

Task 25/38 – Greenhouse Gas Balances of Biomass and Bioenergy Systems

**Carbon accounting and emissions trading  
related to bioenergy, wood products and carbon sequestration**

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***Implications of different CoP decisions for  
bioenergy, wood market and  
land use patterns in Italy***

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## Paper organisation

- 1 **Description of the Italian forest sector**
  - **Natural re-growth of 'conventional' forests**
  - **Natural conversion of abandoned agricultural lands to forests**
  - **Use of wood for fuel**
  - **Af-forestation and re-forestation programs**
  - **Carbon sequestration in wood products**
  
- 2 **Implications of the CoP decisions may have on the Italian forest sector**

- **large part of the forest land is covered by semi-natural stands, with a growing stock well below the maximum long-term average;**

## CARBON STOCK EVALUATION MODEL

$$C_t = T + U + L + S$$

**T** = carbon in forest trees, below- and above-ground

(growing stock + annual increment) \* ( $\psi\omega\phi$ )

$\psi$  = multiplying factor to convert growing stock to standing biomass

$\omega$  = coefficient to convert standing biomass to total biomass

$\phi$  = coefficient to convert total biomass to total carbon (wood density \* fraction of wood biomass which is carbon)

**U** = carbon in understory

**L** = carbon in litter

**S** = carbon in soil

## FOREST INVENTORIES IN ITALY CARRIED OUT IN ITALY: SOME FEATURES

<i>Inventory</i>	<i>Area</i> <i>(10<sup>3</sup> km<sup>2</sup>)</i>	<i>Forested area</i> <i>(10<sup>3</sup> km<sup>2</sup>)</i>	<i>Spatial</i> <i>coverage</i> (%)	<i>Data</i> <i>sources</i>	<i>Inventory</i> <i>design</i>	<i>Grid</i> <i>(km)</i>
National Forest Inventory	301	87	100	b	one-stage	3 x 3
RI Valle d'Aosta	3.3	0.8	100	c	one-stage	0.5 x 0.5
RI Lombardia	23.8	6.0	16	b	one-stage	1 x 1
RI Veneto	18.4	3.5	100	b	one-stage	0.8 x 0.8
RI Friuli - Venezia Giulia	1.8	2.9	100	c	two-stage	0.2 x 0.2
RI Emilia Romagna	22.1	4.5	100	d	two-stage	1 x 1
RI Liguria	5.4	3.7	100	e	two-stage	1 x 1
RI Toscana	23.0	9.8	100	c	two-stage	0.4 x 0.4
RI Urbria	8.4	3.4	100	b	one-stage	1 x 1
RI Lazio	17.2	4.7	20	b	one-stage	1 x 1
RI Sardegna	24.1	8.4	100	c	two-stage	1 x 1

**Data sources:** a) ground assessment

b) ground assessment / cartography

c) ground assessment / cartography / aerial photography

d) ground assessment / cartography / aerial photography / other geo-referenced data

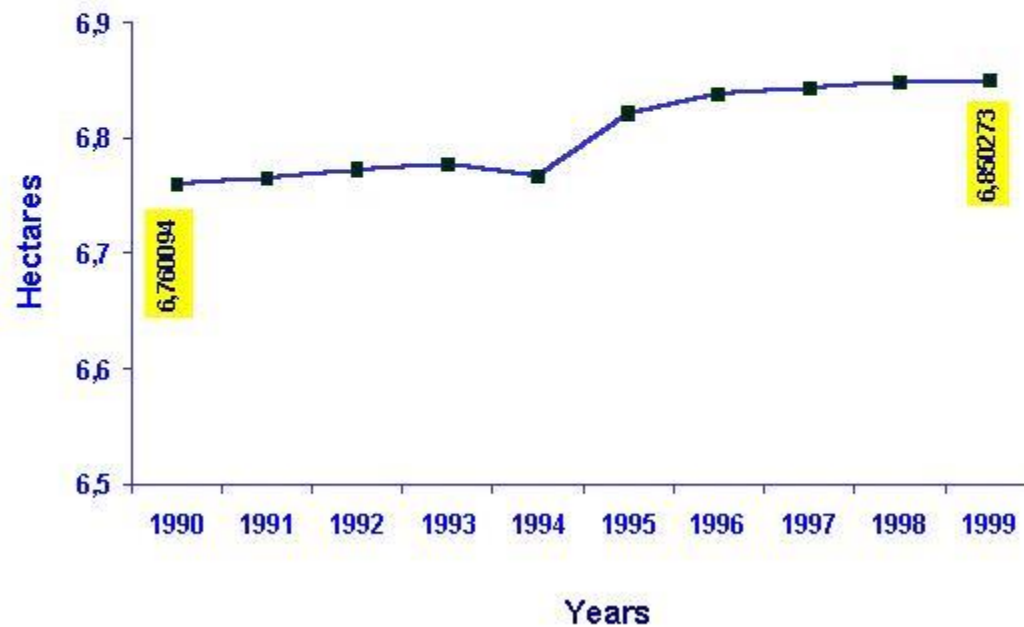
e) ground assessment / cartography / aerial photography / other geo-referenced data / satellite images

## Forest area in Italy, according to different sources

<i>Source</i>	<i>Corine</i>	<i>Ntnl For Inventory</i>	<i>ISTAT For Stats</i>	<i>ISTAT Agr Census</i>
<i>Year</i>	<i>1996</i>	<i>1985</i>	<i>1998</i>	<i>1990</i>
Broadleaved forest	4,902	4,809	5,045	3,728
Coniferous forest	1,309	1,332	1,442	1,105
Mixed forest	974	na	363	676
<i>Total</i>	<i>7,185</i>	<i>6,141</i>	<i>6,850</i>	<i>5,509</i>

