# Harvesting systems

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#### What and where

 5 softwood sites:Donegal (Ballybofey), Mayo (Toormakeady), Galway (Woodberry), Limerick (Abbeyfeale), Cork (Bweeng)

 2 hardwood sites Laois (Stradbally), Tipperary (Dovea)

### When

Save Toormakeady all softwood stands were harvested in March/May 2007 Toormakeady was harvested in June 2007, waiting for dry summer period Hardwood sites were harvested in June/July 2007 All chipping in September 2007

#### Six harvesting methods softwood 1

- Row thinning, chainsaw fell, whole trees, chipping
- Chemical row thinning, fell and chip Silvatec chipper
- Selective thinning, whole trees, chipping

### Six harvesting methods softwood 2

- Row and selective, integrated harvesting, forwarding, road side chipping
- Row and selective, standard harvesting, forwarding, roadside chipping
- Row and selective, chainsaw harvest, quad skidding, firewood production

# Three harvesting systems hardwood

- Row and selective, chainsaw fell, quad skid, firewood processing
- Row and selective, chainsaw fell, horse skid, firewood processing
- Row and selective, chainsaw fell, forwarding, firewood processing

### Road transportation

 Container transport of chips from Silvatec terrain chipper, pilot study

## Softwood, row thin, terrain chip

- All felling was done by chainsaw of the row trees only
- Whole trees remained where they fell
- Chipping with Silvatec terrain chipper and chips forwarder
- Chips delivered into truck containers at roadside







# Results, row thin, whole tree, silvatec

				2007	-	2006			
Assortment	Thinning system	Felling method	Chipper	Average cost roadside	Energy density	Cost/GJ	Average cost roadside	Energy density	Cost/GJ
				€/m3 sb	GJ/m3 sb	€/GJ	€/m3 sb	GJ/m3 sb	€/GJ
Whole tree	row	chainsaw	Silvatec	26,8	6,3	4,28	14,31	7	2,04
Whole tree	row	chainsaw	TP280				19,34	7	2,77
Whole tree	row	chemical	Silvatec	39,6	6,7	5,91	24,62	7	3,52

### Softwood, selective thin, chip

- Felling by chainsaw of small trees only
- Summer drying standing up
- Winching to chipper
- Chip
- System for own production of chips



# Results selective thin, whole tree, roadside chip

Assortment	Thinning	Felling	Chipper	Average cost	Energy	Cost/GJ
	system	method		roadside	density	
				€/m3 sb	GJ/m3 sb	€/GJ
Whole tree	selective	chainsaw	TP230	48,29	7	6,9

# Softwood, integrated harvest, forwarding, roadside chip

- Harvesting 4.3 m crudely delimbed tree sections, so called energy wood, together with 2.4 m box wood and stakes
- Forwarding to roadside, covering with paper
- Chipping at roadside
- Chip transport with walking floor truck







## **Results integrated harvesting**

				2007	7 musmax	-	2006 jenz		
Assortment	Thinning system	Felling method	Chipper	Average cost roadside	Energy density	Cost/GJ	Average cost roadside	Energy density	Cost/GJ
	P.			€/m3 sb	GJ/m3 sb	€/GJ	€/m3 sb	GJ/m3 sb	€/GJ
Energywood	row+sel	harvester	Musmax/Jenz	40,2	6,4	6,27	52,44	7,7	6,81

# Softwood, standard harvest, forwarding roadside chipping

- Standard harvesting of 3 m pulpwood and 2.4 m boxwood/stakes
- Forwarding to roadside, covering with paper
- Chipping at roadside
- Transport with walking floor truck



# Results standard method

			2007	2007 musmax 2006 jenz			06 jenz		
Assortment	Thinning system	Felling method	Chipper	Average cost roadside	Energy density	Cost/GJ	Average cost roadside	Energy density	Cost/GJ
				€/m3 sb	GJ/m3 sb	€/GJ	€/m3 sb	GJ/m3 sb	€/GJ
Pulpwood	row+sel	harvester	Musmax/Jenz	48,5	6,4	7,59		7,1	6,49

Softwood, chainsaw felling, quad skidding, firewood production

- In this system, the trees are felled and sned by chainsaw
- Skidded to the roadside by quad and timber arch
- Processed into firewood and stacked in net bags





# Results firewood production in net bags on pallets

Assortment	Thinning system	Felling method	Firewood machine	Average cost roadside	Energy density	Cost/GJ
				€/m3 sb	GJ/m3 sb	€/GJ
Firewood	Row+ selective	chainsaw	Hawk	202,40	6,22	32,50

## Softwood, overview all systems

	-		Concession in which the	2007			2006		
Assortment	Thinning system	Felling method	Chipper	Average cost roadside	Energy density	Cost/GJ	Average cost roadside	Energy density	Cost/GJ
				€/m3 sb	GJ/m3 sb	€/GJ	€/m3 sb	GJ/m3 sb	€/GJ
Whole tree	row	chainsaw	Silvatec	26,8	6,3	4,28	14,31	7	2,04
Whole tree	row	chainsaw	TP280				19,34	7	2,77
Whole tree	row	chemical	Silvatec	39,6	6,7	5,91	24,62	7	3,52
Whole tree	selective	fel-bun	Silvatec					7	2,68
Whole tree	selective	chainsaw	TP230	48,29	7	6,9			
Whole stem	row+sel	harvester	Silvatec					7,2	5,62
Energywood	row+sel	harvester	Musmax/Jenz		6,4	6,27		7,7	6,81
Pulpwood	row+sel	harvester	Musmax/Jenz		6,4	7,59		7,1	6,49
Firewood	row+sel	chainsaw	Hawk		6,22	32,5			

## Hardwood systems

Row and selective thinning

- Felling, snedding and cross cutting by chainsaw
- Skidding to roadside by quad and timber arch or horse or forwarder
- Processing with Hawk firewood processor into net bags

# Presentation quad

# Horse skidding

# **Presentation forwarder**

# Overview costs hardwood systems

	Stradbally	Dovea	Stradbally	Dovea	Dovea	2006
	forward	der	quad		Horse	chip
Felling	39,19	32,99	46,75	35,22	35,22	5,88
Extraction	20,36	10,75	59,47	33,78	98,49	
Processing	242	242	242	242	242	21
Total €/m3 sb	301,55	285,7		311		26,9
GJ/m3 sb	8,7	8,3	8,7	8,3	8,3	9
Cost/GJ	34,66	34,43	40,03	37,47	45,27	2,99

### Road transportation

Container trucks from Denmark

- Restriction in load: 48 ton in Denmark, 44 ton in Ireland
- Average load 70 m3 lv here against 80-85 in DK

 Containers should and can be lighter (now 5.6 ton, could be 3.2 ton=10 m3 lv more

# Road transportation 2

Road type	Avg speed	Min.	Max.
	km/hr	km/hr	km/hr
Forest road	21,7	10	30
Community road	37,7	12	90
Regional road	46,4	15	93
National road	57,7	27	86

## **Conclusions** softwood

• Whole tree system still the cheapest way to harvest wood for energy Whole tree system in 2007 more expensive than in 2006 Terrain has great influence Band tracks needed on Silvatec chipper Gross weight container trucks should be

lowered to increase load volume

### **Conclusions hardwood**

- Chipping the cheapest solution
- Small scale systems are expensive if you have to calculate with manhours at cost
- Small firewood processor very slow
- More studies needed on rational firewood production