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Land cover changes in Lombardy over the last 50 years

RegioneLombardia

The Lombard forest landscape. A historical summary[1]

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Introduction

Concern for the forest landscape in Italy has undoubtedly arrived late on the scene, but this is fully in line with the social and economic evolution of our country. This problem is due partly to the forest's different "dynamicity" compared with the agrarian landscape, whereby it tends to be perceived as largely static by the majority of the population, unless phenomena occur that affect obvious aspects such as its area. In addition to the biological times of tree cultivation, which are far longer than those in agriculture and make it more difficult to perceive change, less attention has also been given to the events characterizing its historical trends. We thus observe a certain delay in the development of study and research on this subject compared with other topics, although the recent (2006) ratification by Italy of the European Landscape Convention introduced new perspectives and approaches for action, such as those formulated in the National Strategic Plan of Rural Development 2007-2013, which includes the landscape among its strategic objectives.
From a scientific viewpoint it is probably the work of Sereni and the developments of forest history over the last decades that have opened the road to a historical interpretation of the forest landscape. In 1964 Gabbrielli published an initial work bringing this topic to the attention of the forestry community, which gradually began to see it as relevant to the sector. A few years later Patrone (1970), a leading figure in matters of forest management, interpreted the landscape as the result of the work of man, including it among the services offered to society by the woodland. Subsequent studies went into greater detail about the historical transformations of the forest landscape (Piussi, 1978) in relation to the trends of the forest ecosystems, while in the following decade a whole issue of the forestry magazine "Monti e Boschi" was dedicated to this topic, which was considered also from the management viewpoint (Bagnaresi, 1988). The initial historical approach soon had to take account of the rising trends of environmental interpretation, which could in part be connected with Biasutti's geo-morphological interpretation (1962), but then, with the landscape ecology was able to organize a conceptual scheme and a method of research to tackle the study. Unlike the historical approach, the landscape ecology has given little consideration to the man-made component (Forman and Gordon 1986), as is the case with many botanical-type studies; the interpretation of the countryside has been linked to ecological processes and the study of spatial relations, with reference to the functionalities of the ecosystems and biodiversity, though limited to aspects of specific composition. Also the works of Farina (1993) and Ingegnoli (1993), at least initially, gave little importance to the human component, while Pignatti (1993) added information on anthropic factors to the prevalently ecological approach, whilst keeping the descriptive categories of ecological origin conceptually separate from the interpretation of man's role in the ecosystem. We should not be surprised by this exclusion, or by the little consideration given to man as an ecological factor; much of ecological culture has always evaluated and thought of nature as a place where man plays a minor role or is a factor of disturbance in the dynamics of ecosystems. This approach has been extended also to the concept of the landscape and of the landscape recovery which in North America is typically interpreted as "renaturalization", i.e. enhancement of the concept of the wilderness, in opposition to the degradation caused by man-made and natural factors (Hall 2000).
In reality the concept of a "natural ecosystem" and of its "man-made degradation", which is used to define some forest types, is sometimes inappropriate for an understanding of the Italian situation. The work of man in the historic and protohistoric period constantly modified the features of the ecosystem, creating structures often interpreted as stages in evolution or degradation of forest vegetation. In Italy it has been the phenomena taking place within the agrarian or forest systems that have influenced the structures of the landscape; we need only think of the chestnut orchards planted from sea level up to and over 1.000 meters. It is therefore difficult to pinpoint environments that could be a valid reference point for the identification of "natural landscapes" (Moreno 1988). It is another thing to leave space for natural tendencies in dedicated areas or re-create woodlands that reflect natural potential, although the very concept of "potential vegetation" used by botanists confirms the wide margin of freedom enjoyed by man to modify the components of the vegetable world. At present, the synthesis studies combining the socio-economic and ecological approaches in

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1 *This work is based partly on the text contained in the volume: Agnoletti M., Martegani V., 2003, Il paesaggio forestale lombardo, immagini e storia [The Lombard forest landscape, images and history], CIERRE, Verona.*

a historical perspective seem the most appropriate for interpreting the process of construction of the landscape and defining its value. This approach was already indicated by the British botanist Rackham (1973), who exerted a strong influence on various sectors of science, including forestry.

In spite of this, there is no doubt that as far as the forest sector is concerned, most tendencies over the last decade have chosen the idea of "nature" rather than of "culture" as an ideal reference for management. The fact that the woodlands are not to be seen as a "natural object to be bent to the needs of man", but as a "legal entity", also recognizing the existence of a "woodland ethic" to be observed (Ciancio 1994, Ciancio and Nocentini 1996), is quite a different concept from the interpretations of the landscape arising from Sereni's work, which invite us to associate the concept of integrity and stability of the biotic communities with positive esthetic judgments. As against these views there is a situation where the real risks of deforestation are linked to phenomena that can be traced historically to the first part of the last century, given the enormous increase in forest area over recent decades. In reality many of the Mediterranean landscapes that we can admire today are characterized by conditions which, according to classical ecological interpretations, correspond to more or less accentuated states of degradation (Pedrotti 2008). In the majority of cases attempts are made to remedy them by orienting them towards natural evolution. Also the atlas of areas risking desertification, defined as "areas of agro-silvo-pastoral functional sterility", puts the extent of the areas at risk at 58% of Italy's national territory, which means about 15 million hectares as against 10 million hectares of forest and 13 million hectares of farmland, which obviously are included to a certain degree in these areas. In fact, if we observe the data for Sicily we see that almost the entire region is included in medium to high risk areas, including the landscapes of extensive cereal cultivation and other areas where an arid nature has been the salient feature of the local landscape for some thousands of years (INEA 2005). These approaches have effects that are not insignificant on the planning of the landscape, with continual calls to increase the forest area and enhance naturalness.
These interpretations are backed, especially in the protected areas, by European directives such as the 1992 HABITAT, oriented towards the identification of habitats of natural origin to be protected where "fragmentation", a significant feature of many Italian landscapes, is seen as a risk to biodiversity. This statement is of sufficient weight to require a call for caution by the Ministry for the Environment, in its guidelines to the management plans for the Natura 2000 areas. Naturalistic approaches are also reflected in scientific texts interpreting forest types, which are a point of reference for those engaged in the management of forest areas. Based on vegetable associations and therefore on plant sociology, these interpretations are founded on the assumption that a given vegetable community corresponds with a certain environment and, conversely, that a given environment corresponds with a given community, with the result that a community becomes a biological proof of the nature of the environment. The biotic factors include man-produced ones, considered generally as factors of degradation or disturbance with respect to a primitive natural phase. As explained by Cevasco (2007), the plant-sociological approach tends to extrapolate the population from the topographical context to bring it down to a theoretical model, valid on the bio-geographical scale. In counterposition to this interpretation is the historical approach which concentrates on the historical environmental context and the specific identity of a site, developing investigation "on the basis of the present ecological behavior of a species in relation to the practices and systems of management (or non-management)" studied on a local scale. The objective is therefore to recognize, in the characteristics of the vegetation cover, the effects and traces of previous farming systems according to a regressive historical model. When models of evolutionary trends produced by plant sociology define the history of the landscape through a comparative analysis between the systems of the present ecosystems and potential ones, they are unlikely to take into due consideration the historical trends that have influenced our ecosystems. Ecological trends, if analyzed on a local scale, are much more dependent on history than is normally thought (Russel 1997). These are trends not necessarily coinciding with the regressive or progressive ones envisaged on the basis of the "climax" concept; the same concepts of "potential vegetation", "climax", evolutive/regressive series and degree of naturalness actually conceal the reality of historical processes behind theoretical schemas that very often remain to be proven (Moreno 1990). It thus happens that we have scientific interpretations as to the presence and origin of some species in areas where this has already been described as a product of human action, or interpretations of coenosis such as the Mediterranean scrub which see it as a phenomenon of degradation of high-stand woodland and not as a type functional to historical uses of the land. More often we have Sites of Community Importance (SCI) where the natural habitats to be protected are completely anthropized forms of forest vegetation, such as coppice converted to high trunk, re-afforestation, pastures, mixed chestnut woods etc., with results that make it difficult to formulate effective plans of management.
A consequence of such approaches is also the definition of forests as "primary" or "natural". According to the FAO, forests are defined as primary if they do not show visible signs of human influence and where the ecological processes are not significantly disturbed (FAO 2005); this definition already suggests that we are dealing with an assumption that does not need to be demonstrated by historical investigation to determine the quantity and quality of anthropic influences,

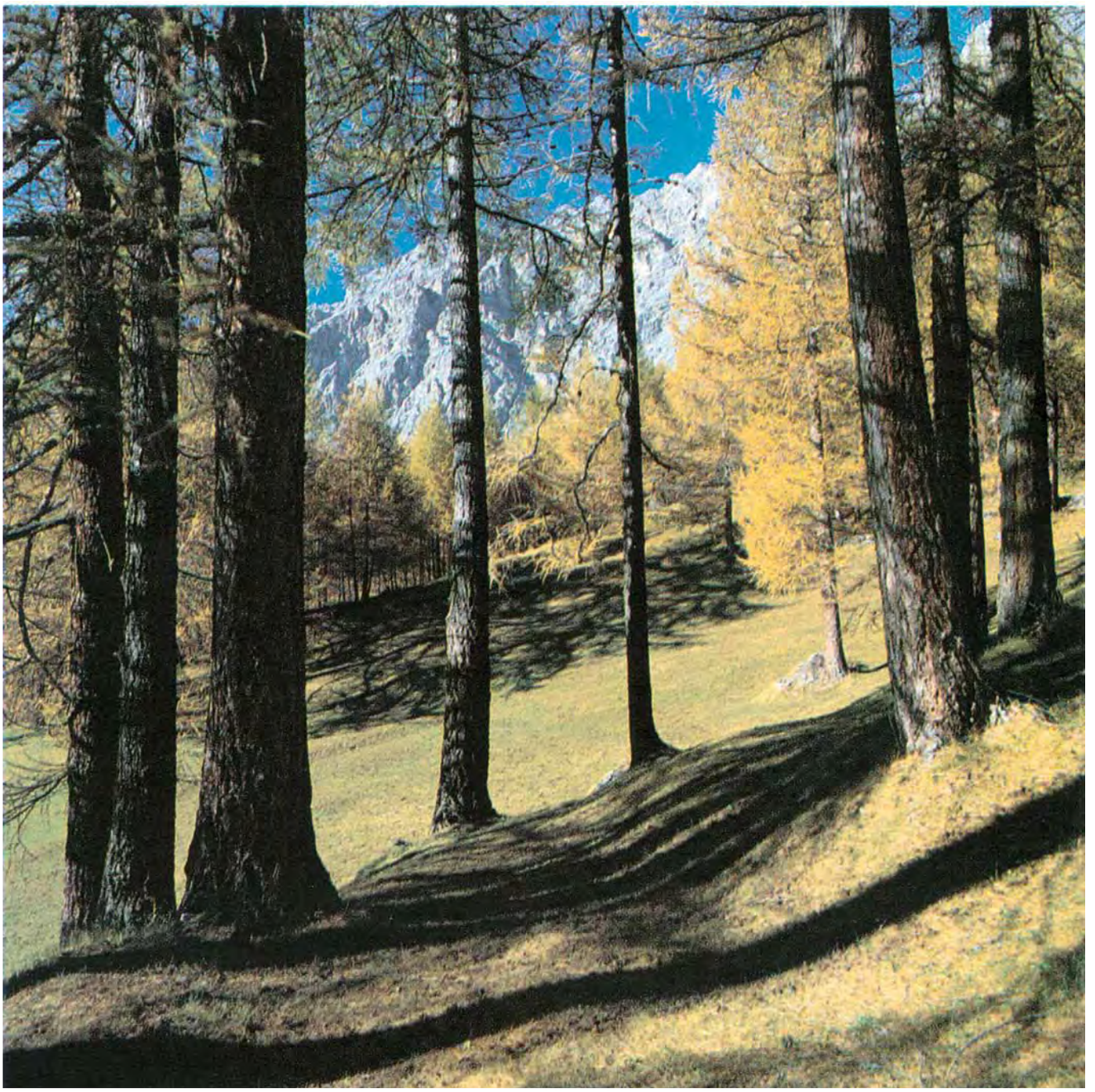

Figure 1
Photo of a larch wood in Val Seriana. Larchwood pastures have a very important role in the landscape, not just for esthetic reasons; in spite of this there are hardly any technical standards and scientific criteria for the management of wooded pastures, which used to be widespread in Italy.

