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## Chapter

# The Archeology of Woodland Ecology: Reconstructing Past Woodmanship Practices of Wooded Pasture Systems in Italy

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and Nicola Gabellieri*

## Abstract

Recently, the woodmanship practices and localized naturalistic knowledge have been acquired as indispensable for the European forest heritage conservation as well as for restoration of individual woodland landscapes. Minor importance has been given to the historical approach, both in the study of the local resources ecology and of the local societal context. Using the results of a series of case studies—applied to the knowledge and planning of sites that host present (or have hosted in past) wooded pasture systems and their environmental legacy—the chapter shows the interest of the environmental resource archeology (ERA): a “multisource approach” in reconstructing past management systems practices and underpinned lore. ERA is inspired by the method and sources of the English historical ecology and topographical history employing both archives and field evidences (palynology, anthracology, etc.).

**Keywords:** environmental resource archeology, historical ecology, wooded pasture/meadow systems, multi-proxy approach, NW-Central Italy

## 1. Introduction

In this chapter, we explore the potential of historical approaches to the study of the ecology of present woodland ecosystems in order to identify the local practices involved in the past management. In particular, an archeological and multisource reconstruction of woodmanship [1] practices and their associated local environmental knowledge is proposed. The title “The Archaeology of Woodland Ecology” explicitly relates to a conference held in 1982 by the British Environmental Archeology Association, which is considered as one of the main starting points in environmental archeological studies in UK (and in Europe). Our interest for such an early milestone relates to the attention that the conference holders had demonstrated to the historical ecology approach and to the studies of Oliver Rackham on the Mediterranean landscapes of Crete [2, 3]. However, Rackham’s historical approach played little or no part in the subsequent years of development in environmental archeology. In fact, only relatively recent contributions by environmental archeologists [4] have finally fully acknowledged

Rackham's use of multiple sources as well as the regressive historical approach. This achievement appears in contrast to the prevailing quantitative and structural ecological models incorporated from paleoecology into environmental archeology studies. Following these lines, in the next pages, we will confront the main topic of the first edition of the *Journal of Environmental Archeology* ("Fodder: Archaeological, Historical and Ethnographic studies," 1998), discussing this theme from the perspective of Rackham's historical ecology or, in other words, relating our experiences in "Environmental Resource Archaeology." Environmental Archeology (EA) commonly refers to an archeological-paleoecological approach to the study of the "human paleoenvironment": the analysis focuses on the relationship between human activity (and behavior) and the environment (considered as natural ecosystem) in the past [5]. Instead, historical ecology studies from the British tradition have proposed a different historical approach, considering the vegetation canopy of a given site as a particular kind of artifact. Consequently, environmental resources are considered as "social products" ("part of local society") and their ecology appears historically defined by activation and production practices, conditioned by conflicts of control and access in local communities, and by local environmental knowledge [6, 7]. In contrast to a purely environmental study, we adopt an historical and archeological analysis aiming to extrapolate localized production and consumption systems and the related social practices that have over time determined the features of the resource and their unique environmental state. This approach, named "Environmental Resource Archaeology" (ERA), has been developed in the last 30 years by the LASA team (Laboratory of Environmental Archeology and History) at the University of Genoa in different projects and applications in North West and Central Italy. The development of ERA methodological approaches is linked with particular microhistorical geographical approaches [8, 9]. "History" is purposely defined as any historical process that links actions and practices, and their material effects on resource ecologies, avoiding historical economic generalizations in term of civilization (e.g., the "longue durée" historical model proposed by the "g  ohistoire" approach of Annales School and F. Braudel) [10, 11]. Similarly, the ERA approach avoid the simplification and generalisation of the local social context as produced by some branches of the "socio-cultural history" in terms of tradition/traditional sociability; for instance, the recently-coined definition of "bio-cultural heritage", suggested by conservation studies, needs to be further clarified analysing the concrete relationships between societies and environment, and paying attention to the form and content of these relations (ownership, access, knowledge, etc.) (e.g. [12, 13]). Focusing on the environmental characterization and reconstitution of local practices, we attain a high societal/economical resolution. For example, the biodiversity of the present site is considered a marker of bio-diversification processes that consistently affect the environmental systems. However, the analysis of small-scale biodiversity variation effects registered in palynological/anthracological sources when contrasted with textual, cartographic, or iconographic sources available at the site of observation scale, sheds new light on the historical dimensions of bio-diversification itself [14]. It is important to recall—perhaps for all non-historian readers—two main principles in the use of evidence as acknowledged by two different but convergent historiographical school: those of English local history and the Italian microhistory. Both traditions are interested in the historical processes that led to the production of the present locality and site "characters" ("characters" is intended as historical products/issues) as well as of the material features of the landscape [15–17]. The rapidly growing interest in an ever widening range of disciplines due to the existence of past multiple uses in the management of forest resources has been largely generated by the growing problems of identification and conservation of

biodiversity, both on a global (e.g., studies on land bearing trees of savannah-type cfr. [18]) and local individual rural landscape scale [19].

