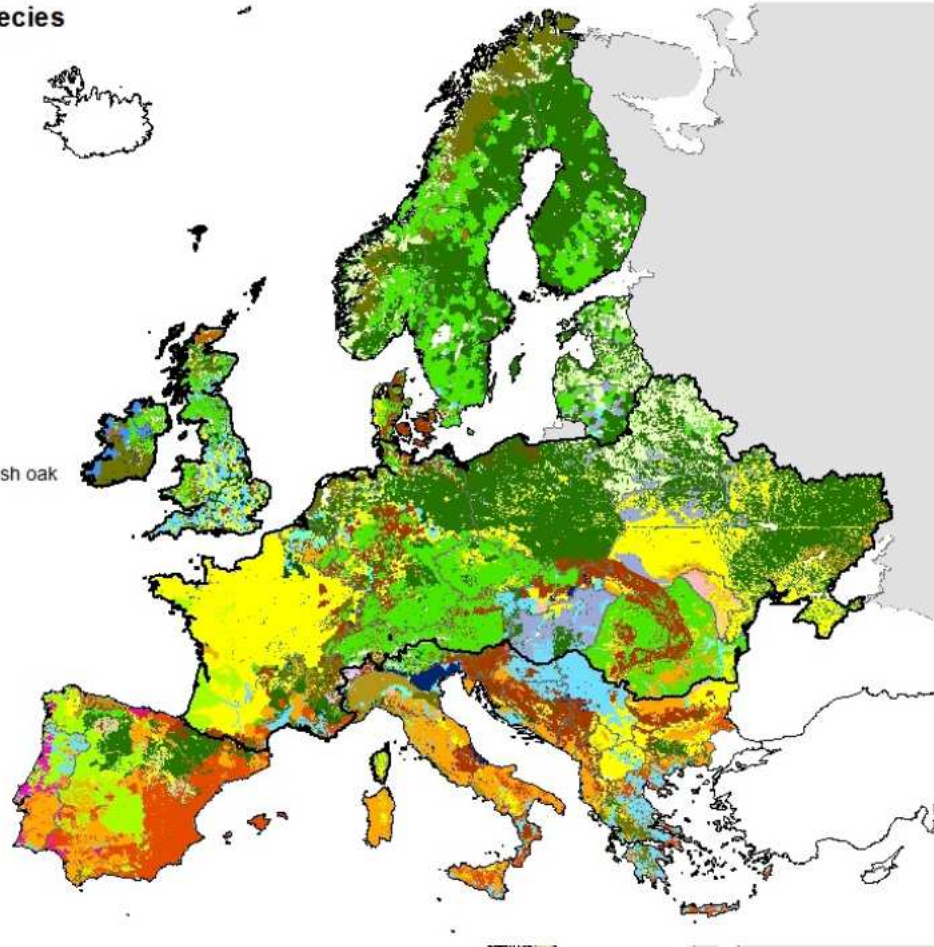
Dominant Tree Species

Broadleaved

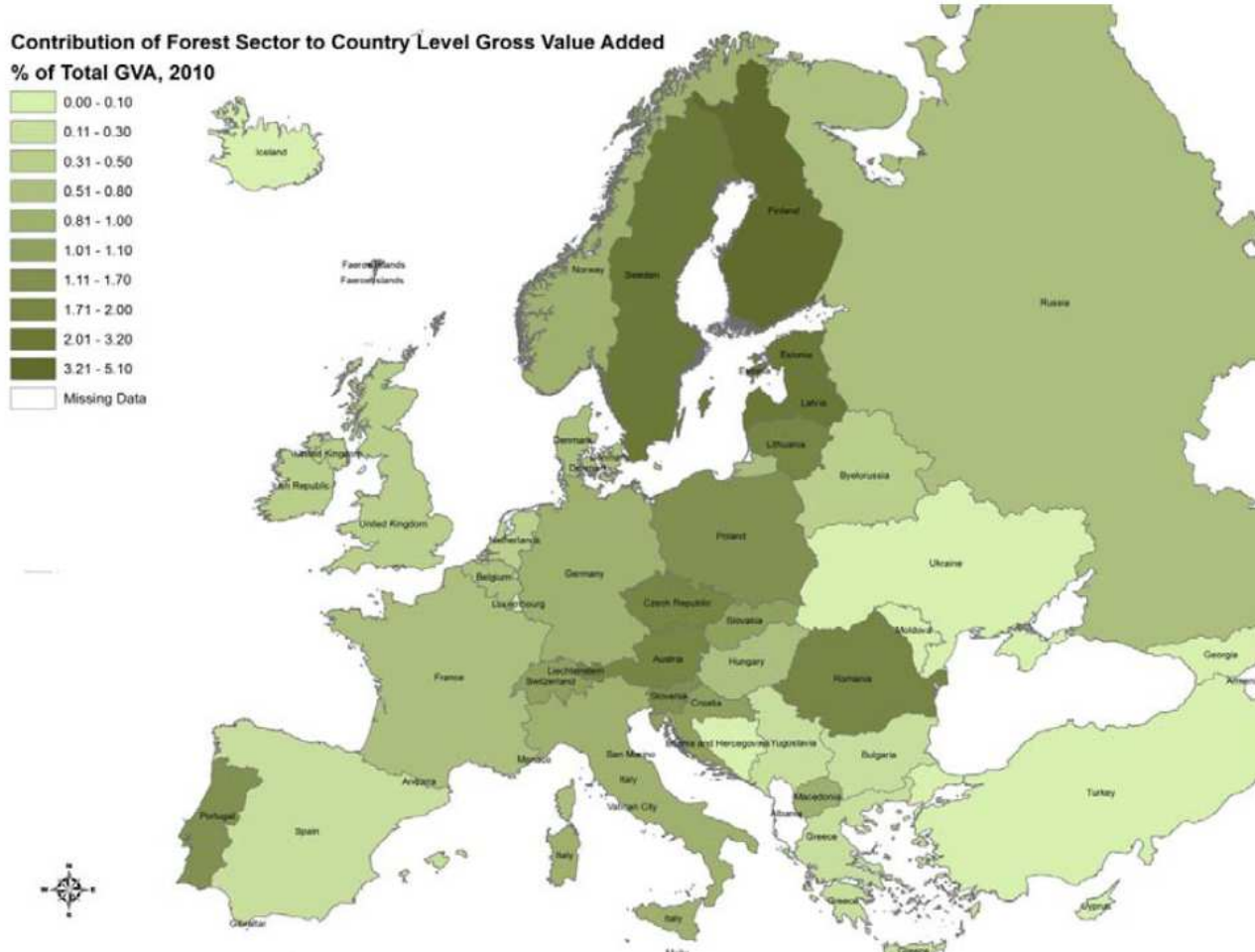
-  Alder spp
-  Birch spp
-  Hornbeams spp
-  Chestnuts spp
-  Eucalyptus spp
-  Beech spp
-  Ash spp
-  Broadleaved misc
-  Oak misc
-  Poplar spp
-  English oak & Cornish oak
-  Robinia spp

Conifers

-  Fir spp
-  Larch spp
-  Conifers misc
-  Pine misc
-  Spruce spp
-  Maritime Pine
-  Scots Pine
-  Douglas Fir