but is a convention accepted by the scientific community. According to FAO data, the Italian “primary forests” amount to about 160.000 hectares and consist prevalently of integral forest reserves and other protected areas. Overall in Italy about 3 million hectares of forest resources are subject to various forms of protection for naturalistic purposes (Marchetti and Mariano 2005), about 10% of the entire national territory, and about 27,5% of the forest area, then there are sites of the Natura 2000 network to be considered, i.e. those created expressly to protect natural habitats, which cover no less than 21,5% of the forest area. As regards naturalness it is worth making a few historical clarifications. Already in Roman times there were about only ten woodlands left relatively untouched (Di Berenger 1859): Selva Cimina (Viterbo), Selva Litana (Bologna), Selva Gallinara (Pozzuoli), Selva Angizia (Fucino), Selva della Sila, Selva Diomedea (river Timavo), Selva Fetontea (river Livenza), Selva Lugana (Peschiera). The alternations between beech and spruce in the Alps, between holm oak and pinewoods on the coast, between chestnut, oak and beech on the Appennines, between tree and shrub vegetation, typical of the scrub, are all variations linked to human activity rather than to natural causes. On the other hand, in a country where vegetational, climatic and soil characteristics, together with the needs of the population, have allowed planting of the chestnut from sea level, contesting the land with the olive tree, up to 1.500 meters on Mount Etna, we can understand that any interpretation referring exclusively to climate or soil would have difficulty in defining the naturalness of a vegetable formation with any certainty. In the same way, in a country which at least since Roman times tree species have been imported from abroad, to speak of native and alien vegetation and seek a criterion for deciding which is natural vegetation, is a difficult operation. We would in fact need a “Historical Atlas” of Italian forest vegetation to give an interpretative instrument enabling us to characterize it completely also as regards its historical origin. These are not insignificant issues, if we consider that once they are classified as natural habitats the woodlands come under quite strict legislation, which landscape conservation has to take into account, so that the reclamation of a pasture, a terracing or a chestnut orchard are in fact precluded whatever the real situation on the land. The identification and definition of natural habitat is therefore a widely disputed question, especially when we study the historical trends of forest transformation in protected areas (Agnoletti 2007). These are not only Italian but also European tendencies; suffice it to remember the celebrated natural areas, like the Polish forest of Białowie□a, where historical-environmental investigation detects an uninterrupted presence of farming, grazing and hunting activity from as early as 500 BC. According to the IFNC[2] of 2005, most of the woodlands in Italia originated through semi-natural processes (69,2%), i.e. following silvicultural activity. The woods of “natural origin”, which also include the vegetation originating with the aid of indirect human activities, are less than a sixth of the overall woodland area (15,4%). As far as Italy is concerned, we can conclude that in the last few decades we have seen a process of removal from the collective memory and from scientific thought of the original characteristics of the Italian landscape, as a cultural product, in favor of an alleged naturalness responding more to social needs than to historical or ecological evidence, which however we also have to take into account at legislative level. This is a sociologically interesting phenomenon, typical of a “weak” culture which has not had the strength to advocate the points of strength of the man-made landscape typical of the Mediterranean, as against ways of thinking from the North American and North European cultural environment, which are often accepted uncritically, with evident advantages in opportunities for researchers to be better integrated into the dominant scientific context internationally, but are certainly farther from the reality of Italy and the Mediterranean.
Compared to all this, the inclusion of the landscape in the Strategic National Plan of Rural Development 2007-2013 as an objective of farming policies, as already mentioned, has introduced not only strategies and actions for the landscape but also new concepts at the basis of its planning (Agnoletti 2010). As well as the consequences in the regional Programs of Rural Development, the Landscape Working Group set up at the General Directorate of Competitiveness for Rural development of the MIPAAF (Ministry of Agriculture, Food and Forestry), has through its activity promoted studies such as one aimed at drawing up a “National Register of Historical Rural Landscape”, to identify – and define their state of preservation – those agricultural, forest and pasture landscapes requiring conservation and enhancement.

Lowland forests, wood pastures and land division: the origins of a cultural landscape

In its 23.856 km^2 area, Lombardy offers a diversity of landscape with few equals in Italy, especially if we consider its variety of physical environment. From the over 4.000 meters altitude of the Pizzo Bernina to the Oltrepò there is a varied sequence of mountain, hill, plateau, lake and flatland environments that is rarely to be found in other regions. In this extended altitude gradient we can recognize six main geographical zones: the Alps, the PreAlps, the hills, the high flatlands, the low flatlands, the Pavia (and Mantova?) Oltrepò, each with quite different histories and a quite different natural appearance. This geographical differentiation was adopted by the old Landscape Plan which recognized these

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2 *Nazional Inventory of Forests and Forest Carbon Reserves* **3** *National Forest Inventory.*

belts as so many “landscape units”, increasing them to seven by the addition of the “urban landscapes”, and subdivided them internally making a total of 17 zones (Negri, 1998). In the whole territory the role of the woodlands is not secondary, as it covers about 598.500 ha (IFN[3], 1985), with the greatest presence in the province of Brescia (25,5%) and the smallest in the province of Cremona (1,4%). This area amounts to 25% of the region, with a variety of types ranging from riparian vegetation and poplar plantations in the plain to the formations at the upper limits of Alpine vegetation. It is worth remembering that already foreign writers visiting Lombardy in the 1700s and 1800s, such as Goethe, Stendhal, Shelley, Chateaubriand and Montesquieu to name but a few, not only celebrated the landscape of the lakes, or the tree-intercropping of the lowlands, but were also attracted by the quality of the woodlands. Not by chance Stendhal and Shelley were impressed by the splendor of the chestnut plantations that descended from the mountain slopes of the Lario, compact almost to its shores (Farneti 1972), highlighting the beauty of one of the most interesting woodlands historically and culturally.

In analyzing the trends in historic times we cannot ignore that some important aspects relating to the distribution of forest vegetation, like the human settlements, have been conditioned by the climatic evolution and the particular terrain of the region. This applies especially to the particular situation of the Insubric region, which features the typical vegetation of the Mediterranean zone, with little connection with the Alpine or PreAlpine environments, but is the result of the immigration of thermophylous and south-eastern plants in the post-glacial period. The subsequent worsening of the climate was to bring about the “isolation” of these formations in the lakes area, by eliminating the routes of penetration from the sea across the Po valley plain, except the area of the Euganean hills which still show evidence of it. The particular climatic conditions of the Insubric region and human activities have enabled this Mediterranean type vegetation to reach up to the present in Lombardy. The remaining geographical regions in Lombardy see the presence of vegetation in line with a continental climate in the Alpine area, with significant variations depending on the exposure of the slopes; the south-facing ones favored human settlement and the more thermophylous species. The same continental character is recorded in the Po valley flatlands, with high humidity and with rainfall limited but well distributed throughout the year, while the abundance of water is mainly due to the runoff from the Alpine and Apennine chains, with groundwater emerging to form the belt of spring heads in the vicinity of the Alpine slopes and dividing the territory into the more irrigated and fertile low flatlands, and the more arid upper plain above them. This is a belt that man has progressively moved northward, to increase the irrigated areas, and to which we can add all the canal networks dug in the plain, which are the main reason, rather than the climatic regime, for its fertility today.

Bearing in mind the environmental situation and the results of paleo-botanical research, it seems probable that in protohistoric times the Po valley plain was covered by extensive forests, interrupted by swamps and clearings, with a series of drier hillocks and raised areas. These formations, attributable to the mesophilic forest vegetation of the oak and hop-hornbeam woods, were dominated by the pedunculate oak (*Quercus robur*), accompanied by such species as the black alder, poplars, hop-hornbeam and others still. In the 4th and 3rd centuries BC we find an environmental situation already conditioned by the activity of the populations present in this area, which we can divide into three broad ethnic groups: the Liguri to the south of the Po, the Gauls between Garda and the Apennines and the Veneti in the east. According to the writings of Sereni (1997) about the “Greater Liguria” in the pre-Roman period, which included part of the Po river plain, in this period the “*saltus*” (wooded grassland) had already taken on the connotations of a characteristic feature of the landscape. In truth if these peoples, and also the Celtic “invaders”, practiced widely pig-breeding, it is possible that together with the “wooded pastures” typical of the “*saltus*”, there were also many “pastured woodlands”, i.e. not pastures with a scattering of trees but rather not very dense oak woods, suitable for the production of acorns and for semi-wild grazing, which seem to have extended further in Roman times. This landscape was accompanied by farmland which saw the presence of the vine “married” to other trees, probably of Etruscan influence, and which the Romans contributed to extending considerably.

Already at that time the position of the Po valley plain made it a natural strategic area of connection between north and south Europe, attracting the attention of Roma, which in the first decades of the 2nd century BC was engaged in the culminating stage of its conquests (Mainardi, I, 1984). By defeating the Boi Gauls, the Insubri and the Orobi, Roma in fact began the work of political and territorial organization which was to absorb the local peoples into the Roman-Italic culture. However, the latter left important traces of themselves not only in place names, e.g. medio-lanum (hence Milano) from the Gallic matrix, but also in forestry terminology. The name of the Po (Padus in Latin), seems to have come from the “*ragia*” (resin) – called *pades* in the Gallic tongue – which was produced from the forests at the origin of the river, but there is also a long series of lexical remains relating to species which due to their Alpine location were little known to the Romans and which Latin has borrowed form the indigenous speech. Among these we find “*betulla*” (birch) of Gallic

origin, or "*sondar*", from the pre-Indo-European linguistic matrix, indicating associations with rhododendrum and Swiss mountain pine, hence the place-names Sondrio and Sondalo, which indicate already well-defined Alpine landscapes, but the list is far longer, including terms referring to pines, larches, firs and also broad-leaf trees.