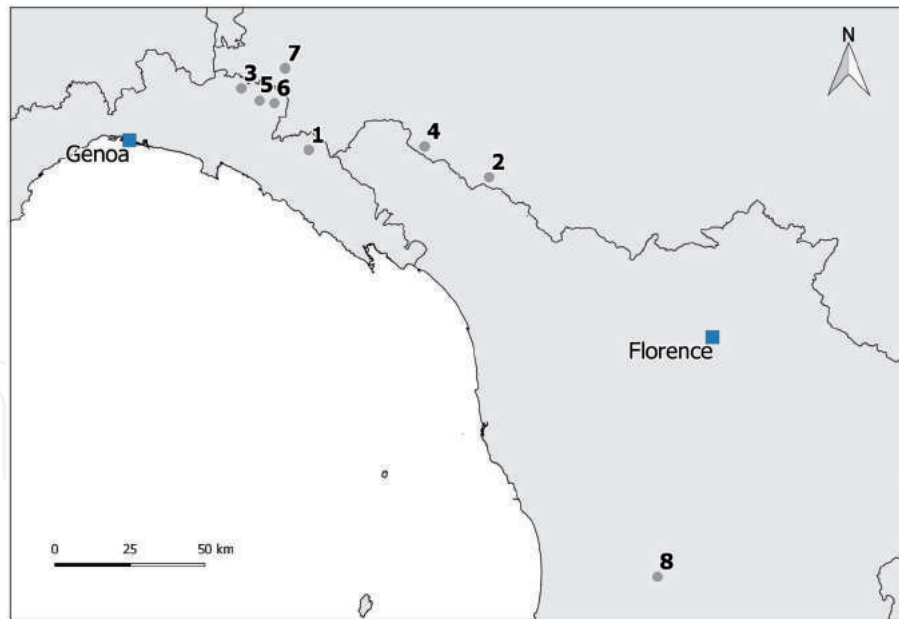
In Italy, it becomes evident, at a site observation scale, that the loss of biodiversity caused by the expansion of secondary forest formations on previous agricultural land (field, meadows, etc.) is the same loss effects that follows the abandonment (or lack of management) of many woodland type (e.g., coppiced woodlands or abandoned wooded grasslands). The regressive historical approach takes the previous ecology of the abandoned (or re-naturalized) resources as reference. This historical confrontation—in order to reconstruct the past biodiversity of the site—is seldom taken in account in paleoecological studies. Paleoecologist are rather interested in global climatic continuity/discontinuity, and rarely explore the topographical scale of the observed site both in space and time. Generally, material historical processes are surrogated by a more or less linear coevolution model of “Man and Nature” relationship. On the other hand, in historical geographical studies, wooded pasture is still assumed as “semi-natural system” rather than a fully historical issue of past sylvicultural/woodmanship [20]. Consequently, dealing with environmental conservation policies, they are prone to assume global bio-cultural heritage and rarity values or traditional cultural value-oriented policy [13, 21]. The reconstitution of past biodiversity at a landscape scale would of course be the main goal of environmental history and archeology. Nevertheless, at least in Italy, the landscape archeology seems to be more focused on settlement than on environmental resources [22]. Any confrontation or interdisciplinary project involving such different disciplinary participation is possible without taking into account the historical nature of the observed processes. By such a premise, it became necessary to question what kind of historical approach and sources have a scientific ground in the application of historical ecology researches. Has such a historical approach been applied, for instance, in the bio-cultural heritage definition as proposed by the conservation organizations [19]?

The ecology of past multiple systems (and in particular of wooded pasture systems) offers a very interesting interaction between forest resources, their biodiversity, and the actions and practices that has controlled and generated their environmental diversity. The role of traditional knowledge in shaping forests and their biodiversity in Europe and across the world has already been stressed in several publications [21, 23] drawing attention to differences in the approaches of conventional historical researchers nurtured by global environmental history, as opposed to historical ecology. In the former, the bio-diversification processes (as historical processes) are largely neglected or subsumed into general observations concerning global change, or are embedded in presumed “a-historical” and “traditional” economies and standing agro-sylvo-pastoral systems. Instead, the latter proposes that in the field of environmental and cultural conservation studies, such broad assessments are necessary prior to multi- or interdisciplinary applications.

Bio-diversification processes may be observed in, for example, paleontological and paleoecological studies at very different timescales. In the historical ecology case, diversification changes are observed at an historical time scale. As consequence, bio-diversification processes can be addressed through specific historical and historiographical topics (for an in-depth discussion of the issues emerging from studies of bio-diversification processes see [14]).

The case studies selected in this chapter (**Figure 1**) have been explicitly developed in different applied research projects devoted to specific sites and individual landscapes starting from the multisource methodological premises of the British historical ecology.

The historical approach is adopted here in order to identify and characterize past and ancient wooded pasture ecology. Also, it addresses more theoretical problems as posed by the historical ecology research development. In our case studies, woodland ecosystems are assumed as ecosystems concerning



**Figure 1.**

*Case studies location map. (1) Upper Vara Valley; (2) Prati di Sara; (3) Montarlone—Pian Brogione; (4) Prato Spilla; (5) Mogge di Ertola—Moglia di Casanova; (6) Upper Trebbia-Aveto Basin; (7) Ceno—Nure valleys; and (8) Montieri.*

land-bearing trees showing savannah-type ecologies (*sensu* [24, 25]). Each woodland that will be considered here appears to be composed of pure or mixed populations of silver fir (*Abies alba*), beech (*Fagus sylvatica*), and Turkey oak (*Quercus cerris*). Moreover, this section is also intended to contribute to a better evaluation of the sources (textual, cartographical, sedimentary, anthracological, oral, etc.) and purposes when such an analytical historical approach is adopted in geographical studies on woodland landscapes and resources. Field and documentary evidence collected during multidisciplinary historical ecology studies of sites in the northern Apennines of Liguria and Tuscany will be commented upon. This topographical scale research indicates that the key drivers in associated biodiversity changes resulted from medieval and post-medieval transformations in management practices.

The case studies are arranged in order to underlay the importance of the topographical and social local context (e.g., exploring local forest resource terminology meaning). Such an analysis is possible when the language of textual sources is deciphered in the light of the local taxonomy system, as is the case of the 1822 Forest Inventory in Upper Vara Valley (paragraph 2). Field and sedimentary evidences are contrasted focusing on the historical ecology of beech and fir wooded pasture sites and their bio-diversification processes in the Upper Trebbia and Aveto Valleys (paragraphs 3–4). Finally, the recent development of environmental resource archeology related to the study of charcoal hearth soils (paragraph 5) demonstrate the relevance of anthracology in woodmanship practices characterization and in the comparison of wooded pasture system at a European scale.

In terms of final remarks, the case studies suggest that historical ecology approaches, applied locally, can raise key questions and new data, which can differ from those of the traditional archival and textual based studies, as well as those from non-historical ecological research. The methodology adopted in a locally based approach should use specific historical analyses, documentary, and archival sources, together with archeological and sedimentary evidence. This results can contribute not only to finding answers to the key questions, but also to the generation of new research directions on forest resources ecology and their applications in the European rural heritage identification.