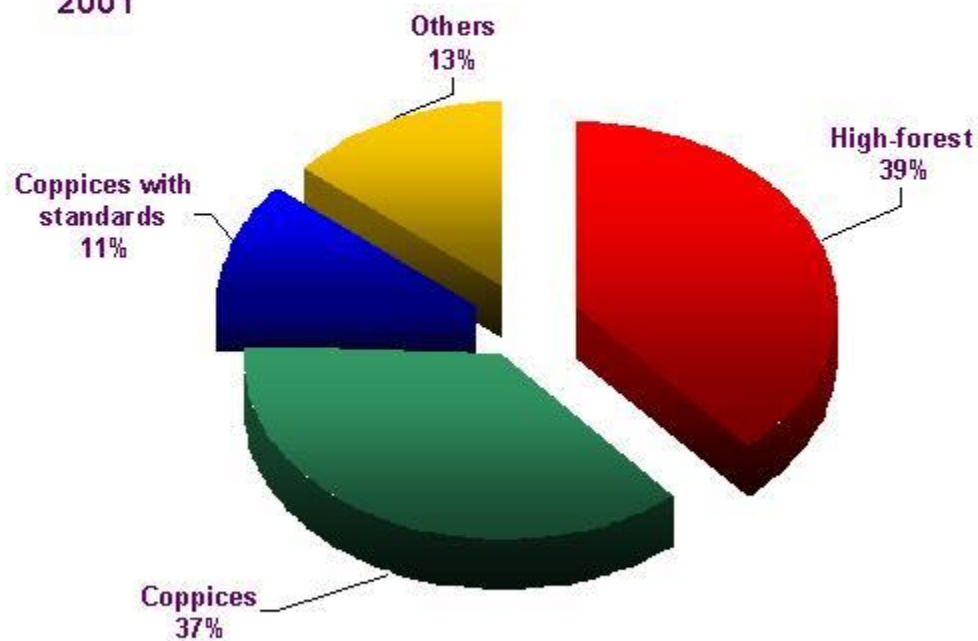
Thousand hectares

**Forest area changes in Italy (1990-1999).**  
**Source: ISTAT**



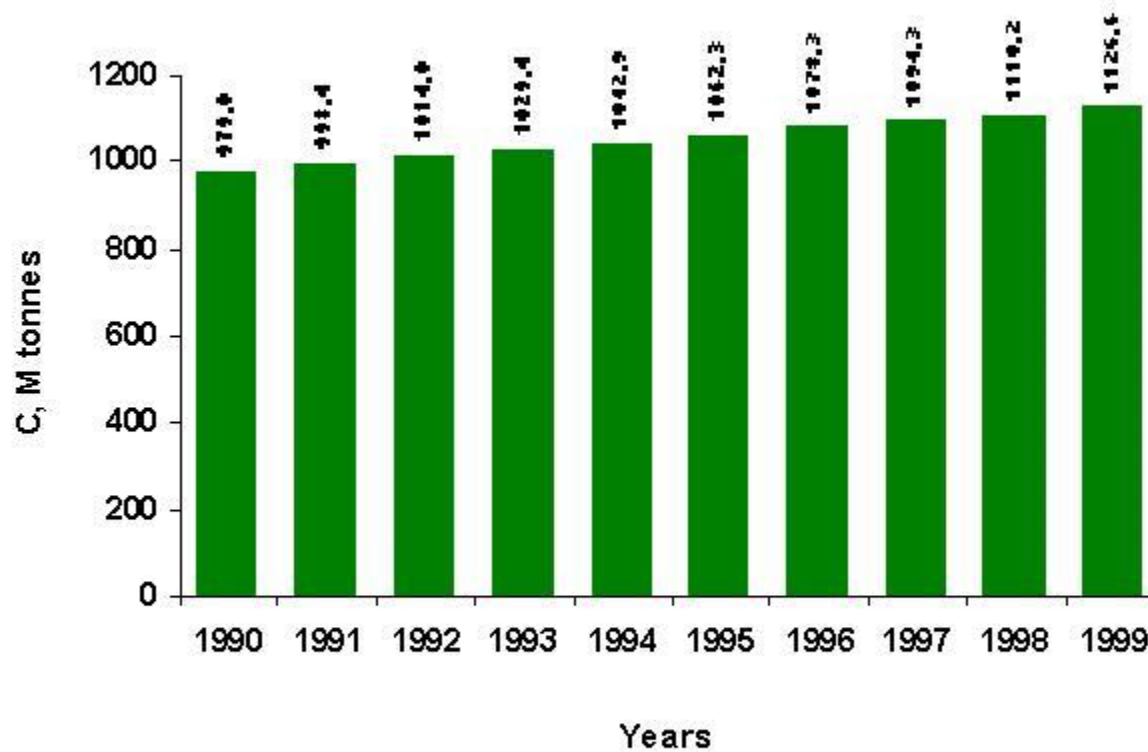
1,3%

Forest area in Italy: proportion by type of woodland. The total forest area is 6,850 million hectares. Source: ISTAT, 2001