In those centuries the work of reclamation and cultivation of the lowlands began, with the steady shrinking of the original great woodlands of the plain. By Strabo's time many of the swamps which Hannibal had had to cross with difficulty had been reclaimed by Scaurus Emilius in 109 BC, but also Polybius and Livy talk of pastures and abundant cultivated fields. In spite of this it seems precisely that the structure of the oak woods, especially in the wide series of terraces of the middle diluvium that stretch from the last mountain slopes to the Po – which had a prevalence of poplars, alders and willows along its banks – was dedicated to grazing by large herds of swine. Cato notes the importance of the production of dried meats among the Insubri and the large size of the animals, which could not be transported except on wagons. Polybius, for the first centuries of Roman colonization, describes herds of a thousand or more head, which after spending the night in rudimentary shelters would come out to graze in the oak woods. It was therefore a semi-wild breeding system, whose widespread existence tells us of important modifications by man to the forest landscape, considering that pig grazing, by eliminating young plants, favored a sparse, high-stand woodland devoid of undergrowth, with obvious consequences for the natural renewal of these formations. A landscape therefore existing prior to Roman colonization, which soon spread throughout Italy and was maintained in some areas until the early 1900s, with a historical persistence of at least two millennia, but today absent from the Po river plain.

Contrary to common belief, however, it does not seem that the plain was the primary place of human settlement. The chronology of the anthropization of different altitude levels reveals an initial, though sporadic, presence in the mountains, while the lowlands seem to have been colonized mainly as a result of reclamation. The information available for the Bronze Age talks of semi-nomadic agro-pastoral systems, where small cultivated areas were tied to the needs of stock-breeding and the necessary moves in search of pastures (Guidetti 1998). The first phase of populating the mountains was in the alluvial fans and the more fertile scree areas, as a consequence of the clearance of oak and beech woods. The most stable settlements were concentrated mainly in the mid-mountain altitude band, with gentler slopes and often with more evolved soils, especially on the plateaus, where there was a continuous shrinkage of the woodlands to create cultivatable land (Borgioli 1946). The picture is obviously vague with little detail, as is the evaluation of the actual degree of deforestation, on which the sources are anything but agreed.

In the Iron Age the exploitation of the mineral resources by the Celts, especially in the pre-Alpine areas, must in any case have affected the structure of the landscape, due to the development of traffic for the trade in iron and salt. As Sereni (1997) points out, it seems to be ascertained that at the time of Roman colonization the mountain woodlands, like those of the lowlands, were at the center of activity for both harvesting and production of trees. The trees were already felled with "strong, heavy iron axes", tools that had now supplanted the former stone axes, which were unsuitable for felling large trees, and which enabled the felling of trees on the Ligurian Apennines up to eight feet in diameter, which already at that time were sent to Genoa for ship-building. This was an important technological innovation, as it was no longer necessary to open clearings in the forest only with fire, but allowed selective felling of forest species for use as timber, already a commodity for trade with the Roman conquerors. This activity went alongside the habitual commerce of other products that the mountain people regularly traded with the lowlands, i.e. "resin, pitch, resinous branches for torches, cheeses, wax and honey". In the high-stand woods there was already therefore a process of selection of species which was to change the countryside, as recorded for Etruria at the expense of the white spruce, while also coppicing spread, as described by Pliny the Elder[4] and still more by Columella.

The edict of Claudius in 46 AD, relating to disputes in the fields and pastures in the Como area, already describes the general features of the Alpine landscape, which were to be maintained over time by the local communities and do not seem to have been too much influenced by Roman colonization. In this mountain landscape, if only vaguely described, we note a significant absence: the chestnut orchard. The presence of the chestnut fruit is not confirmed with certainty in lakeside dwellings, nor in Bronze Age tombs, and everything suggests that it was not yet established on the southern side of the Alps; this seems to be confirmed by some specific studies (Negri 1919, Pavari 1925). The spread of this species in the Lombard area had probably already begun before the conquest, reflecting the spread of Roman culture, which had imported the tree from Greece, where it had in turn been introduced from Asia Minor. With Roma the spread of the chestnut tree proceeded rapidly, since the chestnut formations all seem to have come from artificial plantations, which gradually extended their area at the expense of that occupied by the more thermophilous beech woods, which at the time were probably the dominant feature in the mid-mountain forest landscape.

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4 *As a note of interest, Pliny originated from lake Como.*

If the mountains were the seat of forestry, pasture and gathering activities, in the lowlands the Roman settlers brought about a progressive expansion in farming activity and an organization of the land whose division gave it a field geometry which has been partially preserved down to our times. Also in this case, Roman techniques found themselves competing with the pre-existing ones, which made wide use of native forest species, such as the field maple and the elm. The "*Atinia*", as reported by Pliny and Columella, was an elm widely used to fasten vines, while Varro mentions trees called "*opulus*" and "*rumpus*", elm or field maple, used to marry the vines. It seems that the term "*rumpotinetum*" may already refer to the "Po plain *piantata* of treed vines", a technique that Columella reports as being in use in Gaul[5], but probably introduced by the Etruscans. The great development of agriculture was linked to the Romans, who extended their farming techniques into the conquered regions, attributing much importance to it as a "status" symbol which conferred great value to the management of the farms, where the owners often lived stably, with a tendency that was to be accentuated with the urban crisis recorded form the 3rd century onward. In that period a reorganization of the empire was carried out, which raised Milano to the role of imperial capital, situated at the center of a road network connecting it not only with Italy but also with the regions of the north and east, where a large part of the fate of the empire was now being played out.

It seems clear that with Roman rule throughout Cisalpine Gaul there was an organization of rural space where the order of the crops was counterposed to the "disorder" of the "natural" landscape. Thus a new make-up of the territory came about, representing one of the many characteristics of Roman civilization which by spreading farm crops at the same time reduced forest spaces, so that the expanse of cultivated areas in the first imperial age seems to have doubled in comparison with the past (Carena 1977). In this way initially only functional needs were satisfied, but later these were to become esthetic too, contributing to increasing the value of agricultural property, to the extent that Horace complained that some villas privileged ornamental plants such as the plane tree, rather than the "humble but extremely useful elm". Contrasting with the order of the agrarian landscape however was the extension of the "*saltus*", which occupied significant areas, in homage to a pastoral economy of fundamental importance, with an extension that seems to increase in the Lower Empire not so much due to the beginning of a slow process of disruption of the landscape but to its further extension at the expense of the natural landscape. It is probable, however, that alongside intensely farmed areas there were still significant wooded areas, such as the Selva Lugana near Artelia (Peschiera), which is recorded as the location where the barbarian invaders were defeated in 268, but also as a place populated by boar (Piccioli 1918). As can be seen from these brief notes about the Roman era the border-line between woodland and "non-woodland" was already diluted into a more complex mosaic, where the trees of the grazing land, single or in groups, left their place to plantations, with a careful but widespread use of forest species.

Reafforestation and new agricultural development between the fall of the Empire and the Middle Ages

With the crisis of the Lower Empire and the first incursions by Germanic peoples, but especially from the first years of the 5th century AD, with the invasion of the Goths and the sack of Roma by Alaric (410 AD), the agents of disruption of the Italian agrarian landscape accelerated significantly, in a process accompanied by the steady decline of the towns. The phenomenon in Lombardy may have been less violent at the beginning, considering the significant support given by the Milanoese clergy to the reign of Theodoric, while the most negative period was probably that of the war between Goths and Byzantines with the destruction of Milano in 536. With the arrival of the Longobards in 568 AD and their stable settlement in Italy, a process of disorganization of the landscape set in, with a reduction in farmland areas and a re-growth of woodland and pastures, connected with an inexorable fall in population favored by famine and pestilence; the population of eight million or so in the imperial period had fallen to an estimated four million by the 6th-7th century. It was in fact also a great crisis of the Greco-Latin "cultural codes", which only the clericalization of knowledge by the church attempted to preserve, with a parallel crisis of the collective memory of the populations, which was reflected also in the structure of the landscape (Renucci 1974).

In the sub-Alpine hill areas and in the upper flatlands, the disintegration of the farming countryside toward forms linked to the silvo-pastoral economy was probably slower, but throughout Lombardy the tendency observable in most of Italy seems to be confirmed. The regression of the cultivated landscape was probably accompanied by an unfavorable climatic phase (Le Roy Ladurie 1965), and it was in this context that the natural trends of the countryside recovered strength, with the extension of the woodlands in the mountains and the plain, a process favored by the intense hunting activities of the new rulers, who set aside large areas of forest for the purpose, protecting them with specials laws

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5 *By this term Columella referred to modern Lombardy, which was then part of Cisalpine Gaul.*

such as the one promulgated by the Longobard king Liutprando in 726. Together with the extension of the woodlands, however, there was also a disquieting expansion of the marshes, not only in the Po valley plain but in many other areas of the peninsula, which had formerly been described as places of flourishing agriculture in the Roman period and now turned to marshland (Jones, 1974). A strip of woodland and swamp returned on the banks of the Po and came to cover a large part of the Mantova and the Reggio areas. In the mid plain the woodland areas were more discontinuous, while in the upper plain and the sub-Alpine band of low hills, outside the heathland areas which were also used for pasture, a more or less numerous peasant population persisted, with cultivated areas but also wide uncultivated areas. The changes in the landscape were reflected also in the redefinition of social roles: in Longobard society the swineherd was undoubtedly more important than the small farmer and the economic value of the woodlands was linked to the number of pigs that could graze there. This was therefore a regressive phase that brought the forest landscape of the plain back towards forms preceding the Roman colonization and involved also the mountains, where the change was less dramatic, but where the woods were again expanding, giving a new impulse to the beech woods, which were probably favored by a cooler climate.

After the Saracen incursions of the 9th and 10th centuries and the Hungarian forays, the disruptive processes had now reached their limit and we begin to see an inversion of trend, notably with the rebirth of Milano, which began in the Carolingian period. The constitution of the St Ambrose monastery marked the first step in a new growth in importance of the church, once again privileged in the course of the struggles for the crown of Italy in the 9th century; its point of strength was its possessions on lakes Maggiore and Como, where agricultural and pastoral activities were quite prosperous. These possessions grew through continuous donations of forest and grazing land, but also with the acquisition of state lands, and were structured according to the more general schemes of the Curtense system, as is well documented for the constitution of the patrimony of San Salvatore of Brescia (Toubert 1983). Thus, in the first years of the second millennium a process of organization of the landscape began, starting in the hills and the mountains, on land once more preferred to the swampy terrain of the lower plain. Areas like the Bergamo hills were by now influenced by the cultivation of the olive tree, the chestnut and the vine; wine was to become one of the main products of the area, while oil production and the export of farm produce from the region of the lakes was well developed (Andreis 1993). The chestnut grove in this period seems to have substituted the woods of downy and sessile oak especially on the south-facing slopes, but also coenoses typical of the cooler areas characterized by linden, maple and ash. This can be seen also from the medieval statutes of the communities, where the obligation often appears to plant this species, which on the higher slopes went to substitute the beech. In the upper part of the mountains the need for pastures as a result of the new stock-breeding development led to the progressive removal of forest vegetation, but the forage must often have been insufficient, as cartloads of hay were sent from Milano and Novara in the 11th century to satisfy the great demand of the Bergamo area.