## 2. Wooded pasture: looking for the local historical context

In 1822—at the very end of the customary regime—the entire forest resources of a high valley of the Eastern Ligurian Apennines (Upper Vara Valley) had been described orally in front of the local judge. Excluding the chestnut orchard—considered at the time as a purely agricultural land use type—each landowner has been questioned about the rights and management system of their land. These descriptions (called “Consegne”) were transcribed by a notary chancellor, had a legal value, and were collected in the agenda for the formation of a Forest Inventory in charge to the Forest Administration of the Kingdom of Sardinia. The *Consegne* are textual source type that in recent years have provided historical ecology research in the NW Apennines with a reliable sample of hundreds of wooded parcels with the opportunity to localize them and assess the precise environmental content of the site [26, 27]. As commonly attested in this type of documents, the language of the oral answers interacts poorly and confusingly with the form and terms proposed by the administration’s questionnaire. Interestingly, the text of each single “parcel” description provides us an in-depth insight of the local environmental resources vernacular terminology. This last is a problem that renders this documentation virtually useless for the Forestry Administration which, in the following years, did not unify a coherent description of all the local woodlands documented in the Ligurian mountains. At the end of the enquiry, for the administrative/prescriptive purposes, the local land uses types were reduced to a few (4–6) conventional forest categories. The rich resources vernacular terminology was converted in the international economic and forestry scientific literature classes (largely written in French in the Kingdom of Sardinia) and already adopted by the administration before the initiation of the 1822 inventory. In a small sample, such as in the studied parishes of the Upper Val di Vara, it is possible to discover and characterize 21 different forms of local use of the forestry resources.

### 2.1 Local forms of use of the wooded soil: from text terminology to the taxonomy of local environmental knowledge

Starting from the apparently confusing contents of the answers—mixing local and administrative terms—it was nevertheless possible to identify various local forms of forest uses. By breaking down the precise references that each of the owners was obliged to elucidate in order to establish the arboreal species composition, management practices, and obtainable productions, it is possible to identify a global logic in the local system that appears in opposition to the logic of Forestry Administration. As demonstrated in previous works [28], local language terminology corresponded to a coherent local taxonomy of forest resources which had juridical power both in technical and legal terms during the customary regime [29]. The history of these mountain woods resources, as in the whole Mediterranean area, appears to be dominated up to these years by animal production economies; indeed, the forest resources’ types appear to be largely placed in a variety of common land use systems. The commons (variously called “comunalie,” “comunelli” concerning this part of the Ligurian—Emilian—Tuscan mountain reliefs) are pivotal in the organization of seasonal movements of livestock. Until the abolition of the commons rights on land from the late nineteenth century to the beginning of twentieth century [30], they appear to have been located in the summer quarter (“alpi” dial.) of the significantly extended double facing—South Tyrrhenian littoral pasture and North Po Plain pasture—transhumance seasonal movements. Ovine and caprine flock (but also, in minor amount, bovine herds) lay during winter grazing in long fallow lands, marshes, and coastal lagoons (but

also, in some specialized systems that link sheep and olive and vineyards cultivations) on the Tyrrhenian shore (“marine”/“maremme”) [31] or conversely—north facing—on the Po Valley plain field and marshland (“valli” dial.) [32]. It has already been noted that the existence of different types of multiple use practices in common lands became the framework in the post-medieval age. This contributed to the characterization of a history of highly conflictual use of pastoral resources (developing the medieval practice of clan s’ feuds) among the family kinships entitled to access (see the central role of common land in the microanalytical essay of one of these Apennine valleys, in [33]). In the microhistorical-geographical analysis of this type of textual sources, the conflicting use of this technical terminology clearly emerges. A linguistic tension (and a consequent or ambiguous linguistic use of the terminology) is always present both outside and also within the social framework of rural communities in the production of discourses or texts concerning forest resources, land use and related production practices [16, 17]. For example, the two local woodland uses type, (cfr **Figure 2**, column 1) *Macchia* and *Selva*, are not intended as synonyms for high forest of beech, but are clearly distinguished in the 1822 text and are actually distinguishable when placed in different aspects or phases relating to the positioning of the single parcel alongside the local utilization cycle. This exercise of contextualization shows that a generic reference to the locality, or to an imagined local context, does not allow this documentary material to be treated as a product in a supposedly homogeneous social bloc (e.g., the rural community? The peasant knowledge?). Moreover, does not allow us (or let imagine) a linear, so-called “traditional transmission”, of the local practices and related environmental knowledge as they appear mentioned in the text (e.g., assuming the existence of an a-historical traditional ecological knowledge).

## 2.2 Commons, the ubiquitous wooded pasture systems

As one can see from **Figure 2**, of the 21 local taxa referred to different wooded land use, only 4—named in the 1822 documents as: “Selva arborata,” “macchia,”

UTILIZZO	SPECIE							FORME DI TRATTAMENTO				PRODUZIONE PRINCIPALI			
	Fs	Oc	Cs	Fo	Oc	Esp.	A g	Psp.	FUSTAIA T.SALTU.	TURNIA.	NON-CEDUO* SGAMOLLO	CAPITOLLO	PASCOLO	FRONDA	ASSORT. LEGNAME
1 Selva arborata	*								S	100-150	▽	▲	◆	◇	□
2 Selva arborata	*	*							S	200	▽		◆	◇	□
3 Macchia	*								?	?	▽		◆	◇	?
4 Bosco arborato	*			*							▽		◆	◇	
5 Bosco arborato	*								S	100	▽		◆	◇	□
6 Boscaglia arborata	*										▽	▲	◆	◇	
7 Bosco arborato	*	*							S	100-200		▲	◆		□
8 Terra pascolativa	*												◆		
9 Terra arborata	*										▽	▲	◆		
10 Selva arborata		*									▽	▲	?	?	
11 Bosco arborato		*							?				◆	Frutto?	
12 Bosco arborato	*	*	*										◆	◇	
13 Bosco di		*		*								▲	◆	◇	
14 Bosco di			*		*						▽		◆	◇	
15 Boscaglia di		*				*					▽	▲	◆	◇	
16 Boscaglia di				*	*	*					▽		◆	◇	
17 Boscaglia di		*	*	*	*	*	*				▽	▲	◆	◇	
18 Terra arborata		*									▽		◆	◇	
19 Terra arborata di		*	*	*	*						▽		◆	◇	
20 Terra arborata		*					*	*			▽		◆	◇	
21 Terra arborata							*				▽		◆	◇	

**Figure 2.** (Upper Vara Valley—SP) The woodland resources of the past Mandamento of Varese Ligure in 1822. Local land use type (in the first column of the figure), species composition (in second column), management practices (in the third column), and main production (in the fourth column) ([28], Table 35). Sources for the construction of the table were texts of the “consegne” (consignment) made to the Forestry Administration of the Kingdom of Sardinia of each individual forest parcels (“tenute di bosco”) in observance of the law RR Patenti 13.7.1822.

