Italy: evolution in forestry utilization and mechanization

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Introduction
The National Forest Inventory of the Carbon Stock (IFNC, 2005) reports that woodland covers 8,759,000 ha, around 29.1% of Italy’s total surface, with a clear positive trend. Evidently, the country’s woodland represents a significant environmental and economic resource, yet the already well-organized wood processing industry gets 80% of its wood abroad. This problem is still mainly imputable to an already inadequate sector of the forestry utilization. Study on the improvement of the forestry utilization sector and what sort of machines can be introduced are thus of great importance for the wood industry and forestry within the Italian sector as a whole.

Materials and methods
An investigation has been developed covering the whole national territory, and implementing data of research already undertaken within the sector whose results have been an object of publications (Baldini et al., 2002; Baldini et al., 2006). The study was based on the answers to a questionnaire circulated to companies involved in various uses of woodland. They were selected from all over the country, and the questions were based on around the last fifty years of activity. The questionnaires were compiled on 200 enterprises of forestry utilization on 3164 recorded in Italy (ISTAT, 2008 a; ISTAT, 2008 b), a percentage of around 6.3%.

DATA, RESULTS AND DISCUSSION

Sale of wood biomass
The forest market (Fig. 1) in the ’50s was primarily constituted by the sale of standing trees, over the years however the tendency has been gradually reversing coming to over 50% of woody biomasses sold at the landing, processed in 2005. The average duration that the felled trees are left in the woods (Fig. 2) is around 109 days and reflects a situation in which over 50% of enterprises keep the logs in the forests for less than 90 days, which is reasonable, at least in economic terms. There are complaints over the lack of planning in making landings accessible, which leads to risks, above all of an environmental nature, due to the danger of fire and damage to the surrounding top-soil when the material is being loaded.

Temporal distribution of work
The amount of 58% of the sample of enterprises studied (Fig. 3) reported predominantly seasonal operations, with an average of 187 days a year (Fig. 4). Only 42% were able to work for almost all of the year, another clear cause of weakness, which implies the need for serious forestry planning.

Quantities of annually harvested wood
The Italian forest surface annually harvested since 2001 to 2005 on average has reached just over 96,200 ha and has just over 94,000 annual fells on average. The most intense and active year in the surface harvested has been 2003 (Fig. 5) (ISTAT, 2008 a; ISTAT 2008 b). The average felled area for the coppice is about 21 ha (Fig. 6), while for high forests it is possible to express only an average volume of about 640 m3 of wood harvested (Fig. 7). The value of 1.08 ha for the 2005 (Fig. 5) is given by the general average that doesn’t make distinction between high forests and coppices. The

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magnitudes involved make it clear that most forestry firms don’t have enough work to mechanize beyond a certain level since the volumes handled would not be enough to amortize the cost.

Logging systems
The graph (Fig.8) shows harvesting systems. It is visible that the system of fulllength wood now covers over 50% of the forestry utilization, thanks to the strong development of the last ten years. The short wood system at 40% holds a conspicuous piece of the forestry sector. The existing necessity to maximize standing timber prices, increase productivity and reduce fire risks, sees within the working system of long wood a good opportunity, which can gradually be directed towards periodical logging. Certainly, the biomasses obtained from branches and tops are not easy to sell, but the market may find uses for this sort of product too, thanks to the current trend to a massive use of biomass for energy production.

The evolution of machinery
Turning to forestry machinery, in particular for felling, the seven periods considered in the graph (Fig.9) show manual methods, mostly saws and hatchets, until 1970, followed by chainsaws from the 1960s, with the total disappearance of manual methods by the present day and from 2000 the harvesters begin to arrive.
In the processing operation (Fig.10), the persistence of manual systems should not be read as a lack of evolution, but as proof that these techniques remain effective for some tasks. Manual methods, above all in de-branching, is by far the least tiring and faster than semi-mechanical methods for some types of tree. Besides the employment of the advanced mechanization this operation seems to be more marked in comparison to the harvesting.
The extraction operation (Fig.11) used human and animal labour almost exclusively in the 1950s. For the most part, felled trees were moved by natural or artificial sliding. Mules were the most popular animal used in coppice woods, horses and oxen in high forests. The situation started changing in the 1960s as animals and manual extraction were first complemented and then replaced by machines. Tractors were used to tow out trunks directly, and there were also sporadic cases of winches.
The trend towards replacing animal and human labour-power with machines strengthened from 1970-90. Chutes were used less, apart from specially equipped trails in which PVC or plastic sheet chutes were used. Oxen and horses started disappearing, but mules remained in use for the most difficult and inaccessible areas. The tractors were used for the skid, but the first forest winches imported from elsewhere in Europe began making their appearance.
From 1990 to the present, machines became predominant, chutes were made only of PVC and most used animals were mules. The mechanization that is most popular is of two types; one is not very specialized of rural derivation defined as mid and the other one with strong forest specialization defined as advanced.
Among the mechanics equipment there are agricultural tractors, agricultural tractors of forest version and skidders, but there is also an increasing number of accessories: forest winches, forest hydraulic grabs and cages installed on back and front lifters.
Transport (Fig.12) in the 1950s and 1960s rested principally on sky systems, and to a lesser degree on earth systems. The sky systems were gravity cable and cable yarders model “Valtellina”, while the earth systems were by oxen or horses, but also tractors with trailers, or in very limited cases trucks. From 1970 until now, the sky systems have left the fields to the earth systems and the use of animals is slowly disappearing. The old sky systems have been completely replaced by cable yarders using various types of stations such as pilons, motors and carriages. Earth transport is now done by tractors with trailers, or to a very small extent trucks and forwarders.
As the graph (Fig.13) shows, annual firewood production grew from the 1960s, thanks to the growing size of Italian cities, which needed wood for heating. Wood was then slowly replaced by heating fuel, and its consumption peaked around 1980, tapering off until the present day. Nowadays, wood is burned in fires, not out of necessity but as a fashion statement.