In the lowlands and hills the clearances and deforestation again tended to spread crop farming, a process that took place in parallel with the general growth in population recorded from the 11th to the 13th century, raising the population of Italy from five to eleven million. A division of the land came about, which saw a mountain area, with woods and pastures still linked to a community management, a hill and upper flatland area where the dominant feature was cereal crops, and a low flatland area where reclamation by drainage created a mosaic of agricultural crops. From the landscape of the plain with wide stretches of woodland in the early 12th century (Fumagalli 1976), though by now man-made, we then pass to a situation in the 14th century where the scarcity of the forests obliged the communities to develop forest safeguard measures, with a tendency quite similar to that taking place in a large part of Europe (Duby 1984). In spite of the subsequent fall in population as a result of new pestilences, this process continued relentlessly and the woods of the Po plain resisted mainly where the plough had difficulty in penetrating. This was however a period of great dynamicity of the Italian economy, based especially on trade, while farming does not yet seem to have been the subject of massive investments in the land.

Another element conditioning the extent and quality of the forest landscape in this period was undoubtedly mining, a tradition already begun in Roman times as far as iron ore was concerned, but which reached great intensity towards the 13th century, as occurred for the nearby Trentino, to grow again towards the 15th century and continue longer for non-ferrous ores. The Camisolo silver mines were already active before the 11th century and were to continue their activity until the 19th century. Mining activity consumed enormous quantities of wood; not by chance the first book on silviculture, “Silvicultura Aeconomica” by Von Carlovitz, was published in 1713 to give indications as to how to manage the forests necessary for the mines. The demand for wood for pit-props in the mines and for accessory structures, but above all necessary for processing the ore in the smelting furnaces, which were quite numerous in Val Camonica and also in Val Seriana and Val Brembana, was very high, which made it necessary also to move smelting to the highest altitudes The

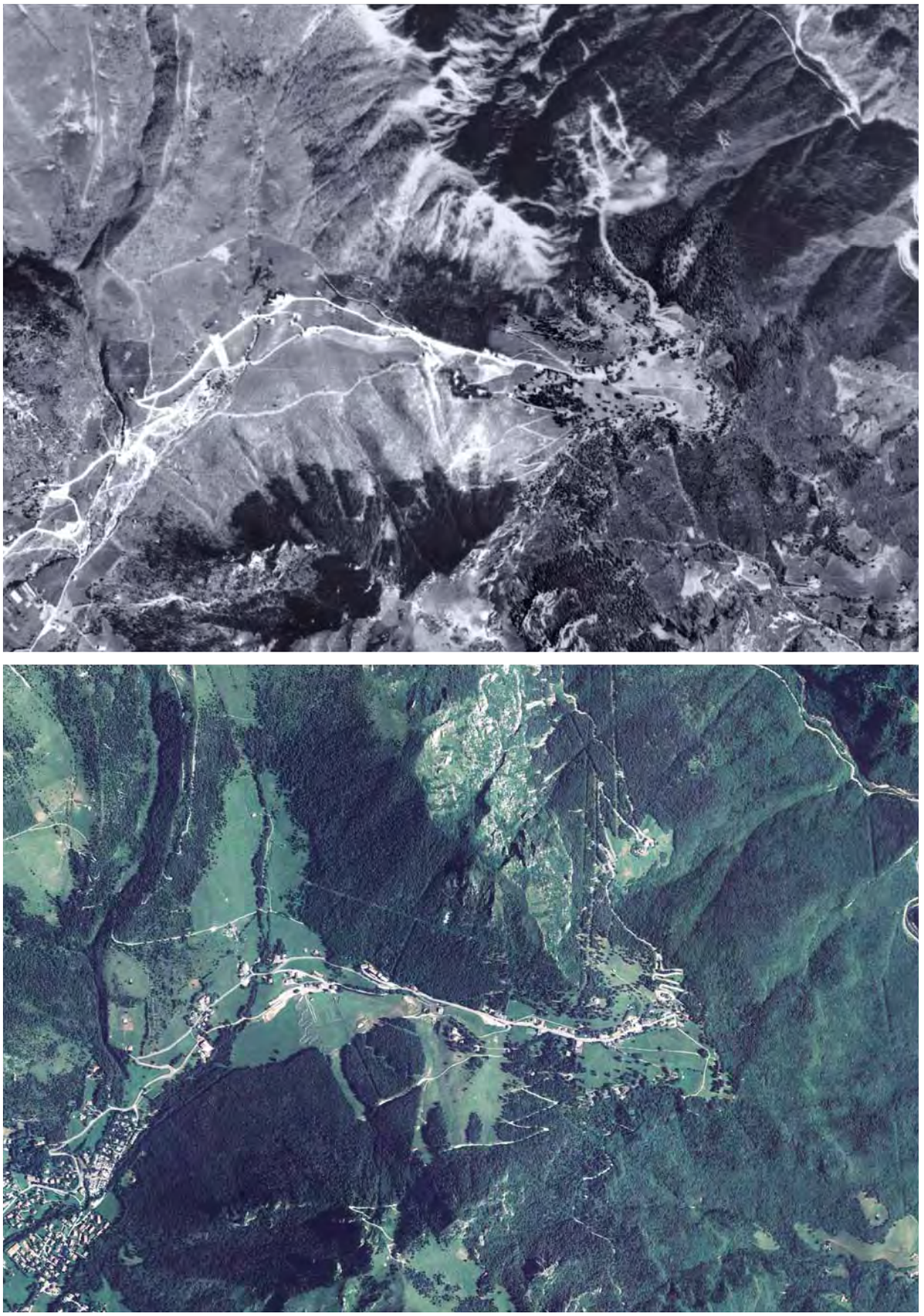

Figure 2 (a, b)
Example of colonization of pastures by tree and shrub vegetation. Passo della Presolana. Comparison between 1955 and 2007 orthophotos

waste form the working can still be seen at archeological sites around 2.200 meters in altitude, although the average level was between 1.400 and 1.900 meters. According to 19th century estimates a smelting furnace could consume about 7-8 thousand cubic meters of wood a year (in the case of resinous wood), to be transformed into charcoal, while in terms of forest area the requirement was 916 ha for a furnace, 314 ha for a forge and 209 for a mine (Montagna, 1987).

In the renaissance period the alpine landscape of the "*malghe*" (mountain huts), created generally at the limit of the tree vegetation, took definitive shape. The increase in grazing land was achieved also by the elimination of the upper limit of the woods through cutting and burning, operations that lowered this limit, substituting the woods with secondary grasslands of shrubland, often characterized by rhododendron and juniper. It seems that the present limit of these shrub patches may have been occupied in the past by woods, around 2.200 meters, but the creation of pastures also facilitated colonization by pioneer tree species such as the larch. This species distributes itself in quite a wide altitude band, from 300 up to 2.500 meters, forming a typical feature of the wooded pasture mountain landscape, which has survived down to our times (Bernetti 1995). In addition to a lowering of the upper limit of the woods, with a direction from the top toward the lower areas, numerous clearings were opened in the mid-mountain areas, mown in the summer and grazed in the intermediate seasons. The great demand for pasture also made it necessary to regulate its laws, through statutory legislation that also fixed the presence of herds or flocks from other areas (Della Briotta, 1956). A reference to timber production as an element of transformation of the landscape is certainly not missing from this description of high-level woodland. In the area of monte Lavio, in Val Camonica (Berruti, Valletti 1988) at an altitude of around 2.000 meters, together with traces of grazing activity from the 15th-16th centuries, the woods of larch, spruce and Swiss pine (the latter today has practically disappeared) were already influenced not only by the activity of the "*scutellari*" but also by forestry uses[6]. For their management a wooden dam (*stua*) had been built to float the timber valley-wards, a transport system that remained in use from Roman times to the early 1900s (Agnoletti 1998).

The "ordered" reafforestation from the 16th to the 18th century

The tendency to an increase in tree planting outside the forest formations accelerated also with the big changes of the 16th-17th centuries, which saw the decline of Italy as a major trading power, due to the different conditions of competitiveness of the economic system, and its steady transformation into a farming country, with increasing investment in land. The processes of expansion of farmland in the lowlands and hills, although involved in a number of phases of crisis during the 1600s and 1700s, might lead us to talk of treeless landscapes, but this was certainly not the case; there were new "woods" coming into being, but with another structure. In reality the plantations and the intercropping stretched as far as the eye could see, like a new forest, whose extension was proportional to the growth of an agriculture that could not do without it. The tree species used in agriculture now provided a wide range of products such as twig bundles, wicker, firewood, poles, timber for building and lumber, and especially foliage to supplement the poor forage base. This was achieved largely through the coppicing techniques inherited from Roman times, which included clear-cut coppicing, pollarding or side-lopping. Principally elms, maples, poplars, mulberry and willows were planted and their planting was imposed in rent agreements, while in sale agreements they were an essential part of the value of the land, a heritage that we have seen highly considered also in Roman times. In Brescia province alone in the 16th century more than six million mulberry trees were planted a year, while there was "a wide mulberry wood" along Lake Como (Nicoli 1902). The density of the plantations in some areas reached levels that recall veritable woods rather than tree plantations. While there might be 50-70 plants per hectare in some areas, in others double tree-rows raised the number to as many as 200 plants per hectare (Cazzola 1996), a quantity that leads one to think of the chestnut orchards almost as "degraded woodland", given that their density was in the region of 100-130 plants, not to mention the marine oak plantations for the production of curved pieces. It is certain that in the lowlands, woodland as a full-density formation was now much reduced. In the countryside of Pavia, between the Ticino and the Olona, the Charles V survey shows that it was present in only 3,2% of the territory, while in the province of Cremona the cultivated area represented 80%, meadow 14,7% and woodland was left with only 1,52% (Cazzola 1996). We do not have figures enabling an estimation of the percentages of the various tree species in the lowlands. Purely by way of orientation and without the necessary ratio per unit area we can quote what was written by Cazzola for the Duchy of Modena and Reggio, where mixed crops were however much more common than in Lombardy, obtained from a 19th-century census. Here we count about 1.500.000 elms married to vines, 456.000 poplar, 262.000 willow, 79.000 mulberry, 36.900 maple, 12.600 walnut and 6.392 ash, while of the original oak woods 12.600 oak trees were left. This confirms the tradition originating in the pre-Roman period of marrying principally the elm to the vine.

note
6 *The scutellari were makers of carved wooden crockery*

Figure 3
Photo of the Bitto di Albaredo valley. The remaining wooded pastures should be protected, not only for the diversity of the landscape but also for their contribution to biodiversity; today the pastures are in retreat throughout the Alpine range.

The intensification of agriculture was undoubtedly connected with the progressive crisis of manufacTorinog; in Milano in the 18th century there were about 4.300 workshops compared with 14.000 in the 16th century and crop farming extended wherever possible, probably at the expense of grazing land (Cazzola 1998). Form the early 1600s the population increased particularly in the countryside, while the cities would no longer see the population levels reached at the end of the 1500s (Mainardi II, 1984), at least until the 19th century. As can be understood, we are talking of a landscape, from the mountains to the plain, where the forest component was diluted into a range of structures functional to an economy increasingly dependent on natural resources, where woods and trees were an essential resource for a population which had reached densities unseen in the past.