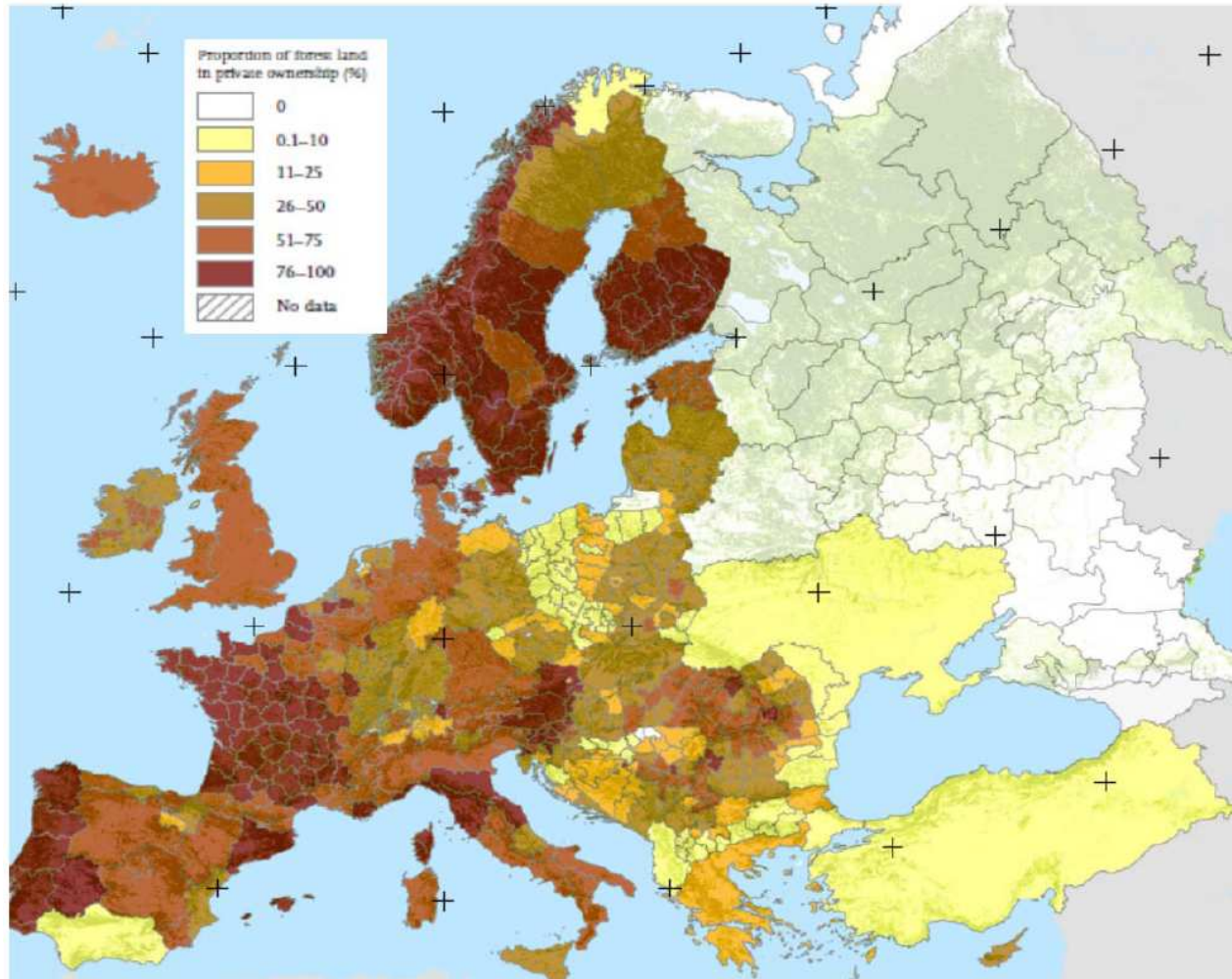


Strata characterisation



Strata characterisation

- Proportion of private owned forests (EFI 2013)