“bosco arborato,” and “boscaglia arborata”—produce wood assortments employing practices that characterized high-standard forest management [26]. These four wood types were composed of pure or mixed populations of beech and oak (especially Turkey oaks), each subjected to a cutting/harvesting practices; a selective cut of every chosen single tree with a cut cycle estimated by users of 100–200 years, called in Italian “taglio saltuario,” and in French “jardinage.” These types of high-standard forests occupied very limited areas in the parish common lands in comparison to the spread of all the others types of lands bearing trees. Largest extension was covered by wooded meadows and pasture devoted to fruit collection, pasture, hay making and, as well as bare areas, dedicated to the mixed production of hay and grazing (e.g., see the Upper Secchia Valley iconographic documentation). All of the 21 local taxa were subjected in 1822 to grazing rights, and even 17 are noted to specially produce leaf for fodder through different forms of treatment of the whole arboreal layer. These local land use types (column fourth central production of leaf fodder) consist of wooded meadow/pasture systems.

**Figure 2** shows that in the Upper Vara Valley, the production of leaf fodder is almost entirely distributed in woods with pure or mixed beech composition (Fs = *Fagus sylvatica* in the second column of the table) and Turkey oak (Qc = *Quercus cerris*). Moreover, green pruning (“scalvo”) practices were allowed in the management of high-growing stands (“fustaie”, or selected areas of wooded pastures with beech or oak to produce fodder, acorns and timber, i.e. 1,2,5,7 in the first column of the figure). These are separately specified documenting the employment of shredding (“sgamollo”) and pollarding (“capitozza”) cuts. The production of leaf fodder and pasture is also reported in the local forms of wood use (first column no. 12, 14, 17, and 19) populated with chestnut trees, which practically formed different shapes of chestnut orchards (Cs = *Castanea sativa*) second column of the figure). It is interesting to note that the type bearing chestnut trees no. 17 appears mentioned as pollarded, although in the *Consegne* documentation the production of charcoal is never mentioned (for this correlation see paragraph 5). As we will see in following section, wooded pasture and meadows—as directly documented in the descriptions of many wooded parcels in 1822 in Vara Valley—are currently involved in the exploitation of individual, scattered small fields, setting a temporary form of minor cereal crop growing (based on the controlled fire practice called “ronco”). This temporary agriculture practice [26] must not be confused with the slash-and-burn agriculture systems, as frequently occurs in archeological and geographical literature. The right to set up the temporary field (“roncare, campeggiare”) in the wooded commons is part of a regular cycle of cultivation treatments and practices, in which the crop itself is not the more important product; the main goal is to control the excess of organic substance and the invasions of shrubs and non-palatable herbaceous species due to intense grazing. In these mountains, such specialization has generated many local variations in the use of wooded pasture. This is also the case, for example, of the so-called “alnoculture system,” involving a cyclical management for agricultural plots of small populations of gray alder (*Alnus incana*) (for an insight focus, see [34, 35]). Resulting from this discussion of the interconnection with wooded pasture systems, it is important to underline that—in the nearest Upper Aveto valley—in a slope in which “ronco” practices have been located by cartographic sources at least since 1720 AD—pollen analysis offers evidence that the “alnoculture” system appears present during the middle Ages on the slope previously occupied by fir wooded pastures [36, 37].



### 3. Past beech wooded meadows ecology (palynological, cartographic, and field sources)

In the Ligurian-Tuscan-Emilian portion of Apennines, it has already been noted that fragments of beech wooded meadows appear located in correspondence with sheep transhumance paths in activity up to the mid-twentieth century. The transhumant flocks that used the summer pastures (“alpi/alpeggi”) were stationed (in winter) on the Tyrrhenian littoral pasture (“maremme”) or in the Po plain marshland (“valli”). As previously outlined, the flock movements involved conflicts between the mountain communities and parishes. In this frame, litigation issues on the borders also arose between the state entities (the surroundings leading city-states of Parma, Reggio, Lucca) or the local lordships that had acquired and maintained a jurisdiction of the grazed area. Thanks to such disputes, in different archives (local and central), we can find series of manuscript maps that provide evidence of management practices that marked the beech wooded meadows resources during the post-medieval age. A fine example is a view map representing the head of the Upper Secchia Valley—in Tuscan-Emilian eastern portion of Apennine exactly at the sources of the Secchia river—that shows the vegetation cover of these slopes in detail. It has been produced by an anonymous painter-cartographer (or possibly a local land surveyor that seems—in drawing this map—to prolong a late medieval tradition of land representation). The map—conserved in the collections of the State Archive of Parma—is not dated, but can easily be attributed to the second half of the sixteenth century (we suggest 1590 ca.). This cartographic document can offer several details that will now be discussed. The different forms of treatment of beech and trees distribution (isolated, kept in small groups or rows) are recognizable. Land-bearing trees show similar management forms (or cutting cycle), as those interpreted using 1822 text on beech wooded meadows and pasture for the Upper Vara valley. In the water color drawing, it is possible to distinguish the presence of high-standard beech woodland concentrated in some stretches or patches (**Figure 3**) at the watershed level. Moreover, large portions of meadows and bare pastures appear where every single or small group of beech trees is represented showing a shape due to the different cutting practices of shredding, pollarding, and coppicing (**Figure 4**).

Shapes of the trees allow a comparison with the reconstruction of the woodmanship practices in medieval English wooded pastures [38] (**Figure 5**).