The active, dynamic picture of the lowlands, according to some authors, goes hand in hand with a mountain countryside where the social and economic processes proceeded at a different pace, with the survival of older forms of farmland agreements and communal uses. However, a look at the Valtellina, one of the most important Alpine valleys, shows quite a vigorous environment that was maintained until the 14th-15th centuries. There were numerous water-powered sawmills, for whose techniques the north-east Alps were in the front line (Agnoletti 1998), producing enormous quantities of lumber for the local communities and for export, but there were also mills for wheat and power-hammers for iron. Agriculture produced millet, barley, oats, and alfalfa; from the vined fields there also came wheat, pumpkins, beans and other legumes while the chestnut orchards provided a fundamental supplement to the diet of the population. In addition to timber, considerable quantities of produce were exported, such as dairy products, iron, livestock and items in stone, but especially wine. As already observed for the Dolomite valleys, the mountains of the 16th century appear as anything but isolated and abandoned; often they were an economically lively place, where the availability of water resources favored numerous industries, while timber and grazing allowed not only subsistence but also trade in the products. This economic framework was accompanied by a fairly complex landscape with tree plantations on the valley floors and vineyards rising up the south-facing slopes and numerous terraces, while the woodlands were concentrated in an intermediate band because of the extension of the pastures which had by then stripped the highest parts according to the pattern of springtime and summertime mountain grazing (Benetti 1998).

The bare landscapes: the forest question between the late 1700s and the Unitary State

In the framework of the Lombard economy of the 17th and 18th centuries, the limit encountered by development in the availability of forest resources is increasingly clear, probably also because of the demographic development which in a century, between the late 1600s and the late 1700s, had raised the population from about a million to 2.150.000. Alongside the main items for export, such as silk and linen, there were large deficits as regards wood, calves and manufactured goods. It is therefore comprehensible that in the wake of the new enlightened tendencies a different attitude was adopted in posing the problem of lack of cultivable lands and the shortage of woodlands in the mountains, evidenced also in the foundation of numerous agrarian societies that attempted to tackle the problem of renewing production techniques scientifically. Among the most debated problems between the late 1700s and the early 1800s were the reclamation of the moorlands and the reafforestation of the mountains, two landscapes on which it was felt intervention should be made given their evident “inadequacy” for the development of the Lombard state.

The Italian term *brughiera*, meaning moorland, or heathland, comes from *bruga*, a local name given to heather, a bushy plant whose name originates from a pre-Roman root, more often called *erica* in Italian. It indicates a type of landscape very common in the past in the upper flatlands, especially in the areas of Varese, Como and the upper Milanoese. The moorland prevailed mainly on the *ferretti*, clay-rich ground, poor in humus, derived from profound weathering of the stones of moraines and Pleistocene alluvia, but decisively influenced by human activities. These uncultivated lands were exploited essentially for grazing and gathering heather for use in the cowshed, with a form of coppicing in cycles of 4-5 years, as was the case for scrub patches in many other parts of Italy. The law of Maria Theresa of Austria of 1779 imposed the selling of uncultivated common land for cultivation by those who purchased it, but the search for suitable proposals for their cultivation and afforestation required much effort, including the holding of prize competitions (Sulli 1985). The characteristics of these lands made farming-type interventions quite uncertain, while tree cultivation might be the only possible alternative. The remedies proposed to modify the moorland countryside were many, including the uprooting of the heather, its burial by ploughing, with subsequent manuring and sowing with forest species. The

Figure 4
Painting by Gozzi where we can appreciate the details of the Ogna landscape in Val Seriana, with the crests of the Presolana in the background. The woodland is present only sporadically, in small groups, to interrupt the stretch of the pastures. (Marco Gozzi, Mountain Landscape, 1832; Gallery of Modern Art, Milano)

proposals to plant demanding forest species found little application, while a certain success was had by reafforestation with pines (especially Scots Pine) and black locust, a species widely recommended at the time for the colonization of poor soils and today characterizing the landscape of the high flatlands between the Ticino and the Adda. However, there was a significant effort by the state administration to persuade owners to interrupt the traditional use of these formations, both through the distribution of educational publications and with the institution of prizes or penal sanctions. It does not however seem that in pre-unification times the reafforestation of the heathlands reached significant areas. More important effects on the changing of this landscape are probably due to the abandonment of traditional practices, which as late as 1910 considered the moorland as the "dowry" of the holding in farming agreements.

More serious, generally speaking, was the situation of the mountains, whose landscape was now decidedly characterized by a bare appearance. Deforestation had already been taken into consideration at the end of the 1700s. As described by Bruno Vecchio, the inspections by the Visitor General Odescalchi in 1773-74 give a picture of communal woods devastated by the grazing of goats in Milano province, the Varese PreAlps and Como province. A great shortage of firewood and timber is recorded in Milano, which imported the former from Sardinia and the latter from Switzerland, but also the serious hydro-geological instability of the slopes, where the woods "have been cut down to the ground…", with an evident hint at the clear-cutting in Valsassina. Where they had not been eliminated the woods were in any case in a poor state, due to the high production of firewood, timber and charcoal, as is said concerning Dongo and Argegno, but also Menaggio, which by then no longer sent fuel to the forges of Lecco. At Nesso it is observed that the chestnut orchards were being cut down to produce charcoal, a phenomenon that probably led not to the total destruction of the chestnut trees but to their transformation into chestnut coppices, by a process that affected all the woodlands to some degree.

This intensification of felling was added to by the effect of grazing, especially by goats, and often with an excessive load of grazing animals, which in particular did not spare the young woodlands in their renewal stage. In truth areas are also indicated where the woods seemed in better condition, as at Varenna and Brinzio, especially due to the protection regulations introduced, but it should be noted that the "visits" were always made in the locations where human pressure was highest. Also as far as the general observation was concerned, that the local populations had neglected farming to give themselves over to wood-cutting thanks to the continuous increase in its price, it should be said that these uses always privileged the more convenient areas, while many difficult areas were not exploited, given the high costs of felling and transport. The disorder in cutting was also observed by Beccaria in his "Elements of Political Economy", where he proposed general regulations to limit cutting of the woods to a quantity "not exceeding its rate of growth" (Vecchio 1974).

The chorus of observations as to the poor state of the woodlands took on the tone of a heated debate at the turn of the century, under French rule (Visconti 2002). The decree of 27 May 1811 by the viceroy Eugene Napoleon and subsequent amendments in the Habsburg period tended to remedy this state of affairs, providing for a prohibition for private woodlands to uproot the woods without permission in the vicinity of mountain tops and along the rivers. Also a minimum frequency for coppicing was imposed (7 years), with the planting of at least 25 saplings, a sign that cutting was occurring very frequently, producing a landscape with low scrubland and few high-stand trees (Piccioli, 1915). A reading of the regulations provides an effective picture of the efforts by the French administration to control the exploitation of the woods, especially those supplying the navy, providing for the drawing up of an inventory and felling plan and detailing the responsibilities of the personnel appointed for the control. Also a special set of forms was developed for verbal trials which envisaged theft, arson and abusive grazing, with the confiscation of felling tools. In reality the control implemented by the state on the woodlands aroused not a few criticisms, especially by the iron industrialists, to whom the Habsburg government in 1789 had even granted pre-emption rights on cutting and for the levels, but was obstructed by the little information available as to the actual state of the woods. Also a strongly laissez-faire line of thought concerning the forests was gaining the upper hand, tending to leave greater freedom to private interests, with the idea that greater efficiency in the care of the woodlands would thus be achieved, while it was considered detrimental to entrust management to the municipal administrations, a principle that was to be restated also with the first national forestry law of 1877. In reality deforestation seems to have been carried out concomitantly by the local populations and the industrialists, who tried to solve the real energy problems of Lombard capitalism (Tonon, 1984) by indiscriminate felling and often trampling the rights of the local people, who in turn also reduced the wooded area, especially by grazing. Whoever was responsible, we are effectively talking about a mountain landscape where the woods often seem to be "one" of the features but not the main one, as recorded also by the paintings of the time. In this connection there is great educational value in the paintings by Gozzi, a Bergamo artist of the "realist" trend, in the representation of the landscape, who from 1807 worked on express commission by the government, portraying abundantly the details of the Lombard mountains. As can be

Figure 4
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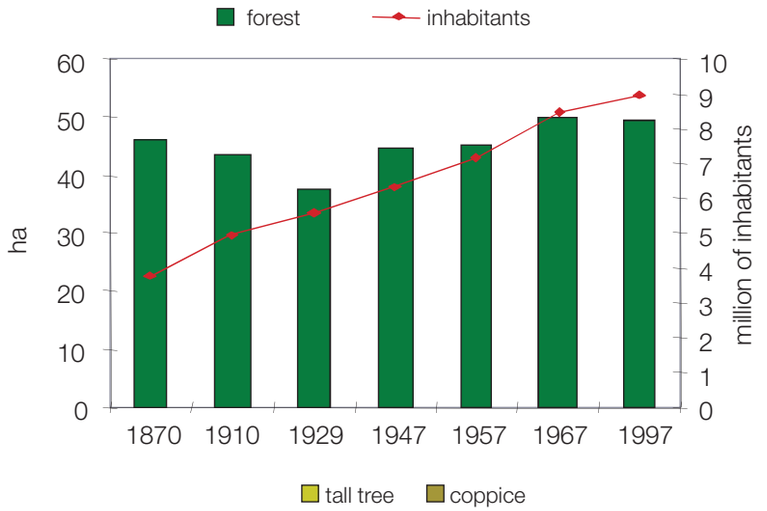

Figure 5
Trends in forest area in Lombardy from 1870 to 1997 (ISTAT, Statistica Forestale, 1870, Catasto Agrrio, 1910)

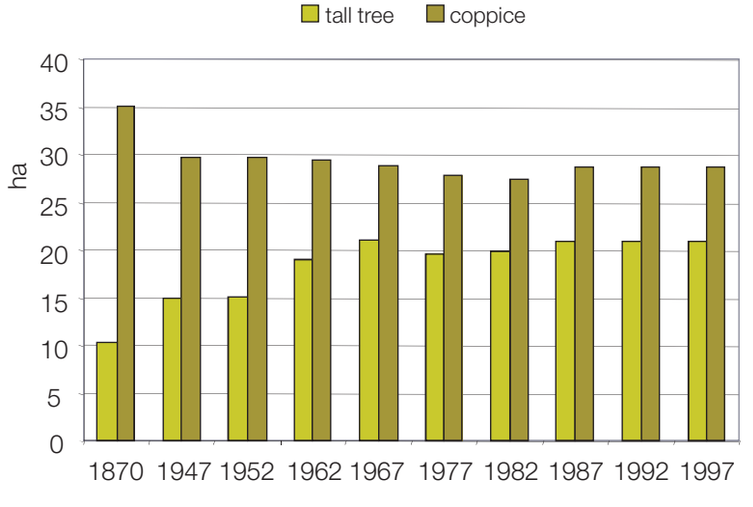

Figure 6
Trend in areas governed in coppice and tall tree in Lombardy (ISTAT).