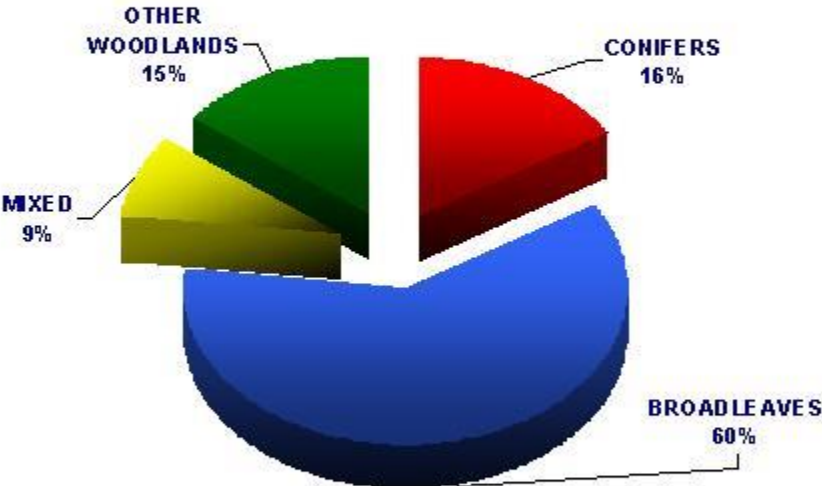




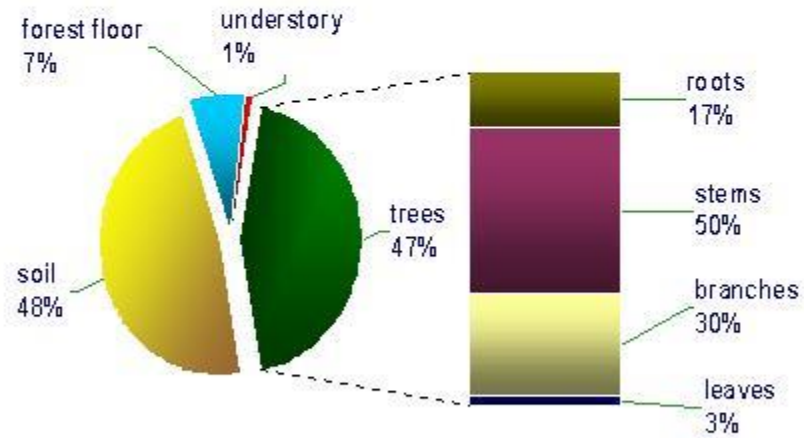
### Italian forest ecosystems: carbon stock changes



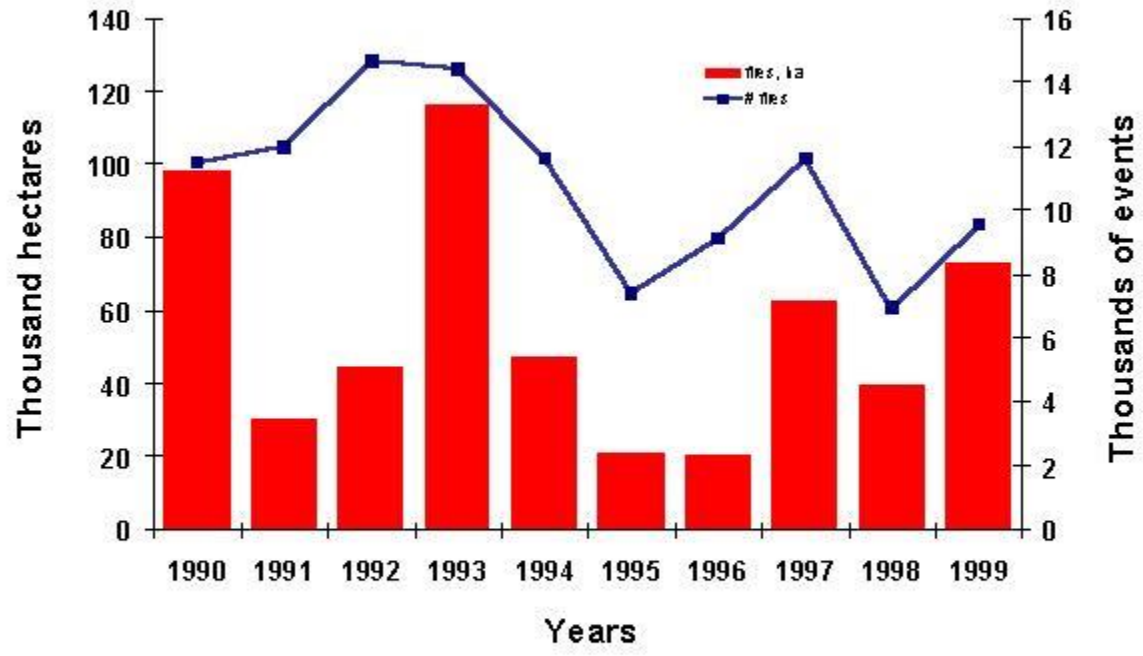
**Carbon in forest vegetation and soil in Italy:  
proportions by woodland type (1999).**



**Proportions of carbon in forest pools and in trees in Italy (1999). Total estimated carbon storage is 1,127 million tonnes.**