As recognized in recent reviews of Italian wooded pastures [23, 39], twentieth century forestry handbook writers and authors—although always favorable to the abolition of collective rights in the woods—positively acknowledged many of the environmental functions of the use of these cutting and harvesting practices. We find field evidence of the effects of activation on the whole ecosystem observing—at the site level—fragments of the landscape of the ancient wooded meadows and pastures. They were found on the same slopes of the Upper Secchia Valley painted in 1590 map, in a site called “Prati di Sara,” in the summer of 1995 during a field survey aiming a vegetation map production [40]. The site extends over low-inclination slopes between Mount Cusna (2120 m asl), Le Borrelle (1623 m asl), and M. Bagioletto (1758 m asl) beyond the current beech forest limit (slightly above 1600 m asl). The site is located in a strip of subalpine vegetation that rises up to the highest peaks, characterized mainly by the blueberry moorland interspersed with alpine-like grassland. The botanical survey and measurements were carried out along a 20-m transect that passes through a group of beech trees and continues into the pasture in the dominant wind direction SSE-NNW. A summary of these first observations is presented in **Figure 6**.

It is interesting to note that while the geographical name meaning meadows (“prati”) recalls the practice of mowing the herbaceous layer, it was actually still in



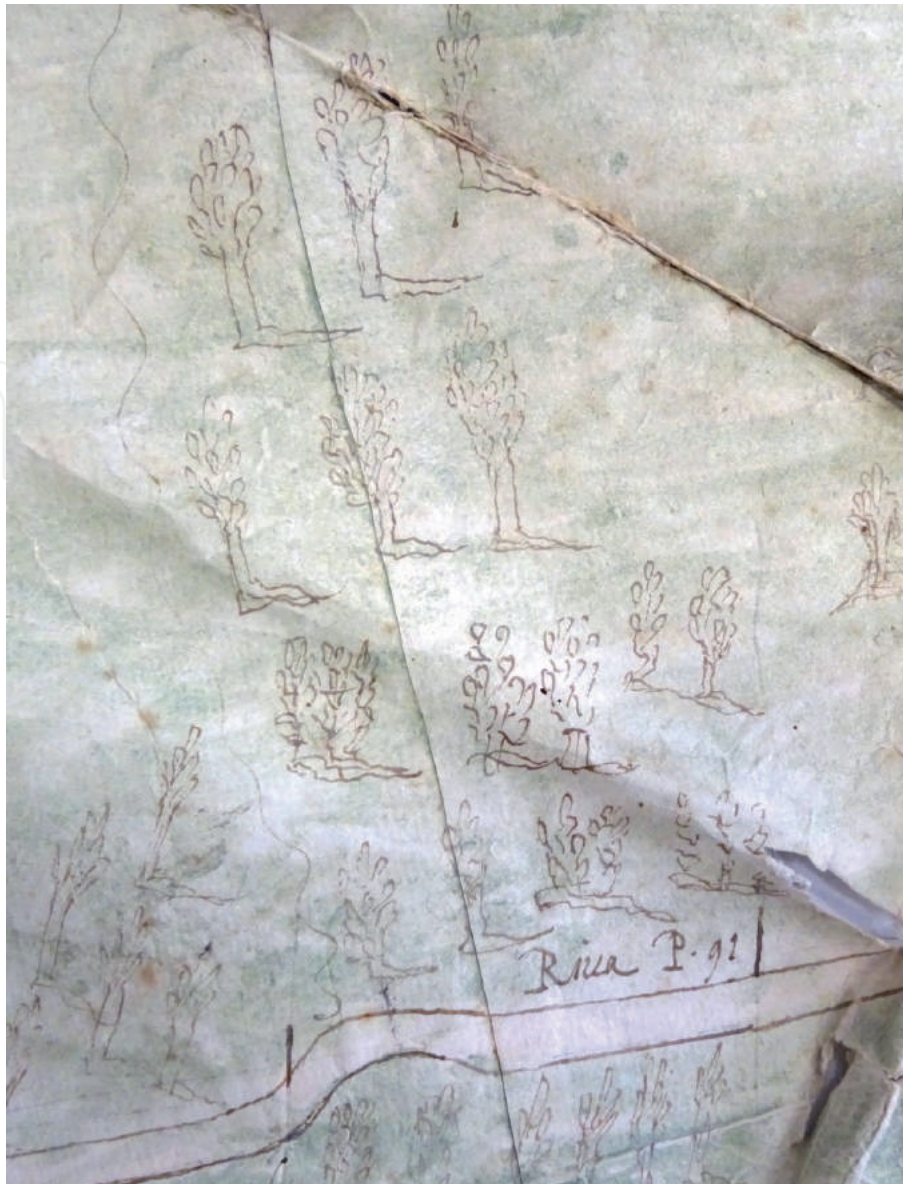
**Figure 3.**

Patches of high-standard beech woodland in a landscape of bare meadow-pasture (detail of the main watershed of Upper Secchia Valley in a Ms map dated 1590 ca A.S. Parma, *Confini*, b.205/7b, dis.887).

use here until the 1960s, as revealed from oral sources collected in the surroundings parishes in the early 1990s. Later, the effect of mowing has been substituted by ovine and bovine grazing. However, due to the gradual reduction of those herds, the environmental effects of grazing become thinner, until 1995 when our observation on the biodiversity of herbaceous layer were made.

At the time of our survey, we found (**Figure 6**): isolated trees (pollarded beeches) (a) that characterized the vegetation of the beech meadows-pastures with respect to the surrounding areas consisting of bare grassland (b). The wooded meadow-pasture occupied most of the flat areas in 1995, where it was probably easier for cattle to be stationed. On this site the presence of good forage grass (e.g., *Poa alpina*, *Phleum alpinum*, *Festuca rubra* and *Agrostis tenuis*) increases by one-third in areas bearing trees (a). On the contrary, the floristic composition of the bare meadow-pasture (b), where *Nardus stricta*, *Festuca ovina* and *Avenella flexuosa* prevail, is considerably impoverished.