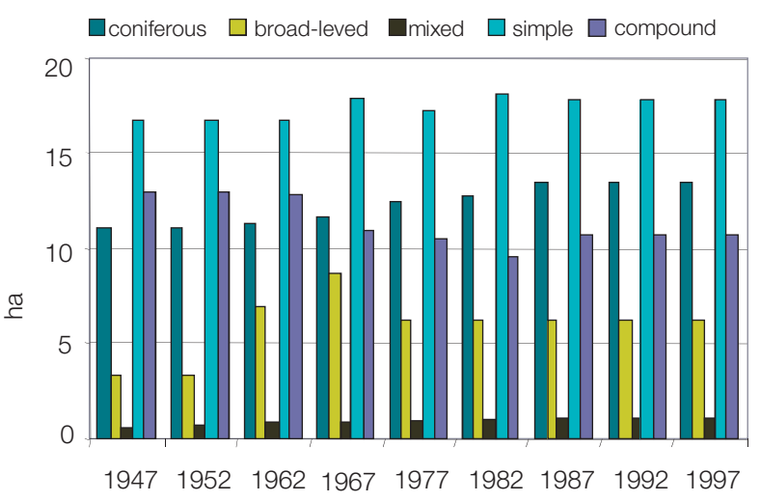

Figure 7
Evolution of the composition of Lombard woodlands (ISTAT).

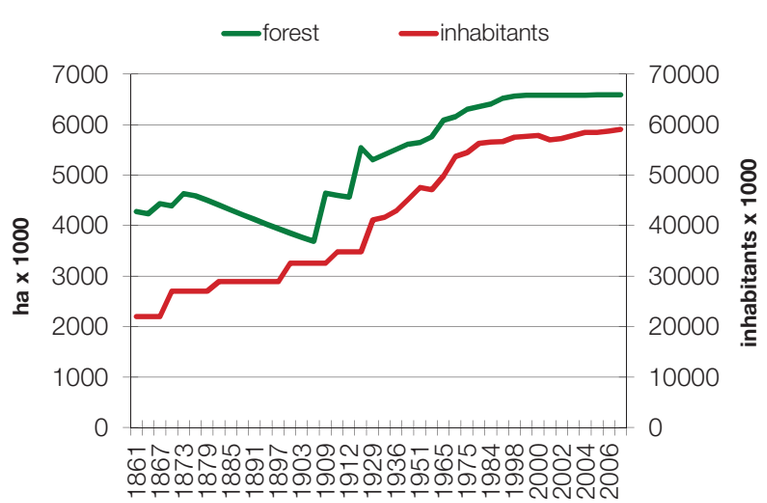

Figure 8
Trend of forest area and population in Italy from 1861 to 2007 (Agnoletti 2010). As can be seen, the increase in woodland recorded in Lombardy is in line with the national trend but does not exhibit the downturn recorded in Italy between Unity and 1910.

seen in his portrayals of Ogna in Val Seriana, the woodland is present in small groups in the scenario of an Alpine pasture, a situation represented also in other pictures painted by him in the first decades of the 1800s, confirming a choice of representation that can hardly be considered accidental (Pirovano 1984). On the other hand, the mountain economy was by then specialized in cattle breeding, by a continuous importing of better breeds from Switzerland, with breeding farms throughout the provinces of Sondrio, Brescia, Como and Bergamo (Borgioli 1946), while the demographic thrust became more and more intense, raising Lombardy from little more than two million inhabitants in 1820 to 3,7 million in 1889, with a population density that was not to be reached by Italy as a whole until 1960 (Mainardi IV, 1984). The problem of the bare mountain landscape was the subject of a prize contest instituted in 1844 by the Lombard Institute of Sciences, Literature and Arts, with the significant title: "Considering the damage resulting from deforestation of the mountain localities and the need to remedy it, indicate the best and easiest way to bring back the woods to the deforested mountains of Upper Lombardy and preserve and profit from them". 25 papers were presented for the competition, with 13 being admitted for assessment, and the prize was won by Francesco Meguscher, an Austrian forestry inspector for the Tyrol and author of a manual of silviculture which was a fair success throughout Italy. The description of the papers presented shows an interesting panorama of the reasons for deforestation and some suggestions for coping with it. Grazing, the needs of industry and the high price of firewood were also indicated as the main causes, while clear cutting on steep slopes was given the greatest blame from the point of view of silvicultural treatments. It was proposed to remedy the scarcity of wood, imported in large quantities from the Tyrol and Switzerland, by planting new woods also in the lowlands, which were already the source of considerable amounts of firewood.

The attempt to create a new forest landscape by the State between 1870 and the fascist period

The bare mountain landscapes also received the attention of the Italian Forestry Administration, which was concerned about the hydrogeological instability caused by deforestation not only in the Alps but throughout the peninsula. From 1867 to 1953 194.720 hectares of new woodland were created in Italy, mainly in the Alps (26%), with a particular effort in Lombardy between 1867 and 1914, second to Veneto (13,7%) for the expenditure on hydraulic stabilization works and reafforestation, with 12,2% of the total. The precarious situation in the mountains probably justified this commitment, initially devolved to the initiative of Local Authorities and private interests more than to the central administration, and it is significant that the province of Sondrio was one of the first to set up a reafforestation consortium, in 1883, to plant about 1758 ha of woodland (MAIC 1915) and that 84% of all the sums committed for Lombardy up to 1914 was spent in that province. The reafforestation activity tended to create a new landscape, proposed by the state, to substitute a "social landscape", with the creation of monospecies conifer woods, with regular planting patterns. These features were quite foreign to the traditional landscape, with a high degree of artificiality and a poor esthetic value, which however had the task of modifying the despoiled appearance of the mountains. The preference given to conifers was linked to the characteristics of the soil to be replanted, but was part of the general tendency to extend this species to cope with the shortage of lumber for construction, which by the turn of the century was now the third deficit item of the trade balance, after cereals and fossil fuels. Unfortunately the population increase and settlement in the Alpine mountain area made the reafforestation policy unsuccessful, arousing hostility from the inhabitants themselves, who saw new woodlands as an obstacle to grazing and in any case as an element foreign to their culture. A problem that had already occurred in France, which was at the basis of the "technical" choice of undertaking great masonry works, rather than reafforestation, but which was to be discredited by the disastrous results of the following decades (Agnoletti, I, 2002). The practical impossibility of proceeding to reafforestation in areas occupied by other cultivation and of limiting these interventions only to uncultivated and unstable terrain was to be recognized in any case by the foresters themselves working in Lombardy (Bresadola 1938).

Figure 5
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With the unitary state also the first forest statistics were collected, finally making it possible to have some quantitative estimates of the importance of woodlands in the landscape. They show a reduction in wooded area estimated at 15 to 30% nationally between 1870 and the 1930s, a tendency confirmed also for Lombardy, where we see a reduction of 18% since 1870. As early as 1862 in the province of Como, we find that there were no longer high-stand woodlands but only coppices, while in Bergamo province the 77.000 hectares reported in 1862 had become 68.000 by the 1930s. Extensive stretches of the "*giogaie*" of Como province were stripped and sporadically populated, principally by alder and hazel, of little interest for coppice management, and in fact the foresters hoped for an intervention by law that would stop grazing for at least twenty years. But it was above all the valleys subject to the activities of the smelting

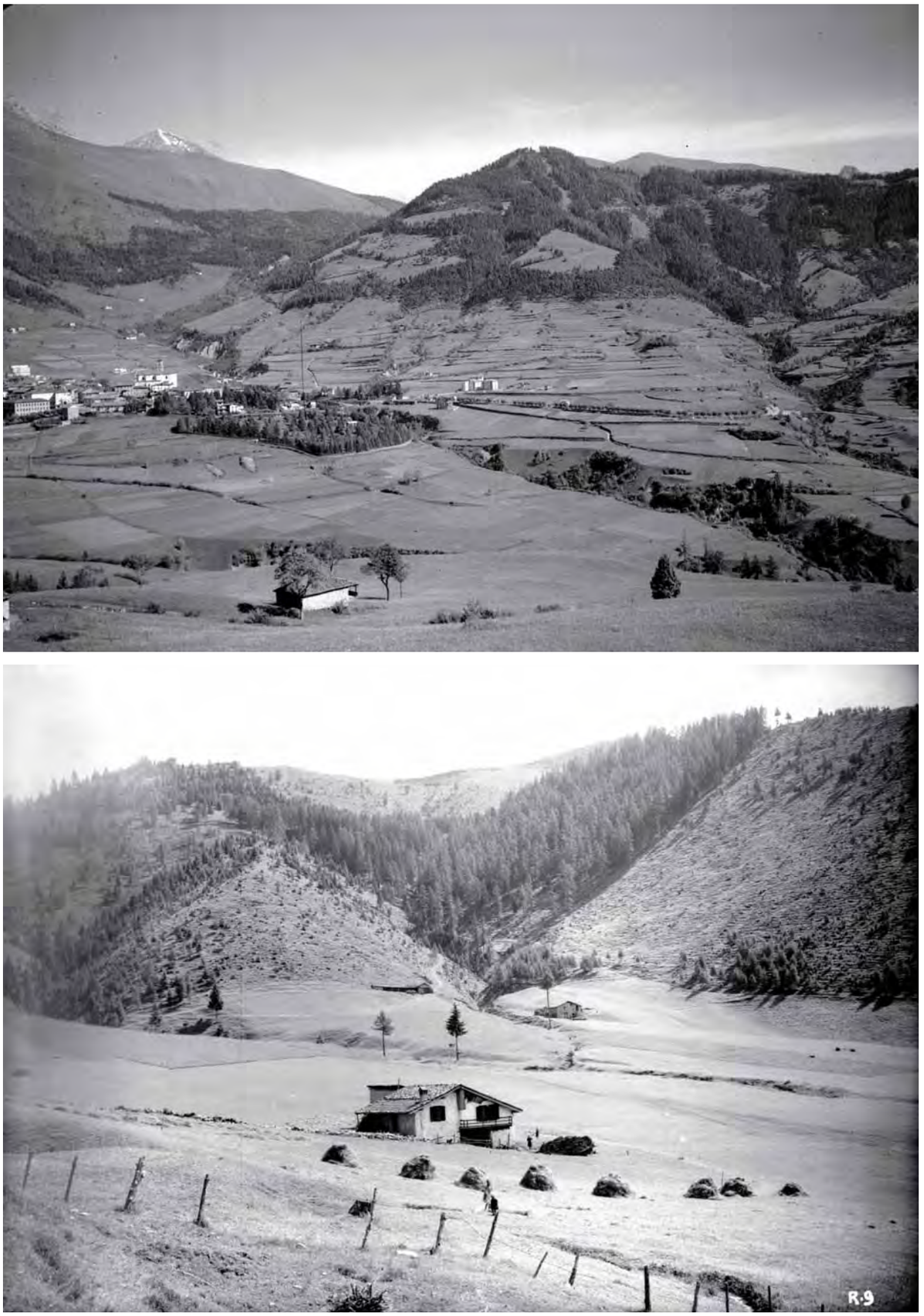

Figure 9 (a, b)
Examples of mountain landscape: view of the valley and deforested area at Borno (Brescia province) (from the Lombardy Region Cultural Heritage Photographic Archive, Simone Magnolini, 1950-1970)

furnaces and those nearer to densely populated areas that showed a serious reduction or degradation of woodland. In the municipalities of Taleggio, Vedesetta and Oltre il Colle, very extensive beechwoods were still reported, while also the conifer woods of the district of Piazza and of the Scalve valley were in good condition. In Valtellina thousands of poles for vine-growing were cut from young spruce and larch trees, so that the forestry inspectorate prohibited this use, while as many as 22 hydraulic sawmills sawed nearly all their material from clandestine cutting (Stefanoni 1862).