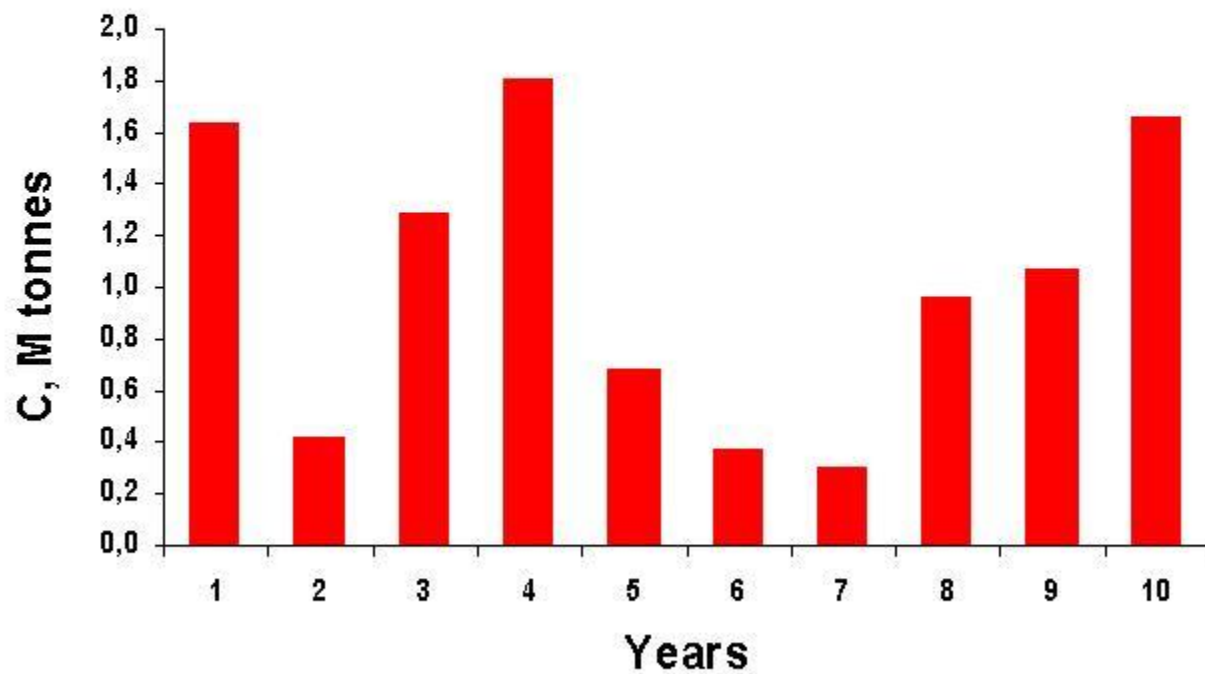


### Fires in Italy, 1990-1999



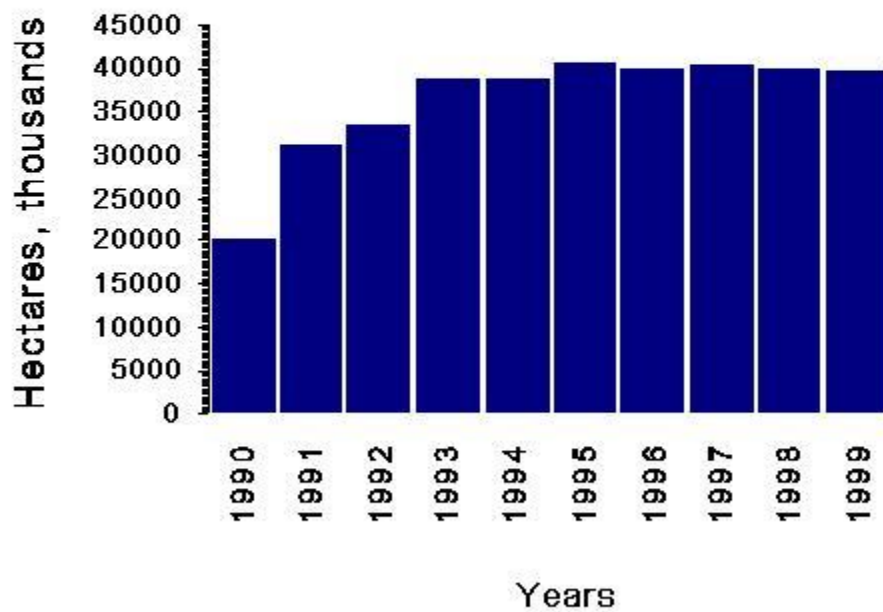
## Italy's forest resources: emissions because of fires (1990-1999).

Source ISTAT, elaborated

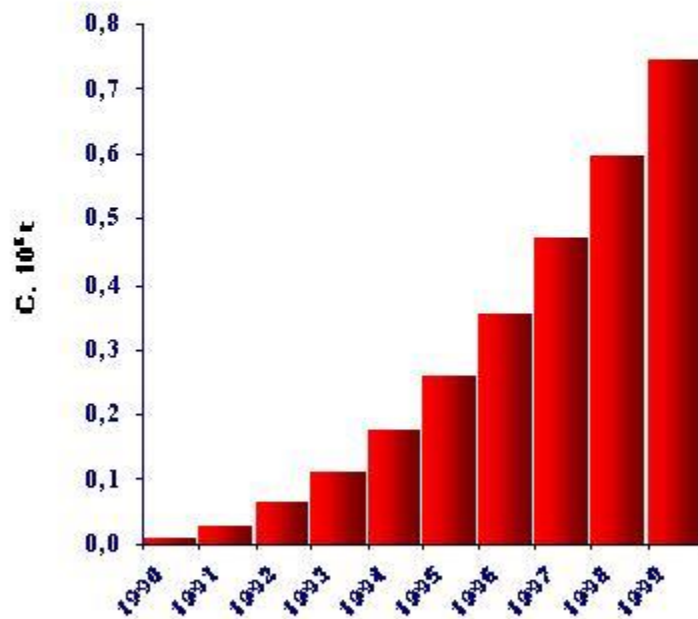


- **large part of the forest land is covered by semi-natural stands, with growing stock well below the maximum long-term average;**
- **the abandonment of marginal agricultural area is favouring the natural conversion of grazing land to forest;**