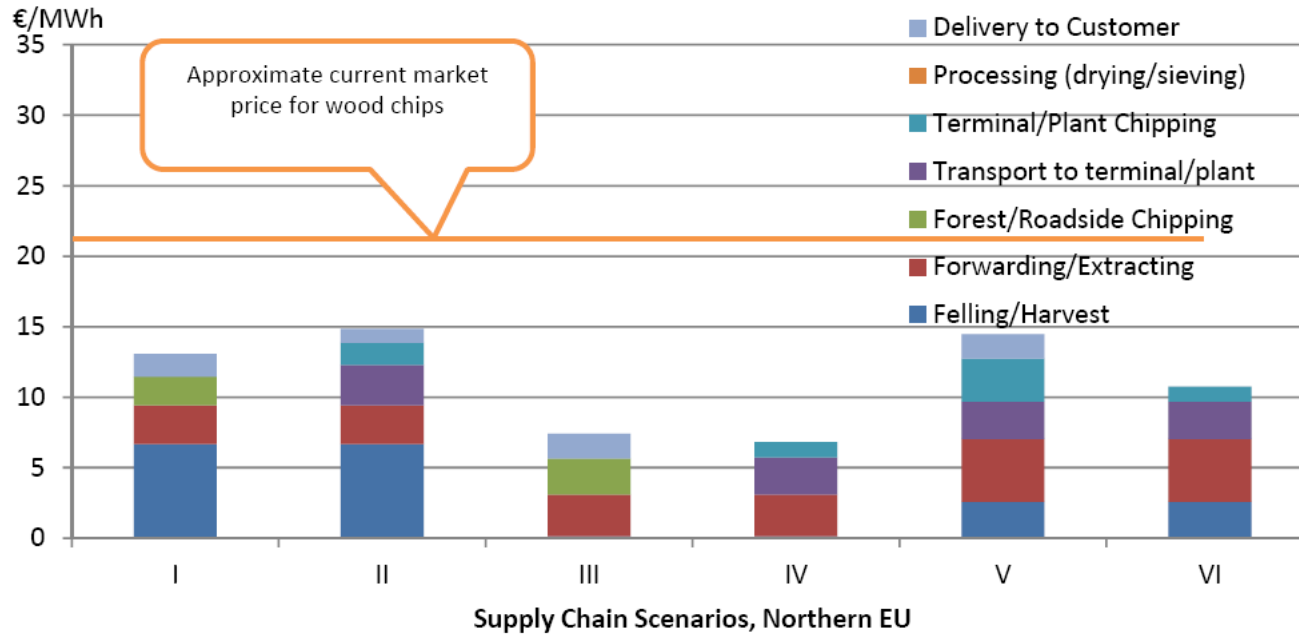
Supply chain description



Supply chain description

North		
<u>Supply Chain II</u>		
Primary Source	Laitila, J., "Harvesting technology and the cost of fuel chips from early thinnings." Silva Fennica (42)2, (2008), 267-283	
Harvest Type	Pre-commercial thinning of whole trees using mechanical harvesting and chipping at terminal/plant	
Tree Species	mix of birch, pine and other broadleaved species	
Moisture Content	40% Fresh, 20% Seasoned	
Equipment	Felling/Harvest	Harvester
	Forwarding/Extracting	Forwarder
	Chipping	Truck mounted Chipper at terminal
	Transport	Truck and Trailer

Supply chain costs – Northern Europe



- I. Pre-commercial thinning of whole trees using mechanical harvesting and chipping at roadside
- II. Pre-commercial thinning of whole trees using mechanical harvesting and chipping at terminal/plant
- III. Industrial roundwood, logging residues, chipping at roadside
- IV. Industrial roundwood, logging residues, chipping at plant
- V. Stumps/Roots, crushing at terminal (felling/harvest is stump lifting cost)
- VI. Stumps/Roots, crushing at plant (felling/harvest is stump lifting cost)