The first factor to be considered in interpreting the general phenomenon of the reduction of woodlands is undoubtedly the demographic increase, which practically doubled the population of Italy between 1861 and 1925, but which gave rise to a veritable “assault on the mountains”. The intensity of this phenomenon was unprecedented, involving the entire national territory and raising the rural population from about 5.000.000 to 8.500.000 (Serpieri 1926), a figure which was to remain stable until about 1951 when the tendency was inverted. In the Alpine and PreAlpine mountains this process followed a different trend, with a high growth between 1861 and 1921, about a million inhabitants, which continued also after the Second World War. In general the demographic growth and the increase in demand for farm produce meant that it was not worth the large landowners while to introduce new technology, given the abundance of cheap labor, but led to the extension of the cultivated area, with the cultivation of even the steepest slopes.

Also industrial development, which was particularly robust in Lombardy, brought about a further increase in consumption of firewood and timber. Our country had no fossil fuel resources and the energy requirements of industry were concentrated on wood and charcoal, which in 1861 provided more than 85% of needs. The use of solid and liquid fossil fuels, which had to be totally imported, grew slowly to reach 60% around 1910, while electricity made its timid appearance towards the end of the century, still contributing only 9% of the national energy balance on the eve of the First World War. This was translated into an enormous consumption of firewood, which according to the estimates of the time far exceeded the production of the forests. The energy need had to be satisfied with an even greater resort to wood gathered outside the forest, by cutting of planted trees and hedges and lopping of farm trees, a production that increased by 50% between 1861 and 1912 nationally, representing twice the percentage of that coming from the woodlands (Agnoletti I, 2002). In the first decades of the century in Lombardy it was estimated that about 2,5 cu.m. per hectare were extracted per year from the lowland plantations, divided between 1,5 cu.m for fuel and 1 cu.m of timber for construction, nearly all consumed within the farm and therefore escaping the assessments of the wood market. It was a value equal to the annual increment of the national woodlands, but greater than the average increase of the Lombard forests (Federico 1946). There was a large increase in consumption of wood for building, on whose production also technological innovations were concentrated, but whose import increased fourfold between the end of the 1800s and the Great War. In Valtellina, with the setting up of the first cableway in 1893, it was finally possible to cut down the forest of Val Madre economically, initiating the spread of these plants to the other valleys. In the sawing industry new steam-driven saws, followed by electric ones, took the place of water-driven ones, while firms like Feltrinelli took up a dominant role in the national and international markets, importing timber even from the Caucasus and Russia.

The joint effect of the three factors – agricultural expansion, energy needs and firewood production – influenced the forest landscape in various ways. The expansion of farming and grazing initiated a rapid process of reduction in the wooded area, to which the decisive effects of the 1877 law were added. This established in its principles the importance of the forest for the hydraulic regiming and at the same time instituted the forestry constraint, accepting the upper limit of the chestnut for the imposition of the restriction and dividing the mountains into two areas for this purpose. Various sources interpret this law as the result of a laissez-faire policy, which tended to favor private property and limit state intervention in this sector, extending the freedom of private interests. In fact the provision circumscribed the safeguarding interventions only to the restricted land areas, allowing private interests much freedom to deforest, particularly in the layer below the chestnut, chosen as the limit for the application of the restriction. The choice of the most typical and symbolic feature of the Italian forest landscape evidently gave rise to conflicting interpretations and significant differences. As we have said, this species can vegetate in a wide altitude band, with substantial differences between the north and the south of the country (Agnoletti, I, 2002).

The restrictions imposed by the law soon turned out to be ineffective and did not enable a real development of reafforestation activities, seeing that both the expropriations and the creation of consortia between state, provinces and privates were proceeding slowly. Overall the law, far from initiating a true policy of reafforestation and protection of the woodland, had the opposite effect. As a result of the lack of restrictions, according to some statistics at least 1.000.000 hectares of woodland were eliminated in the period 1870-1912. Where processes of temporary or definitive deforestation did not take place, changing the macro-structural appearance of the landscape, there was an evolution that modified its inner structure towards forms more adequate to the needs of the rural economy. The most important example

Figure 10 (a, b)
View of Gerola in Valtellina in the 1920s and 2002. In the 2002 photo, on the right, we can note the advance of the conifer woodland over the former pastures, while in the foreground the forest vegetation has only reduced the area of the grassland just above the village.

Figure 11
Example of expansion of woodland at the expense of high-level grassland. Mountain refuge and pastures no longer in use in Val Sanguigno (Photographic Archive of the General Directorate of Agriculture, Lombardy Region, and ERSAF, Daniele Bruno Levratti, 2007).

Figure 6
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undoubtedly concerns the forms of management, which in little more than 50 years (1870-1925) led to an inversion of the ratio between coppiced and high-trunk woods, with a definitive prevalence of the former. This change however did not take place in Lombardy, where the coppice had already prevailed decisively over the high-stand since 1870, and then had begun to diminish until the energy crisis at the end of the 1870s, which started a new slight increase.

The inversion of the trend: the woodland as a protagonist of the new landscapes

Against these large processes affecting Italian society, which was still dependent on natural resources, provisions of law to encourage reafforestation could not do much. It is important however to emphasize the fundamental passage from a philosophy of non-intervention of the state in the forest sector to a total rethink of its role, as shown by the Luzzatti law of 1910 and the setting up of the State Forest Domain, but even more with the laws on the hydro-geological restrictions of 1923 and those of 1933 on full reclamation. Fascism attributed a fundamental role to the improvement of the woods and mountains for the enhancement of the living conditions of the population, speaking clearly of a “rebirth” of the forests in describing the efforts made, which were undoubtedly significant from a legislative viewpoint. This evolution, combined with the socio-economic changes, was to have an important influence also on the Lombard landscape, where the forest component was closely linked to economic activities. The surveys for the forest map drawn up by the National Forestry Militia record in detail the situation of a landscape that still reflected the needs of a social model whose rural milieu was strengthened by the 1929 crisis and the autarchy, but where signs of an inversion of tendency in the relationship between society and resources were already making themselves felt.

In the survey of the 1930s the woodlands covered 18,5% of the Lombard territory, arables 51,6%, grasslands 9,7%, pastures 9,6%, tree-growing 2,1%, productive uncultivated 8,3%. The mountains were still the place where the woodland landscape was most extensive, occupying 36% of the territory, falling to 23% in the hills and 4,8% in the lowlands (Fori 1938). There were as many as 135 Alpine pastures in the provinces of Como and Varese, 195 in the province of Bergamo, 337 in the province of Brescia, 361 in the province of Sondrio, with a grazing livestock load of 86.755 cattle and 87.849 sheep and goats, present particularly in the provinces of Sondrio and Brescia (Volanti 1938). The presence of over 50.000 sheep and goats in areas like Valtellina was related to physical features of the territory, characterized by steep slopes, better grazed by the smaller animals but with pernicious effects on the forest vegetation. In spite of this, Sondrio and Brescia were still the provinces richest in woodland in the region, with 20,2% and 27,3% of the territory, and indeed expenditure for recovery of the mountains concentrated principally on hydraulic stabilization works and not on the woodlands.

The structure of the landscape was now completely remodeled by human activity, as shown by the analysis of the various phytoclimatic bands in Valtellina, which assign at least 11% of the land to the vegetation zone of the *Fagetum* (beech wood), but where there is hardly a trace of beech remaining, while the resinous woodland dominated by the common spruce has now widely encroached on the area of the Fagetum and the Castanetum (chestnut wood), taking up 70,4% of the territory. This dominance that can also be explained by the pressing needs for lumber, while the chestnut wood was still present in 15,8% of the forest area, but already partly converted to coppice. In Bergamo province the chestnut wood was 8%, more or less like the beechwood. But here the high-stand now represented only 24% of the forms of management, while the reduction of the forest area compared with the 1800s was calculated as 20% (Ferrari 1938). Also in Como province the chestnut orchards extolled by Stendhal were reduced to 8%, while fully 29% of the forest landscape was now represented by coppiced chestnut. On the other hand there were still many tree plantations on the terracings covering the slopes along the lakes (Romano 1988). The presence of the coppice seems to prevail also in the lower Milano province, where out of 9.320 ha of woodland 88,7% were coppices of poplar, alder, ash and hornbeam, while the high stand were 11,2% (Federico 1946). Also further south, towards the Apennine spurs of the Oltrepò Pavese, the woods had been affected by the expansion of farmland in the second half of the 1800s as a result of the large population increase. A large part of the original wood of beech, sessile oak and turkey oak had been transformed into agricultural land, the surviving woods occupied 13,3% of the land and the proposed remedy was above all reafforestation with conifers (Pepe 1956). Rather interesting for the specific composition of the Lombard forest landscape is the description of the species used for the production of charcoal and the altitude distribution of the charcoal pits (Quattrocchi 1946). This analysis shows a certain preference for beech, always present in consociation with other species, while the altitude band of the charcoal pits shows the distribution of these activities from 250 up to 1.850 meters altitude.

Figure 12 (a, b)
Portrayal of the mountain of Ardesio in 1626 (above) and 1746 (below). In these two exceptional documents we can observe the same problem of hydro-geological instability of the mountains arising in the same area more than a century later (From C. Pirovano, Lombardia, il territorio, l'ambiente e il paesaggio, Vol 4, page. 47)

It is interesting to note that in the Como area the black locust coppices now covered an area equal to that of the chestnut, confirming the spread of a species widely used also for reafforestation of moorland, which still extended over about 29.000 ha, 29% of which uncultivated and the rest wooded, but which was now an important element in the exoticism that today characterizes the Lombard landscape (Sartori 1998). Exoticism was in fact proposed and encouraged by the foresters themselves, who looked favorably on the introduction of species such as the red oak, of North American origin, not only for wood production but to promote an "embellishment of the landscape" to the advantage of the industry of the "forestiero", already seen as a source of significant earnings (Federico 1938). We are therefore in the early stages of an economic recognition of the role of the forest landscape, although it is indicative that the proposal was to improve it through the introduction of exotic species and not through an enhancement of the traditional landscape.

Figure 5
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As reported by the statistics, there was therefore a change in the 1920s-30s, during which the trend of the deforestation curve was inverted, crossing with that of the population. It is probable that with the easing of the anthropic pressure due to industrial development, able to subtract manpower from farming, to technological progress in the farming sector and the new sources of energy, the woods and the mountain territories began to separate their destiny from the national population growth, aided by legislation favoring the woodlands. This seems to be confirmed particularly in the situation of the Lombard mountains, where one of the most significant economic factors described by the foresters themselves at the end of the 1930s was the notable presence of hydroelectric power plants, implying a new fundamental function of the mountain territories and a further modification of the landscape, necessarily connected with a different relationship between man and natural resources. A process had now begun that on an Italian level would allow a generalized growth of the woodlands that would take them to an area almost 40% greater than in the 1800s[7] nationally, while in Lombardy the increase in forest area can be estimated at around 32%, from 1870 to 1997. In the fifty years after the Second World War reafforestation was to take place on about 800.000 hectares in Italy, a process favored by the Fanfani law, addressing mainly job creation in the south, enabling the achievement, at least on paper, of the afforestation targets set more than a century earlier.