**Abandoned grazing lands naturally converted to forests (1990-1999). Source: ISTAT.**



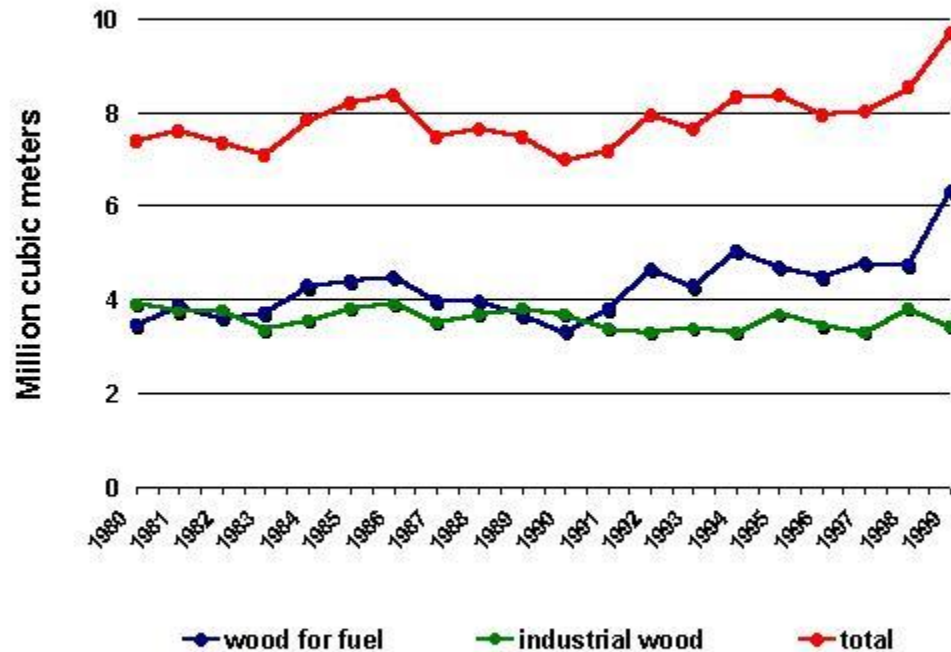
**Cumulated mass of carbon in abandoned agricultural lands, naturally converted to forests (1990-99). (Source: Ministry of Agricultural and Forestry Policies, elaborated)**





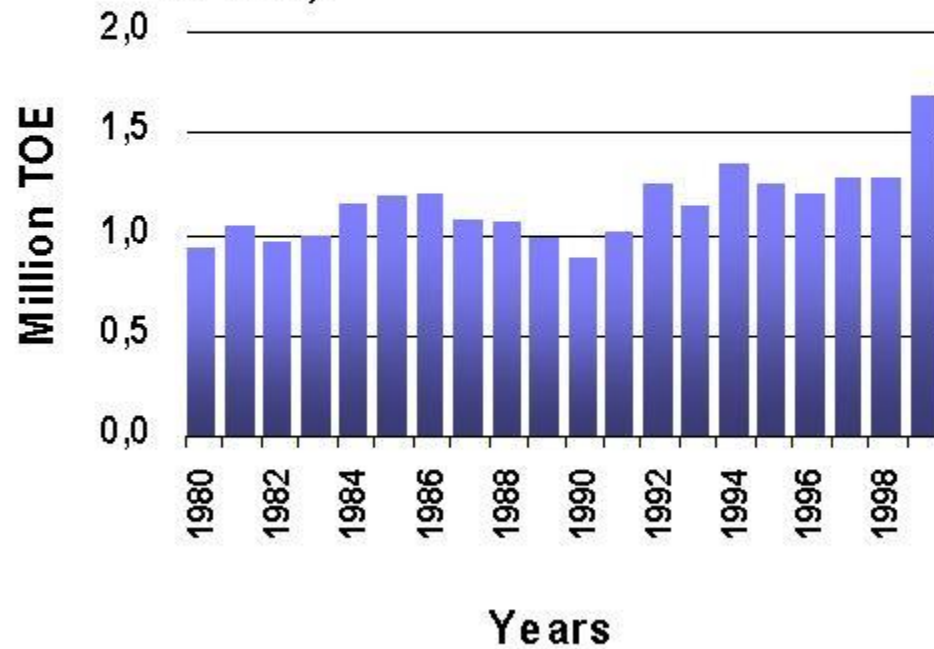
- **large part of the forest land is covered by semi-natural stands, with growing stock well below the maximum long-term average;**
- **the abandonment of marginal agricultural area is favouring the natural conversion of grazing land to forest;**
- **large amount of wood removals is used for energy with substitution effects for fossil fuel consumption;**

