

## Harvesting traditional coppice stands in the Northwestern Italian mountains



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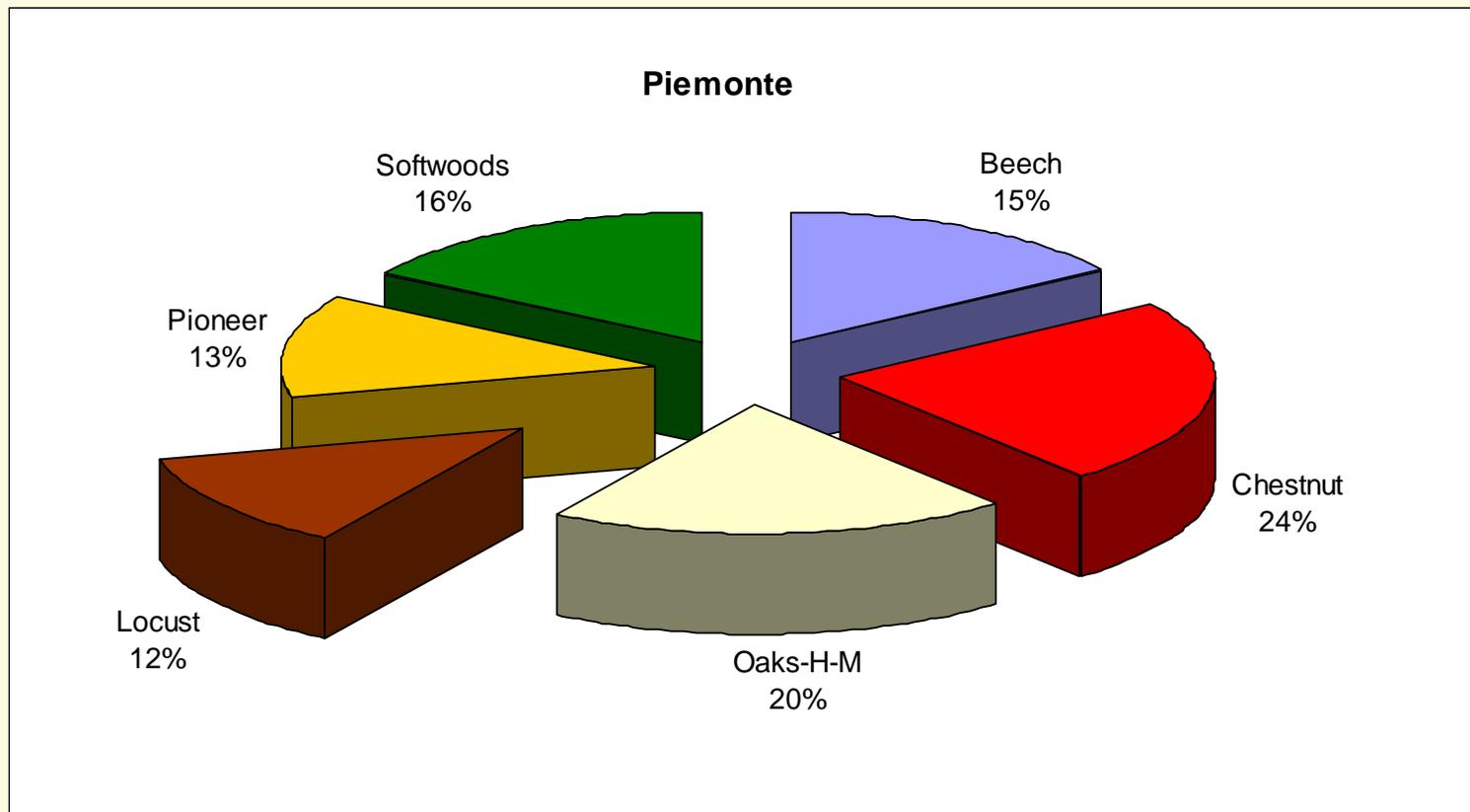
# Traditional coppice

- 📄 Oak, Chestnut, Beech etc.
- 📄 15 to 40 years rotations
- 📄 12-30 cm DBH
- 📄 70-250 m<sup>3</sup>/ha



# A most widespread forest type

 In Northwestern Italy



# Demand & Prices

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- 📄 18M t firewood, 3M t chips (Italy)
- 📄 Timber ~ 100 €m<sup>-3</sup> deliv., chestnut only
- 📄 Fencing 60-80 €m<sup>-3</sup> deliv., chestnut only
- 📄 Firewood 60-80 €m<sup>-3</sup> deliv., chestnut low
- 📄 Chips 50-60 €m<sup>-3</sup> delivered