Supply chain costs – Central Europe

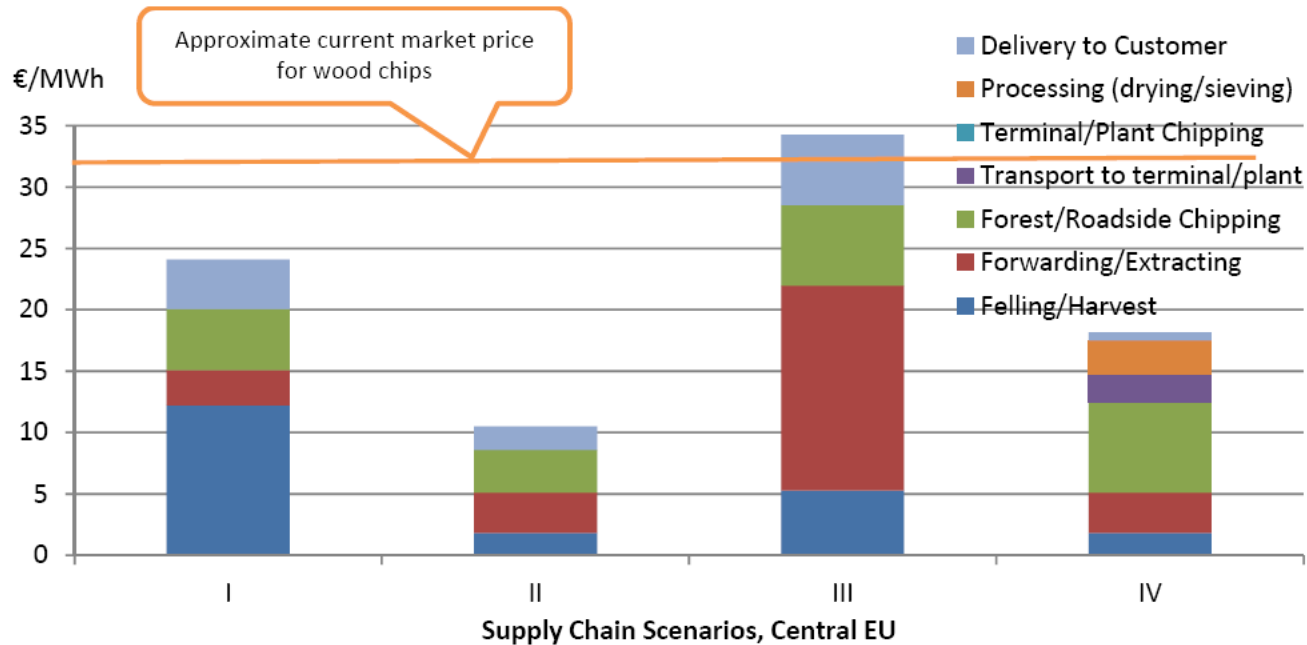
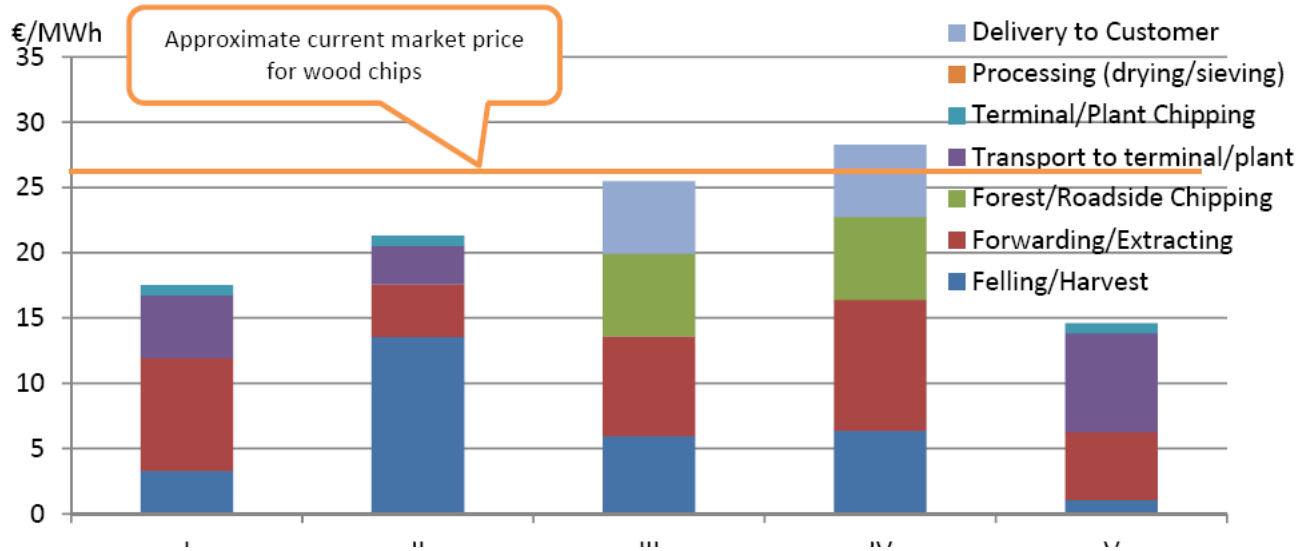


Figure 14: Estimated Cost of Production for Different Central European Forest Biomass Supply Chains

- I. Pre-commercial thinning, mechanical, whole tree system, terrain chipping
- II. Industrial roundwood from felling and thinning (flat terrain) , energy wood, manual harvesting, non-coniferous, chipping at roadside
- III. Industrial roundwood from felling, manual harvesting, steep terrain, cable yarder, logging residues, chipping at roadside
- IV. Industrial roundwood from felling and thinning, energy wood and logging residues, flat terrain, CTL