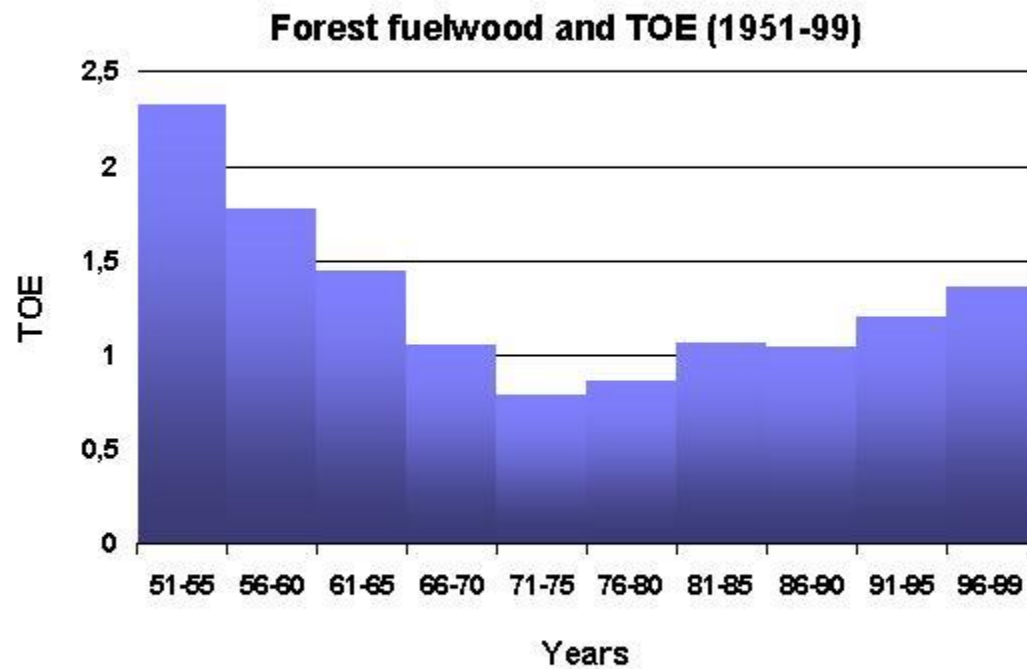
### Wood removals from Italian forests (Source: ISTAT)



The increased domestic consumption is mainly due to three factors:  
the high prices of fossil fuels  
the availability of innovative conversion technology at household level (boilers, stoves)  
the "pizzeria" consumption

### Tonnes Oil Equivalent (TOE) and fuelwood removals (Source: ISTAT)

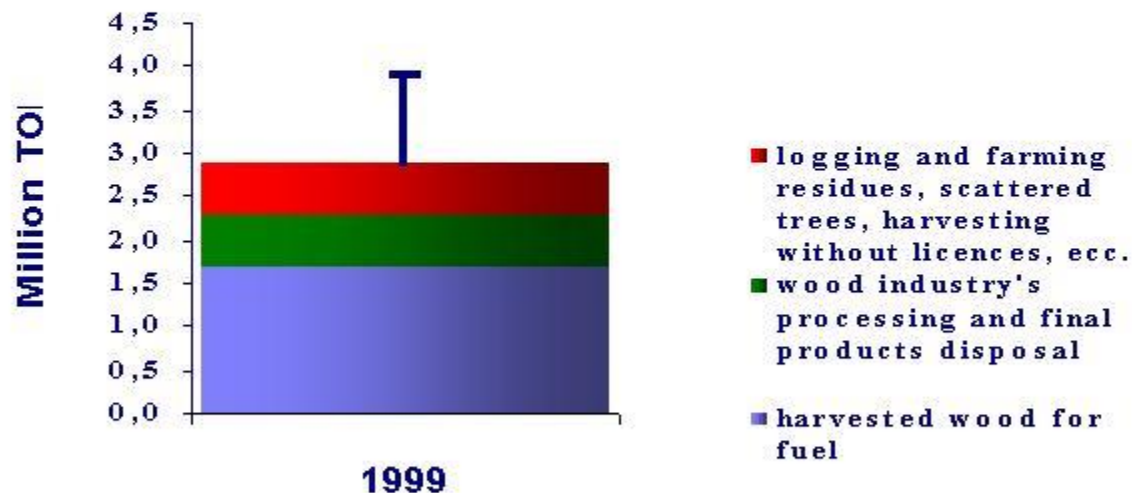




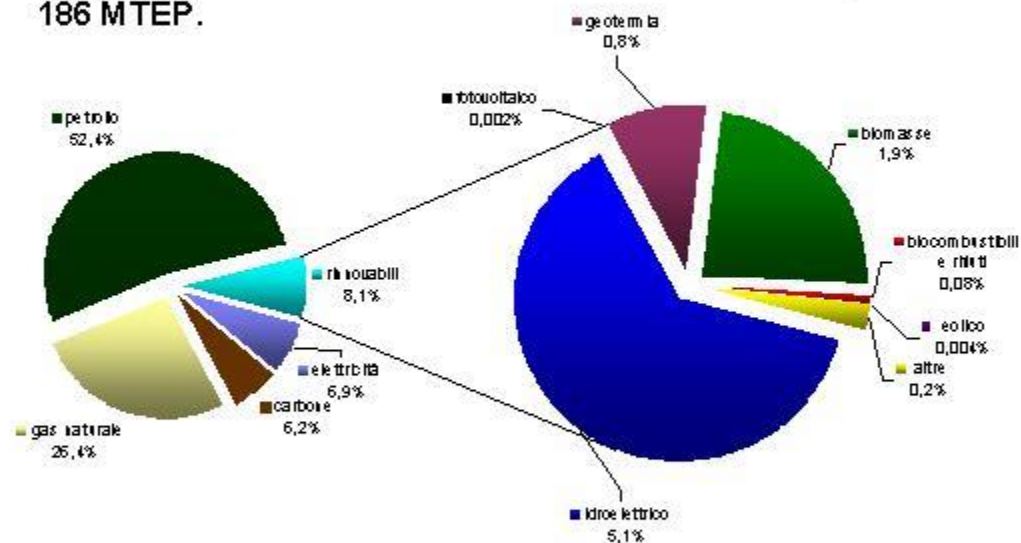
Official statistics are underestimating the current consumption of fuelwood and the production potentials, mainly for the dispersed structure of the supply and the large number of small-scale consumers.