Wood production for the paper industry and wood-based panels (Fig.14) began in Italy in the late 1970s and is still developing strongly today, even if large low cost imports have created difficulties for Italian forestry firms. Production of working wood (Fig.15) peaked between the 1950s and 1970s, a time when railway lines were being built or modernized, and there was a strong demand for wooden sleepers. Towards the mid-1970s, the railways began to use reinforced concrete sleepers, which gradually replaced the wooden ones. Current stabilized production levels are based on wood for slicing and veneer peeling from artificial plantations or high forest, saw logs coming primarily from Alpine woodland, and chestnuts from coppices. Recently, the market in wood beams has revived and forestry firms are working to fulfill the demand.

The economy of the woody products
In the arc of time 1998-2006, the assortments with a great price on the Italian market are the beams, the wood for plywood and that of saw, because of the noblest destination of the material (chain wood-furnish), while the poles record inferior values because it has a more limited alternative of uses (Fig.16 and 17) (ISTAT, 2008 a; ISTAT, 2008 b). To conform to the market demands, from 2005 the production of railway crossroads ended and was replaced by those of cement and the wood for the production of pasta and panels has been listed as chips whose mid price for the conifer assortments is of around 64 € /m3 while that of broad leaves reaches the 96 € /m3. Firewood and coal have been united in only a category, firewood for energy whose mid price reached its maximum value in 2003 (ISTAT, 2008 a; ISTAT, 2008 b).

Safety
Job safety and ergonomy (Fig.18) and the active and passive protection of the operators represents an important theme, nevertheless from the examination of the graph, it is evident that from the end of the 90s there has been an effective appointment from the enterprises, but unfortunately cases of indifference are found still today toward this important theme.

For what concerns professional training, only in the last years (end 90 and so on) its presence is recorded with a slight growth, however the sector still has a strong deficiency.

Bibliography

Figure 1: Italian forest market from 1950 to 2005.

Figure 2: Average number of days that the wood is left in forest (year 2005, 86% of the sample have given an answer).
Figure 3: job typology of the forestry enterprises (year 2005, 100% of the sample have given an answer).

Figure 4: annual average number of working days for every enterprise (year 2005, 97% of the sample have given an answer).

Figure 5: cut annual total surface, number of annual fells and annual average surface to fell.
Figure 6: average area of coppice wood harvested annually for every enterprise (year 2005, 94.5% of the sample have given an answer).

Figure 7: average volume annually harvested for every enterprise (year 2005, 63% of the sample have given an answer).

Figure 8: forestry utilization systems. The full length system includes the full tree system and the full length system (year 2005, 91% of the sample have given an answer).
Figure 9: Felling methodologies used from 1950 to 2005.

Figure 10: Processing methodologies used from 1950 to 2005.

Figure 11: Bunching and extraction methodologies used from 1950 to 2005.
Figure 12: extraction and transport methodologies used from 1950 to 2005.

Figure 13: annual average firewood production for enterprise from 1950 to 2005.

Figure 14: annual average wood for paper and particle board production for enterprise from 1950 to 2005.
Figure 15: annual average work wood production for enterprise from 1950 to 2005.

Figure 16: historical series of the conifers woody assortments prices (ISTAT, 2008 a; ISTAT, 2008 b).
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Figure 14: use of the individual devices of protection and the safety machines devices in the forest yards from 1950 to 2005.
Photo 1: coniferous forest in the Italian Alps.

Photo 2: harvester in a coniferous thinning.
Photo 3: skyline cable system in a coniferous forest.

Photo 4: training course for forestry worker.
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