# Harvesting: traditional



# The study



Site	Province	Placename
1	TO	Rivalta di Torino
2	BI	Cossila San Grato
3	BI	Sala Biellese
4	TO	Rorà
5	CN	Limone P.te
6	BI	Camandona
7	BI	Magnano
8	CN	Pamparato
9	CN	Vernante
10	CN	Rittana

📄 Test modernization

📄 Time-motion studies

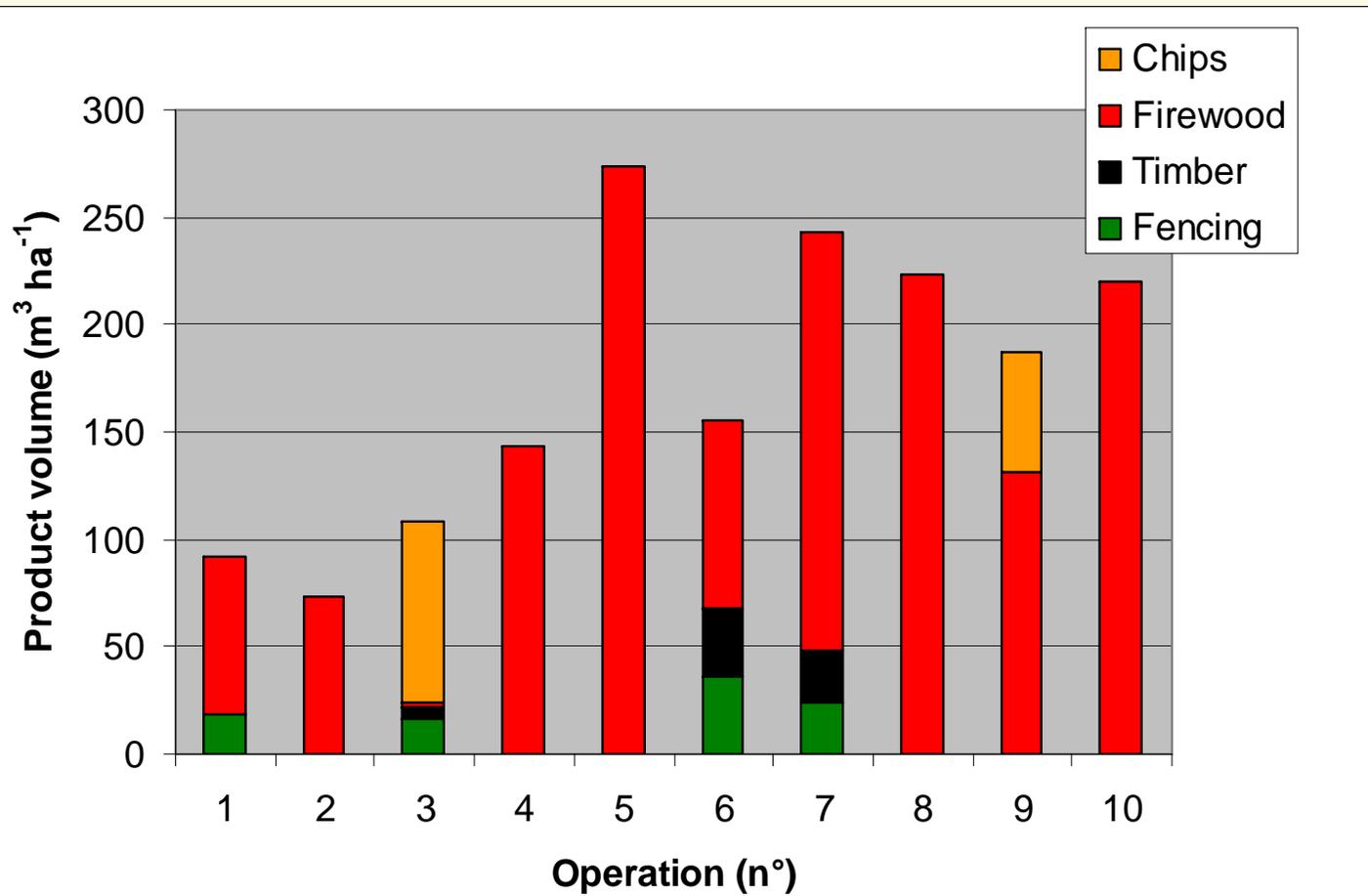
# Sites and silviculture

 Over-mature

 Clearfell or Selection

Site n°	Stand type	Surface ha	Gradient %	Age years	Density trees ha <sup>-1</sup>	DBH cm	Tree size m <sup>3</sup> tree <sup>-1</sup>	Stocking m <sup>3</sup> ha <sup>-1</sup>	Harvest m <sup>3</sup> ha <sup>-1</sup>	Removal %
1	Chestnut	4.98	15	40	1115	24	0.390	226	92	41
2	Chestnut	1.09	45	40	605	27	0.548	338	74	22
3	Chestnut	4.87	25	20	1322	13	0.110	270	109	40
4	Beech	2.50	55	60	955	22	0.464	237	143	60
5	Beech	3.00	65	60	1067	20	0.198	310	274	88
6	Chestnut	1.26	35	20	1226	21	0.263	385	156	41
7	Chestnut	2.63	22	20	1847	13	0.116	420	243	58
8	Beech	4.00	50	60	1895	12	0.099	260	223	86
9	Beech	2.06	45	50	1927	16	0.176	231	188	81
10	Chestnut	0.53	40	30	2038	15	0.153	420	220	52