## Wood for fuel and Tonnes Oil Equivalent (TOE) in Italy

the new regulations that are favouring the recycling of final wood products through voluntary agreements between industrial producers of woody products, consumers and municipalities.



**Consumi energetici in Italia: ripartizione per fonte di energia. Nel 1999 il consumo interno lordo è stato pari a 186 MTEP.**



- **large part of the forest land is covered by semi-natural stands, with growing stock well below the maximum long-term average;**
- **the abandonment of marginal agricultural area is favouring the natural conversion of grazing land to forest;**
- **large amount of wood removals is used for energy with substitution effects for fossil fuel consumption;**
- **forest planting programmes on former agricultural land are developing at a quite high rate;**

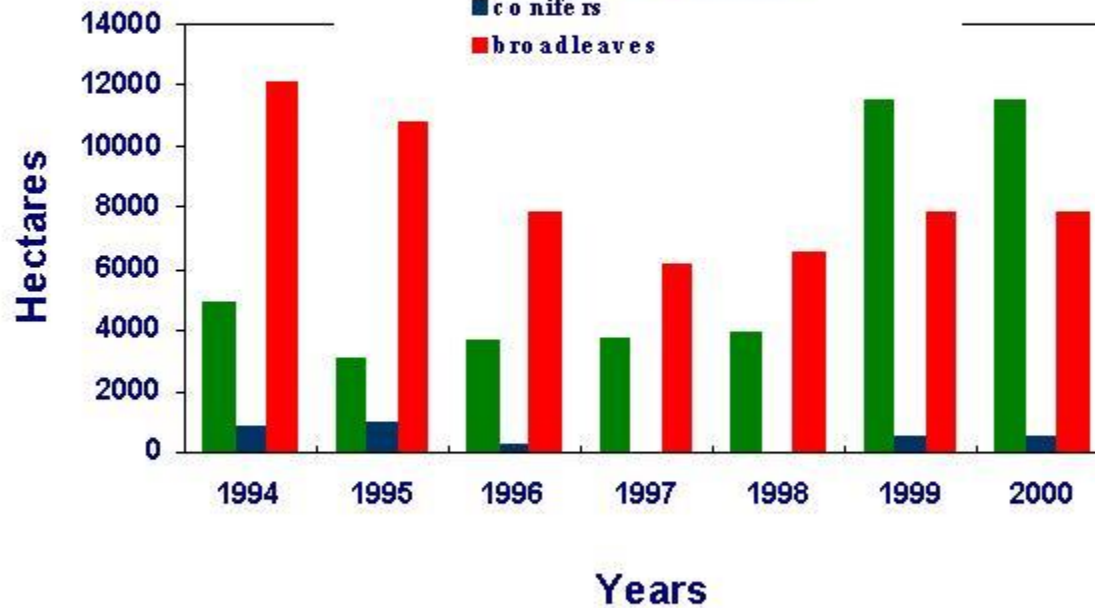
**New forest plantations under the European Commission  
farmland grant scheme (Reg. 2080/92).**

**Source MIPAF**

■ fast growing plantations

■ conifers

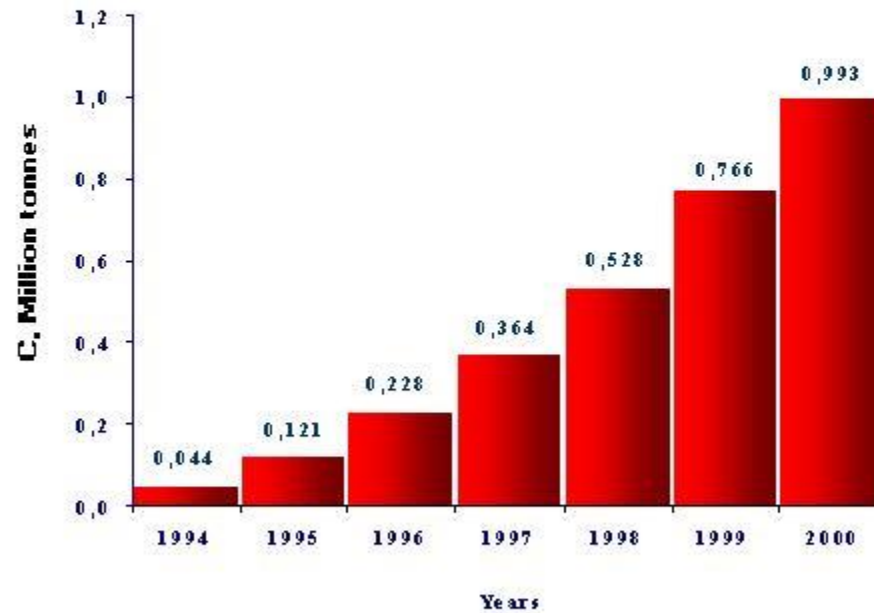
■ broadleaves






## Cumulated mass of carbon in new farm woodlands established under the Regulation 2080/92 (1994-2000).

(Source: Ministry of Agriculture and Forestry Policies, elaborated)