Supply chain costs – Southern Europe

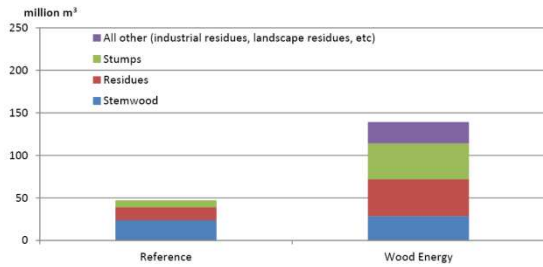


- I. Pre-commercial thinning of whole trees using manual harvesting, chipping at plant
- II. Pre-commercial thinning of whole trees using mechanized harvesting short wood system (CTL), chipping at plant
- III. Industrial roundwood from felling and thinning, manual harvesting whole tree system using cable yarder in steep terrain, chipping at roadside
- IV. Industrial roundwood from felling and thinning, manual harvesting, short wood system using cable yarder in steep terrain, chipping at roadside
- V. Stump and Roots, crushed at the plant (felling/harvest is cost of extraction)

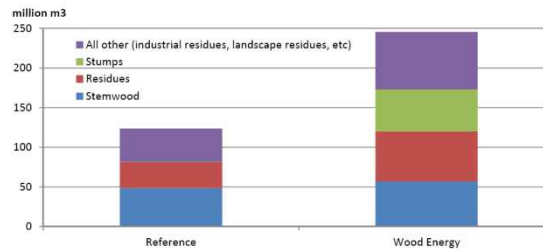
Surplus potential

- **Expected Increase in Forest Supply from 2010 to 2030, Reference and Wood Energy Scenarios**

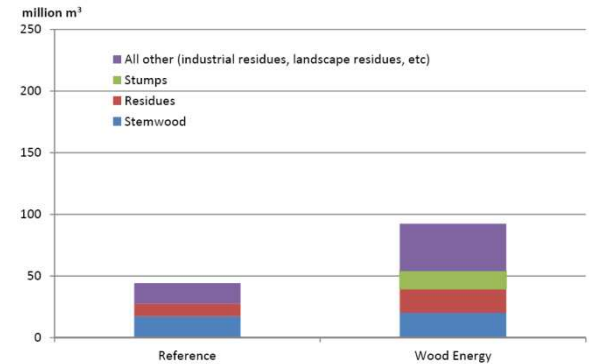
Source: European Forest Sector Outlook Study II



Northern EU



Central EU



Southern EU

Potential cost reduction

- Northern Europe

<i>Process Type</i>	<i>Technology Focus</i>	<i>Outcome</i>	<i>Potential For Cost Reduction</i>
Harvest/Felling	<ul style="list-style-type: none"> Equipment Information 	<ul style="list-style-type: none"> Improve productivity of pre commercial thinning Lower operational costs such as fuel efficiency, repairs, maintenance costs, etc. 	<ul style="list-style-type: none"> High Medium
Forwarding/extracting	<ul style="list-style-type: none"> Equipment Information 	<ul style="list-style-type: none"> Lower stump extract/forwarding cost Increase synergy between harvest and forwarding through IT, increasing joint productivity 	<ul style="list-style-type: none"> High Medium
Chipping/Crushing	<ul style="list-style-type: none"> Equipment Information 	<ul style="list-style-type: none"> Improve productivity of larger mobile chippers. Lower operational costs by IT systems to improve operator performance. 	<ul style="list-style-type: none"> Medium High
Transport	<ul style="list-style-type: none"> Equipment Information 	<ul style="list-style-type: none"> Weight/volume capacity increase (90 ton), lighter containers Lower operational costs such as fuel efficiency, labor cost from improved coordination, routing, inventory control. 	<ul style="list-style-type: none"> High Medium