However, these results arrived in quite a different historical moment for the mountain areas, involved mainly in a process that saw an interruption of the relationship between availability of resources and social needs. In addition to the natural re-forestation of the abandoned areas, there was now a timber market where Italy was a transforming country, acquiring the overwhelming majority of its wood abroad. The calls made in 1961 during the national reafforestation congress, as to the need to extend the Italian forests to meet demands for wood, were misleading. In reality the conditions in which forestry uses in the mountains were conducted and the shortage of prized woodland were increasingly to penalize national production in comparison with wood from abroad, which now saw the prevalence of the transformation industry, especially for furniture. Undoubtedly the new afforestations continued to improve hydro-geological conditions, but with no possibility that these new forests could contribute to modifying the characteristics of the wood market, while their effect on the quality of the landscape was more important. The improving role that the conifers were to play in the function of the ground and therefore the role of a preparatory species for a subsequent entry of broad-leafs had not seen the planting of new woods and these formations today represent a rather stable part of our forest landscape, with a not always positive value. These are evaluations partly applicable to many present plantations of arboriculture for wood, made with European Union funds, that in general will not produce material of great value, but in compensation are changing the landscape of many rural areas. On the other hand the lowland poplar plantations seem to be more deeply rooted in the Lombard cultural identity.

The change in the forest landscape taking place after the Second World War in Lombardy can be further understood by analyzing the ISTAT statistics which on average show an increase in conifers in the high-stand woods and a reduction in broad-leafs. We can also observe a progressive expansion of the simple coppice and a shrinkage of the compound coppice. Aside from the technical reasons that have led to a reduction in the presence of saplings, i.e. of high-stand trees in the coppice, this tendency causes a steady simplification of the landscape, which used to have a number of forms of management such as cutting one third each year, and diversified structures such as that of the moorland shrub patches already described. To this simplification we add in the lowlands the almost total elimination of tree planting in mixed crops. The large-scale mechanization, which was to raise the number of farm tractors from 12.748 in 1950 to 1.075.504 in 1980, and the use of fertilizers made the tree rows at the sides of the fields, from which as late as 1946 about 2.000.000 cu.m of wood were obtained annually, cumbersome and useless. In the mountains, however, the high-stand woods reoccupied the spaces abandoned by grazing and cultivation, while the coppices steadily aged, especially in the areas abandoned by cutting, as they were uneconomical.

note

7 *Uncertainty as to the true extent of the increase in the woodlands in Italy is due to the different survey criteria, a problem linked not only to the statistics of the 1800s but also to the criteria of the National Forest Inventory of 1985 and those of ISTAT, which diverge significantly. Some values may also indicate an increase greater than that stated, which we nevertheless consider reliable for a general estimate.*

The structure of the present landscape of the region can be obtained from the DUSAF 2007 data; in particular the region can be divided into two separate areas, the north part (provinces of Varese, Como, Lecco, Sondrio, Bergamo) and the southern part (provinces of Monza and Brianza, Milano, Pavia, Lodi, Cremona, Mantova, Brescia).

According to these data (ERSAF 2010), the north part of the region presents a mainly forest landscape, where farmland is limited to the valley-floor areas. Woodland and shrub land are to be found on 52% of the area overall and mainly consist of broad-leaf woodland (on 24% of the area considered), conifer woods (11%) and shrub land and sparse vegetation (11%), but there are also mixed woods (6%). Of considerable importance, both from the landscape and ecological viewpoint, are the permanent grasslands and the natural pastures, which involve 14% of the area of the northern provinces. These are land uses that in the mountain areas are in steady retreat following the reduction in grazing and summer pasture activity, with the resulting advance of the woodland and the simplification of the mosaic of the landscape. The cultivated areas are limited to 9% of the surface and the anthropized areas to 10%, while a significant area is covered by the class of the unproductive areas (glaciers, water-course, lakes, rocky outcrops).

The southern portion of Lombardy presents a completely different landscape, where half the territory (55%) is involved in agricultural areas, of which 28,6% (more than 232.000 hectares) are occupied by rice-fields, located mainly in the province of Pavia. The wooded areas are limited overall to 18% of the area considered. Also the open spaces, the grasslands and pastures are very few (4%), while the urbanized areas, in continuous growth, occupy 17% of the same area. As far as the tree component is concerned, the numerous arboriculture plantations should be mentioned, especially poplars: although their area corresponds to only 2% of the southern portion of the region, it must be considered that they actually cover an area of more than 37.000 hectares.

The morphological and environmental diversity that divides Lombardy into two distinct areas is thus reflected in two almost opposite kinds of landscape. The northern part exhibits a typically forest landscape, with the fundamental presence of wide open spaces and farmland areas where traditional-type cultivation is still carried out on the valley floors. The south part on the other hand is representative of a flatland agricultural landscape, with increasing urbanization, where the tree component is mainly due to the spread of tree plantations for timber. Precisely the strong man-made pressure, together with intensification in agriculture, is seen in the southern portion as the cause of a diminution of the quality of the landscape mosaic, while in the northern part of the region it is threatened principally by the shrinkage of open spaces and farming activity and by the expansion of the forest areas.

Over the last ten years Lombardy has faced important transformation processes which, in spite of the short time period, are of a considerable intensity judging from the DUSAF data (ERSAF 2010).
There has in fact been a strong expansion of the urban areas, especially in the southern part of the region, with 25.000 hectares of new man-made areas (+12,6%), as against the 9.200 extra hectares (+8,9%) recorded in the northern part of Lombardy.
Urban expansion is taking place principally at the expense of farmland, which in fact suffers from a strong shrinkage in area, especially in the south of the region, where in 2007 there were 34,800 less hectares of cultivated land (-3,8%) than in 1998-1999. In the northern part however a significant reduction in land destined to crop farming is recorded of about 8,400 hectares, which in percentage terms is actually even more significant (-5,2%), showing the sizeable abandonment of traditional farming activities.
With the decline in practices linked to summer pasture activities in the north of the region we see an increase in the wooded areas at the expense of high-level pastures, with a resulting loss of important land uses from a landscape viewpoint, but also for the biodiversity and the role they have as a habitat for many species of vegetable and bird-life interest. The northern area of the region, feaTorinog mountainous uplands and narrow valleys, as happens in nearly all the Italian mountain areas, in addition to the steady disappearance of activities relating to breeding and summer grazing, also shows a significant reduction in the farming activities that were carried out on the valley floors (-5,2% of farmland area in only 8 years), as both are found to be burdensome and unprofitable. The results for the landscape are significant and are manifested especially with the disappearance of the open spaces that were formerly destined to pasture, which being no longer used are invaded by tree and shrub vegetation.
In the southern part of the region we see a strong expansion of anthropized areas, putting at risk the maintenance of the typical elements of the Lombard plain, which now form only residual features, also because of the excessive mechanization in the field of agriculture. Since the second world war this has rapidly led to the elimination of all the tree features (scattered planting, hedges, tree-rows) and of those particular organizations of the land that characterized the

Lombard countryside. An exception is the modern arboriculture plantations for wood, which now occupy more than 37.000 hectares in the southern part of the region (ERSAF 2010) but which from the landscape and historical-cultural point of view cannot be compared to the tree-planting that traditionally characterized the Lombard lowlands until the 1950s.

It therefore seems we can identify two main trends in the last half-century, with the gradual extension of the forest areas over land abandoned by agriculture and grazing and a reduction in the diversity of environments – which is also part of the total biodiversity – that evolves from complexity towards a greater structural simplicity. In other words, in the plain, in the hill area and in the PreAlps, but to a lesser degree in the Alps, we go probably from a landscape mosaic made up of a large number of small-area elementary "tesserae" to a landscape with larger-sized, more monotonous tesserae. On the other hand, within the single tesserae there is probably a greater complexity, due to the entry of a greater number of tree species into structures that at one time were more homogeneous. These phenomena are connected with a progressive abandonment of farming and forestry practices which determined not only the spatial relationships but also the internal structure of the landscape mosaic. We therefore have not only a smaller variety of pastures or woodlands, but also a smaller variety of different types of woodland and different types of pasture, such as different types of field in the plain, while the remains of some historical periods, like the chestnut orchard or the *piantata* in the plain seem to be steadily eliminated from the landscape.

Conclusions

The evolution of the Lombard landscape has been widely influenced by socio-economic evolution, which has brought about significant differences in density, structure and specific composition of the forest areas over the various historical periods. Today the traces of this diversity of environments have been largely lost, not only in the territory but also in the historic memory of the local populations, whose sense of identity was profoundly linked also to the landscape connotations of the geographical locations. An identity that today can perhaps be recognized in some physical aspects of the territory (mountains, lakes, plain etc.), but is more often influenced by the features of the urbanized landscape. In this sense the seven principal zones into which the Lombard territory has been subdivided only partly clarify the quality of the landscape mosaic and its characteristics of structure. From many studies there emerges not only the loss of diversity of the landscape over time, but also increasing attention to the quality of the elements making it up, accompanied by the public's preference for more complex landscapes (Lassini P., Pandakovich D., 1996). The identification of the meaning of "diversity" and "quality" of the landscape is however possible only if the reference context is clarified. In other words the same element, for example an artificial plantation, can take on a different value not only depending on whether it is a poplar plantation or a Scots pine wood, but also according to the geographical context where it is located (e.g. mountains, hills, lakes, plain, urban areas) and its historical trends (Agnoletti, I, 2002). These greater understandings can be achieved only through a series of studies that deal with these aspects systematically, with projects in which historical investigation can analyze long time periods and the ecological investigation does not limit itself to assessing the specific diversity.

The evaluation of the forest landscape, however, must take account of the prevalent orientations concerning sustainable management on a European level, which assign functions to the woods that concern principally the absorption of atmospheric CO_2, biodiversity, the sustainability of wood production, orientations that certainly aim at ensuring the maintenance and increase of the woodlands, given their significant reduction on a planetary level, but our country must also consider the reduced effectiveness of the Italian woodlands for CO_2 absorption, and the fact that their increase, whilst favoring conservation, is not accompanied by a significant use in national wood production. In this sense it is very enlightening for the Italian situation that although the Italian silviculturists of the 1800s pointed to the extension of woodland as the solution to counter the import of 80% of timber for construction from abroad, 150 years later, with an almost tripled forest area, the quota of imports is only slightly less, showing that the main problem with the Italian woodlands was not their extent.
Also the biodiversity of the woods has been strongly influenced by man as a cultivator, while the diversity of environments, as an essential element of the landscape, is hardly ever considered. This approach, in reality, is shown by a growing public awareness for countryside values and the greater economic value attributed to them, indicated by growing phenomena such as agritourism and, to a less aware (or widespread?) degree by ecotourism, and also by the choices regarding the

quality of life, leading people to prefer the country to the city, or by the phenomenon of second homes. All this obliges administrators to give increasing consideration to the resources of the landscape, as also sanctioned by the national agricultural policies and the European Landscape Convention. A landscape of quality, as well as having a function as a tourist attraction and an increasing importance in rural development, has now taken on considerable importance in the field of sustainable development, representing a model of positive integration between social, economic and environmental factors over time and making its planning and management much more demanding and less neutral than in the past.

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