- 
- **large part of the forest land is covered by semi-natural stands with a growing stock well below the maximum long-term average;**
  - **the abandonment of marginal agricultural area is favouring the natural conversion of grazing land to forest;**
  - **large amount of wood removals is used for energy with substitution effects for fossil fuel consumption;**
  - **forest planting programmes on former agricultural land are developing at a quite high rate;**
  - **wood working industries are specialised in high quality furniture making, with a potential for long-term carbon sequestration in wood products.**

**Italian forest products market in 1985, 1990 and 1996 (1000 cubic metres in equivalent volume of rough wood)**

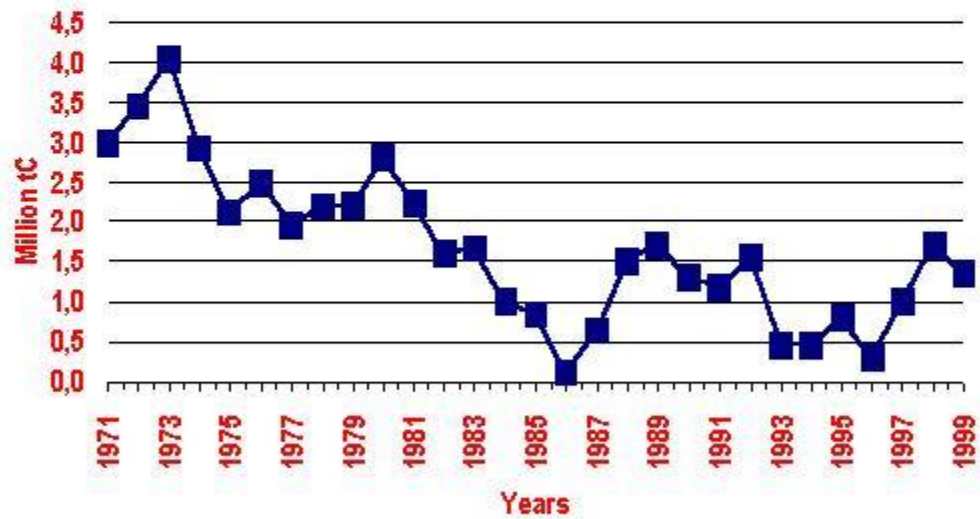
Years	Domestic Production (1)	Import (2)	(1)+(2) (3)	Export (4)	Apparent consumption (5)	(1)-(5) (6)	(1)/(5) % (7)
<b>a. raw wood</b>							
1985	9448	5496	14944	12	14932	-5484	63.3
1990	8038	7150	15188	19	15169	-7131	53.0
1995	8031	8129	15994	308	15786	-7755	51.0
1999	10913	11249	22162	268	21894	-10891	49.8
<b>b. semi-finished wood products*</b>							
1985	10222	18081	28303	888	27415	-17193	56.5
1990	11931	21769	33699	1120	32579	-20684	54.8
1995	11351	29980	34987	2225	34161	-29154	43.3
1999	11812	31220	42667	3602	39065	--27618	36.7

Sources: FAO, Yearbook of Forest Products, Rome.

\* sawn wood, particle- and fibre-boards, woodpulp, plywood, veneer sheets, sleepers.

paper (2 years)  
building and construction (15 years)  
furniture (7 years)  
packaging (3 years)  
other final uses (3 years)

### C sequestered in wood products



<i>Scenario</i>	<i>Fossil fuel consumption</i>	<i>Wood market development</i>	<i>Land use patterns</i>	<i>Externalities provision (1)</i>
<i>business as usual</i>	No trend changes: stabilisation	No trend changes: increased external dependence	No trend changes: forest abandonment, f. land natural expansion, natural conv. of coppices to highforests	Reduced biodiversity in Mediterranean areas in the short term (fires)
<i>Price premium for domestic production of wood for energy (see green certificates, use of carbon tax, etc.)</i>	Increased fuelwood removals; reduced consumption of fossil fuels	Increased external dependence for industrial wood products	Reduced coppice aband., increased commercial thinnings	Reduced forest fires and of semi-natural forests
<i>C accounting only in forest stocks</i>	No trend changes: stabilisation	Increased external dependence for industrial wood products	Increased coppice conversion to high-forests	Increased forest stock (biodiversity)
<i>C accounting in forest stocks and in wood products</i>	Increased availability of residues from wood working activities; reduced consumption of fossil fuels	Increased domestic removals and apparent consumption	Increased economic interests in active forest mngmnt, increased plantations	(2)
<i>AF-forestation and reforestation projects in the CDM</i>	No trend changes: stabilisation	Reduced domestic removals	Reduced economic signif.ce of dom. forests; forest abandonment	Reduced BD in Mediterranean areas in the short term (fires)
<i>Carbon conservation projects in the CDM</i>	No trend changes: stabilisation	Increased domestic removals and apparent consumption	Increased plantations	(2)

(1) environmental effects connected to the domestic forest resources management conditions

(2) effects depending on the approach adopted in evaluating C fixation in wood products

## Conceptual framework for analysing the effects of different C sequestration policies on Mediterranean forests