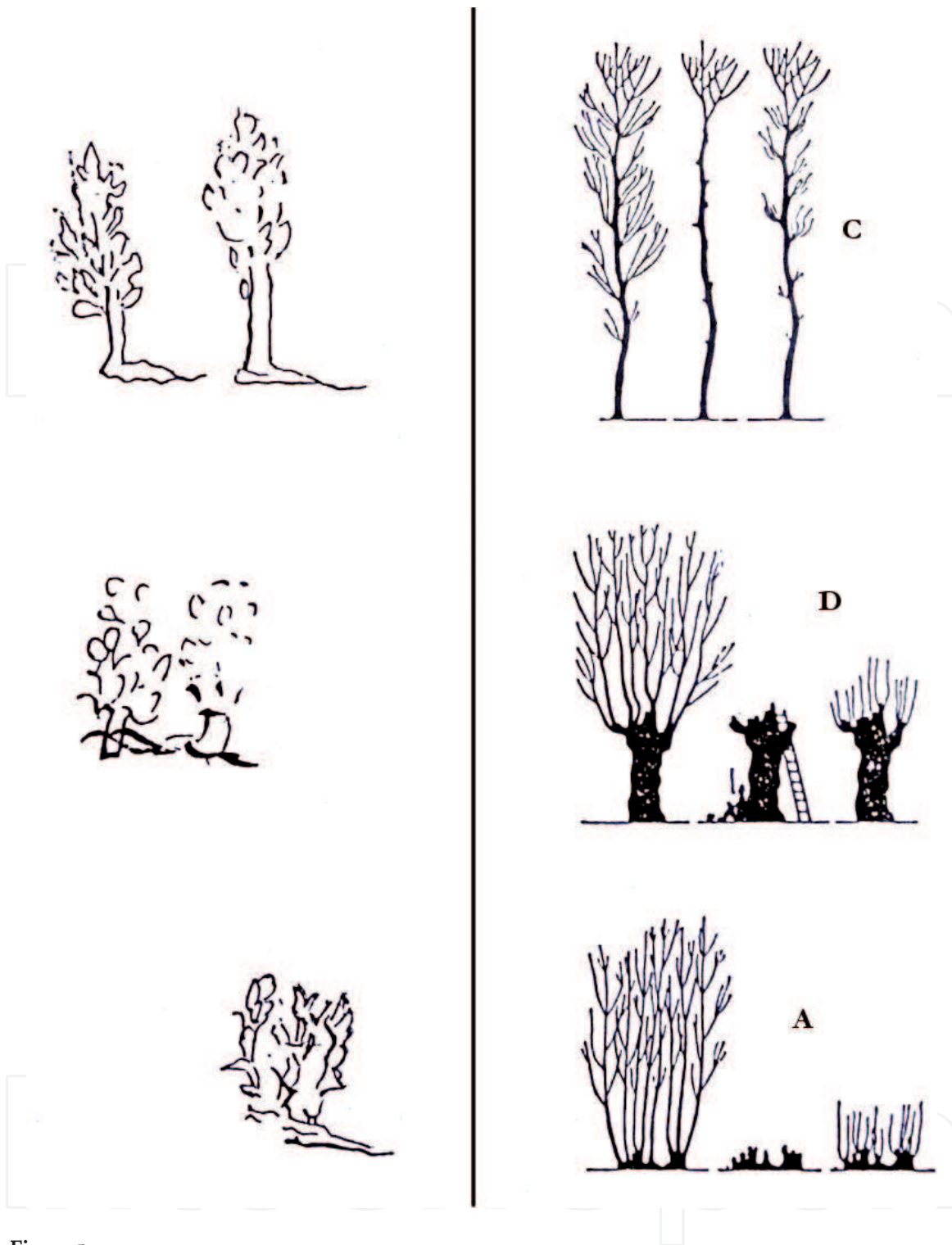
The diagram in **Figure 6** represents the positive effects of the scattered pollarded beech trees on the herbaceous vegetation of the wooded meadow-pasture as recorded along a 20-m transect. In the area where the beech trees grow (a), the biomass of the herbs layer increases (1) (the height has been measured as an index) and the fodder ratio (3) (the ratio established between the presence of good fodder species and the total number of species detected) is tripled. In the figure, the graph has been duplicated in order to suggest the possible multiplication of the positive effects on a wider surface subjected to the beech grassland-pasture-system in which the single pollards showed a regular spacing of 20–22 m. This last measure is obtained comparing from the “fossil parcel” of beech wooded meadow pasture as found in the site of Rachixina (Upper Trebbia Valley) that will be discussed below. In particular, the situation under the pollarded beech trees (a) can be described as a dense and rather luxuriant lawn that prefers fresh and deep soils, whose composition exceeds the 30 species of herbaceous plants with the dominance of *Festuca*



**Figure 4.**

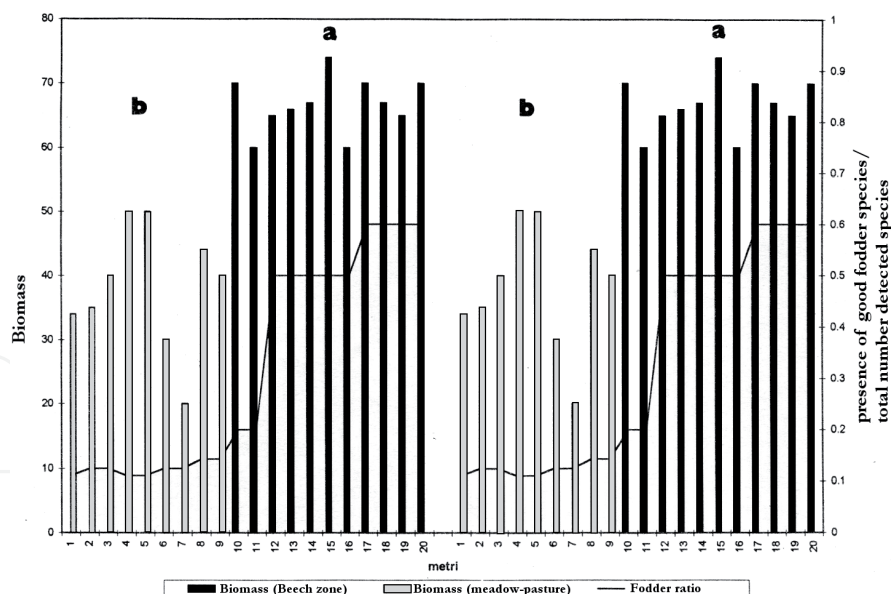
*Beech trees distribution and shape in a wooded meadow-pasture (detail of the central slope at the spring of the Secchia river Valley, ca.1590 A.S. Parma, Confini, b.205/7b, dis.887).*