# The harvest



# Harvesting methods

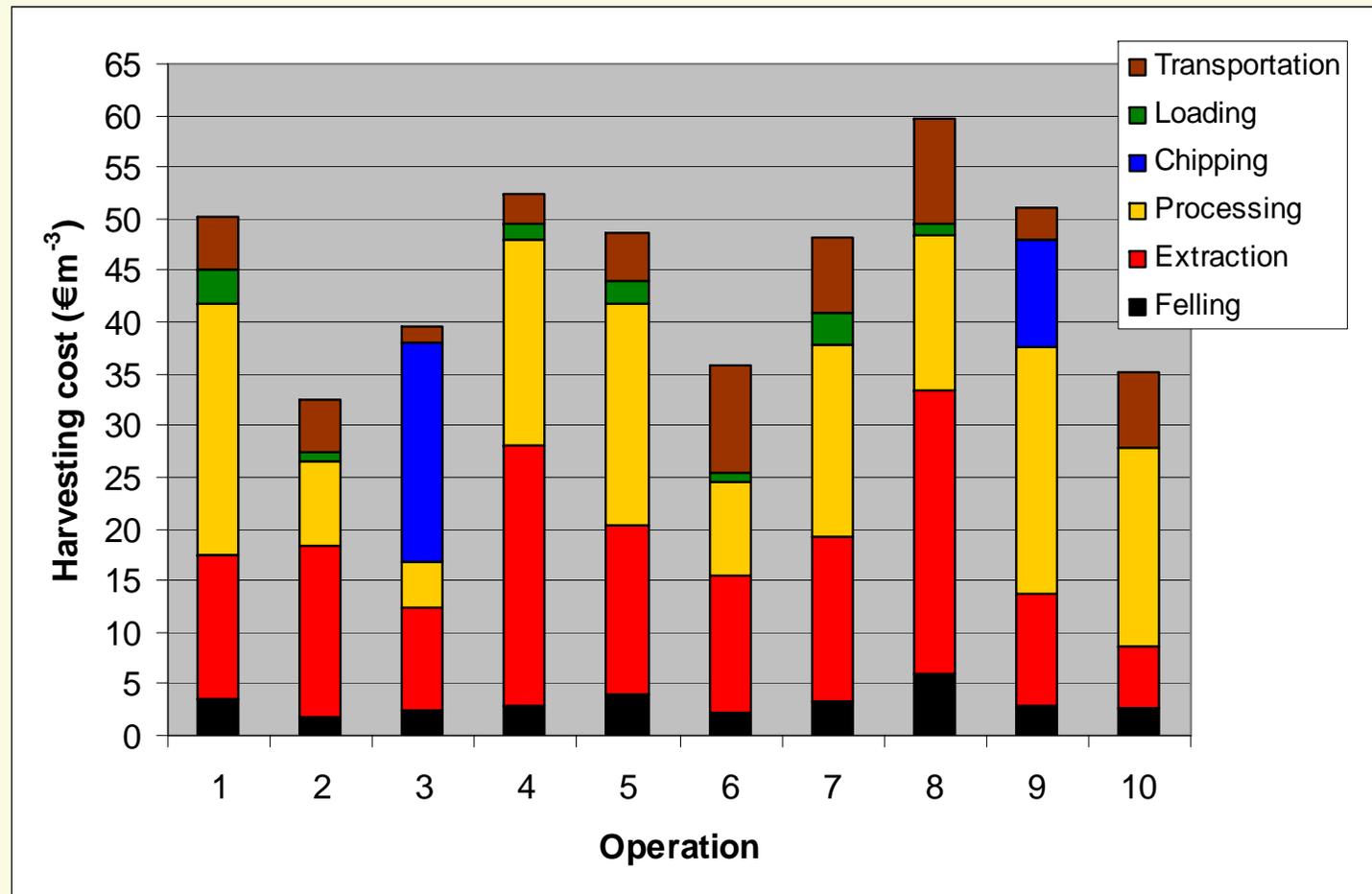


# Productivity

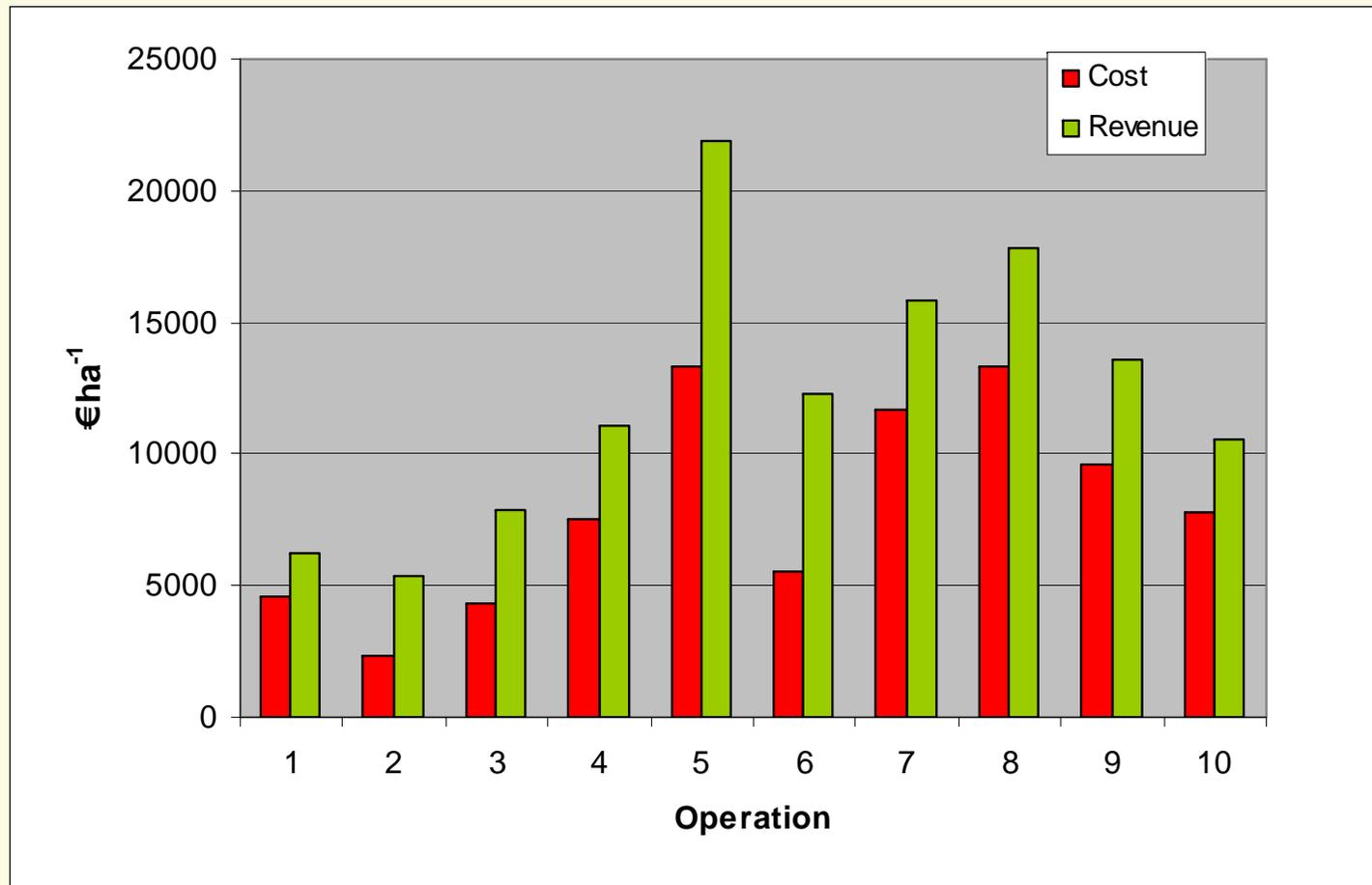
 Includes delays, 20-40 % (higher w/forwarder)

<b>m<sup>3</sup> solid SMH<sup>-1</sup></b>				
<b>Operation</b>	<b>Machine</b>	<b>Mean</b>	<b>min</b>	<b>Max</b>
Felling	Chainsaw	6.6	2.1	15.0
Extraction	Tractor	5.0	3.4	8.0
Extraction	Yarder	4.6	3.4	6.0
Extraction	Forwarder	8.9	5.9	11.2
Processing	Grapple-saw	5.2	2.0	9.8

# Harvesting cost



# Economically-viable operations



# Conclusions

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- 📄 Mechanization, biomass
- 📄 Adapt methods to technology, not reverse
- 📄 Grapple saw
- 📄 Cable yarding