Potential cost reduction

- Central Europe

<i>Process Type</i>	<i>Technology Focus</i>	<i>Outcome</i>	<i>Potential For Cost Reduction</i>
Harvest/Felling	<ul style="list-style-type: none"> • Equipment • Information 	<ul style="list-style-type: none"> • Improve productivity of pre commercial thinning but also steep terrain harvesting • Coordination of harvest across many small parcels from improved market pricing. 	<ul style="list-style-type: none"> • Medium • High
Forwarding/extracting	<ul style="list-style-type: none"> • Equipment • Information 	<ul style="list-style-type: none"> • Increase effectiveness and productivity in steep terrain • Improved coordination placement 	<ul style="list-style-type: none"> • High • High
Chipping	<ul style="list-style-type: none"> • Equipment • Information 	<ul style="list-style-type: none"> • Improve productivity of mobile chipper in both equipment and efficient operation. • Lower operational costs through better coordination and placement 	<ul style="list-style-type: none"> • High • High
Processing	<ul style="list-style-type: none"> • Equipment 	<ul style="list-style-type: none"> • Cleaning/Sieving • Drying 	<ul style="list-style-type: none"> • High • High
Transport	<ul style="list-style-type: none"> • Equipment • Information 	<ul style="list-style-type: none"> • Weight/volume capacity improvements • Lower operational costs such as fuel efficiency, labor cost from improved coordination between chipper/terminal/customer. 	<ul style="list-style-type: none"> • Low • High

Potential cost reduction

- Southern Europe

<i>Process Type</i>	<i>Technology Focus</i>	<i>Outcome</i>	<i>Potential For Cost Reduction</i>
Harvest/Felling	• Equipment	• Improve productivity in steep terrain harvesting and thinning operations	• Medium
	• Information	• Adoption of IT systems that increase operating efficiency	• High
Forwarding/extracting	• Equipment	• Improve effectiveness in steep/terrain	• High
	• Information	• Improved coordination and placement	• Medium
Chipping	• Equipment	• Improve productivity of mobile chipper to operate in limited spaces	• High
	• Information	• Lower operational costs through better coordination and placement	• High
Transport	• Equipment	• Weight/volume capacity improvements	• Low
	• Information	• Improved coordination between chipper/terminal/cust omer.	• High

Cost reduction strategies – harvesting / organisational structures

Favorable Harvest Activities

- **Direct harvesting/extracting with harwarder or synchronized forwarder**
 - conventional system involve the separation of the felling and extracting of residues
- **Geometric thinning**
 - modified/enhanced silvicultural practices
- **Biomass Quality Enhancement**
 - storing/drying (improving quality without increase of cost)

Cost reduction strategies – harvesting / organisational structures

Favorable Organizational Structures

- **Promote Competitive Market Structures using Information Technology**
 - the market for forest energy has evolved slowly as market participants adapt to market signals and new information regarding near future and distant expectations
- **European Wide Online Auction/Clearinghouse to Improve Market Efficiency and Coordination**
 - Advantages both for sellers and producers vs. traditional trading approach
- **Expand Forest Biomass Market through Cooperative Organizational Structures**
 - forest owners * forest biomass trade centers * forest biomass energy firms partnering with agriculture biogas producers

Summary & conclusions

- **Potential Cost Reduction from Equipment and Information Technology**

Process Type	Technology Focus	Potential for Cost Reduction		
		North	Central	South
Harvest/Felling	<ul style="list-style-type: none"> • Equipment • Information 	<ul style="list-style-type: none"> • High • Medium 	<ul style="list-style-type: none"> • Medium • High 	<ul style="list-style-type: none"> • Medium • High
Forwarding/Extracting	<ul style="list-style-type: none"> • Equipment • Information 	<ul style="list-style-type: none"> • High • Medium 	<ul style="list-style-type: none"> • High • Low 	<ul style="list-style-type: none"> • High • Medium
Chipping/Crushing	<ul style="list-style-type: none"> • Equipment • Information 	<ul style="list-style-type: none"> • Medium • Medium 	<ul style="list-style-type: none"> • High • High 	<ul style="list-style-type: none"> • High • High
Processing (Drying/Sieving)	<ul style="list-style-type: none"> • Equipment 		<ul style="list-style-type: none"> • High 	
Transport	<ul style="list-style-type: none"> • Equipment • Information 	<ul style="list-style-type: none"> • High • Medium 	<ul style="list-style-type: none"> • Low • High 	<ul style="list-style-type: none"> • Low • High