*rubra* with which other good forage grasses are associated, along with proteins-rich pulses. The situation observed in (b) can be described as an impoverished stage of (a). The herbaceous layer is sometimes dishomogeneous and the number of species is lower; the physiognomic aspect is that of a meadow-pasture dominated by *Nardus stricta*, a grass rejected by cattle, and with which other bad forage species are associated, while few *Phleum alpinum* and *Festuca rubra* are still found. These positive variations induced in the herbaceous layer—certainly known by the past users of the wooded pasture—are obtained through a precise distribution of the beeches, of their number in function of the micro-topography, of the prevailing winds, of the water regime and of the fire regime controlled by shepherds. As is known, Oliver Rackham—with which the results of the observations at the site Prati di Sara were discussed—used to include the environmental and production processes that were activated in these wooded grassland in the more general study of the historical ecology of savannahs with deciduous trees; a plant typology about which there is no doubts concerning origin due to management by fire (cfr [41]). Pollen evidence from the very close site of peat bog at Prato Spilla [42, 43] has shown that the system documented in 1995 still at work at Prati di Sara became an integral part of



**Figure 5.**  
*A comparison between (on the left) the sixteenth century cutting practices (from the ASP 1590 map) and (on the right) the Rackham reconstruction of medieval beech wood pasture woodmanship practices: A. Stool Coppicing; D. Pollarding; C. Shredding [38].*

the summer management of the higher portion of the slopes during the Lombard period. In the upper part of the pollen diagram, the basis of the M3 horizon has been radiocarbon dated to  $1400 \pm 45$  BP, which coincides with the “Lombard Age” (sixth and seventh centuries AD) of settlements in the northern Apennines [32]. The uplands witnessed major changes in land management and settlement patterns during the Lombard phase, from an economy based upon woodland grazing (a “saltus” system, widely practiced during the Roman period) to the “alpes” beech wooded meadow system, in which livestock feeding is provided by herbs, hay, and fodder production. At the Prato Spilla site (A), the significant reduction in tree

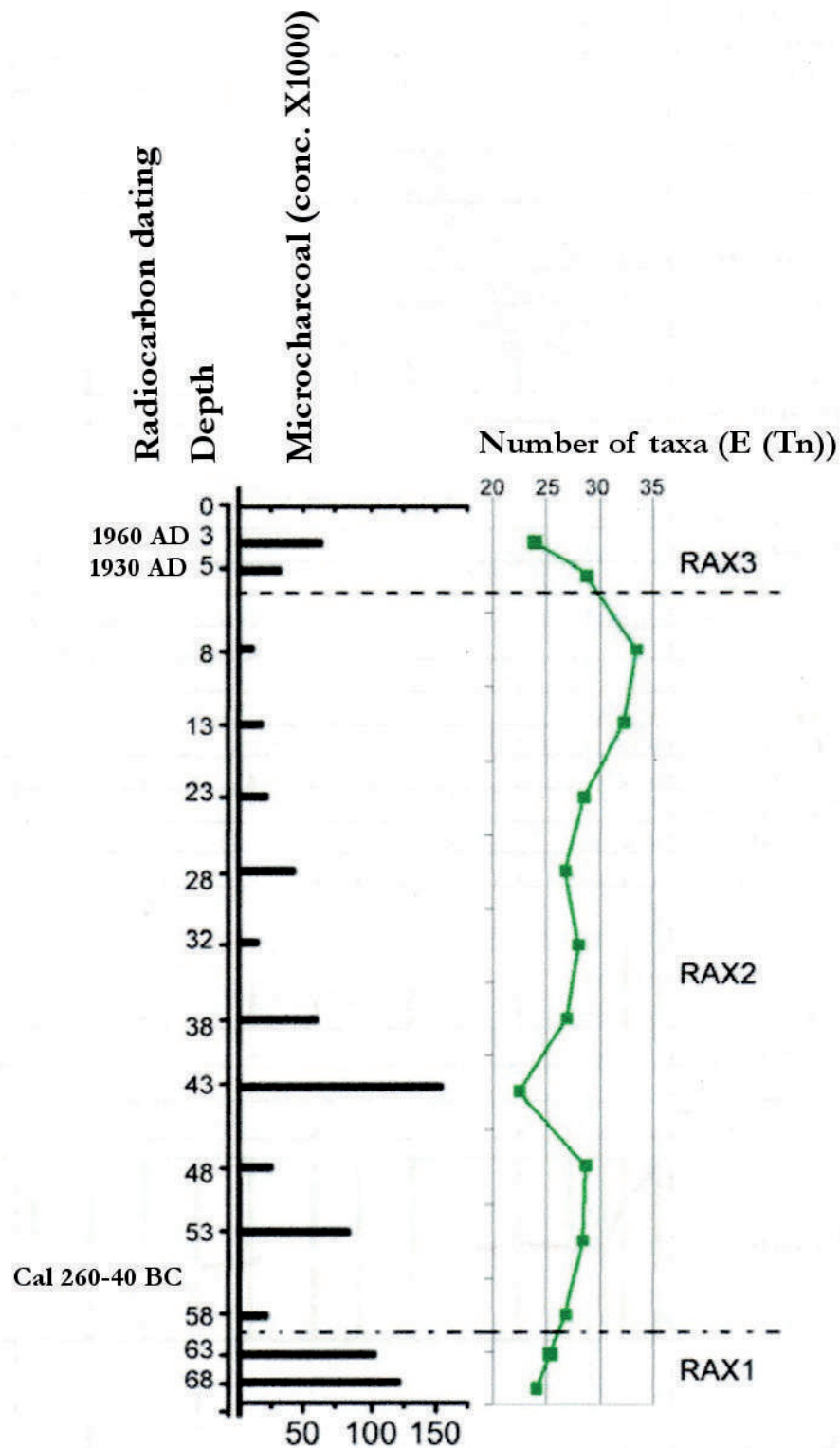


**Figure 6.**

Effects of the pollarded beech trees cover on the herbaceous vegetation layer of the wooded meadow at the site Prati di Sara (Upper Secchia Valley) [40].

pollen, accompanied by expansions of beech, fleaworts (*Plantago* sp.), and grass pollen reflects this change from “saltus” to “alpes” systems. Actually, the grit and sand layer at this horizon indicates that this change led to significant disruption of local soils, which in turn suggests that the established vegetation-soil associations were sensitive to change. It is unlikely that farming activities were ever intense, and they are likely to have been seasonal in the Prato Spilla area, as suggested by the temporary practice of “ronco” for the Upper Vara Valley multiple use system. It could be of interest to note that in a more recent part of the core, the pollen diagram cored at Prato Spilla shows a new expansion of Gramineae and Cyperaceae, in connection with beech pollen reduction. This possibly documents a more intensive use of the Alps slopes for hay making on bare areas as shown in the 1590 map of the individual landscape at the sources of the Secchia River and a fragment of which has been studied in the field at the site Prati di Sara.

As mentioned above, past beech wooded meadows ecology has been documented both by pollen and present floristic survey at the Rachixina site located on the W-NW side of Mount Montarlone at 334 m asl (High Trebbia valley, GE) (cfr **Figure 1(6)**). The surveyed area is part of the common land pertaining to the inhabitants of the parish of Casanova in the municipality of Rovigno. The present tree cover consists of an aged beech coppice within the Natura 2000 SIC IT 1331012 “Roccabruna.” Here, a parcel of ca. 700 mq of surface presents a population of 15 pollarded beech trees: a “relict” of the wooded meadow part of an *Alpe* no longer used since the beginning of the twentieth century [40]. The parcel escaped the coppice cut for charcoal production that affected the whole common beech forest in the 1930s [44, 45] due to conflict with a supposed private property. Since then, it has not undergone other uses and the abandonment has given an unusual form to the suffering no more pollarded trees that generated a peculiar circle of radical suckers [7, 46]. The herbaceous layer underlying the beech forest is very poor due to the heavy leaf litter deposit, and it is practically absent under the pollarded trees. Anyway, some traces of past herbaceous layer can be detected observing palynological results [44]. The pollen diagram obtained in April 2007 by sampling a soil profile of about 75 cm shows the existence of three different phases attributable to variations in management of the vegetation cover [44]. The first and oldest phase (RAX 1)—that according to the radiocarbon dating should



**Figure 7.**  
 The historical process of bio-diversification. The ecology of the site changes following the change in forest use: an estimate of the degree of biodiversity present in the different historical phases reconstructed by the pollen diagram at Rachixina site ([44], Figure 41).

be earlier than 280 BC—have a forest cover dominated by beech in which are present hazel, alder, deciduous oaks, pine, and silver fir. The presence of heather (*Erica* gen.) possibly proves forest grazing practices: a landscape that perfectly corresponds to the “saltus” phase documented by pollen sources at Prato Spilla site. The second phase of the pollen diagram (RAX 2) shows the dominance of beech on all tree species (silver fir practically disappears) together with the highest percentage of pollen from herbaceous species. A marker of the adoption of the wooded meadow system through a process that pollens have documented also at Prato

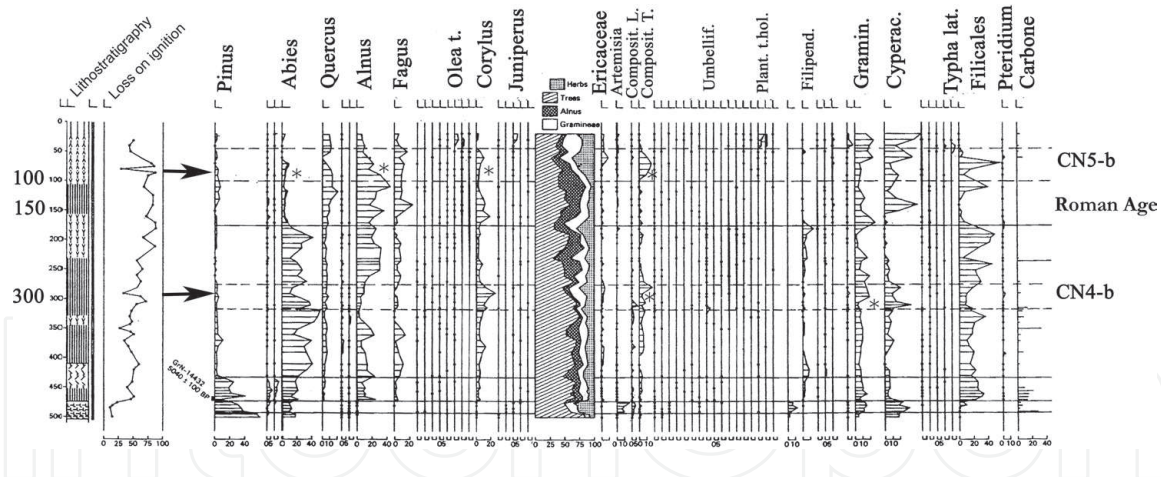
Spilla site, likely the *Alpe* system adopted after the Classical age. It is interesting to note that the highest degree of biodiversity of the site is recorded during the RAX 2 phase. The fire practices are shown on the columns of microcharcoal. The ecology of the site undergoes a rapid change around the first decade of 1900, when the main sheep transhumance from the coast stopped. A change that also affects the soil pH: during the centuries of use of the wood pasture, appears to be less acidic giving the N added by the flocks dropping. **Figure 7** documents the process of site bio-diversification. It shows the estimate of the degree of biodiversity present in the different phases reconstructed through the pollen diagram. The diagram, on the right side, shows the result of quantitative analysis of the microcharcoals: a peak of concentration at a depth of 43 cm could be related to the adoption of the beech wooded meadow system. Subsequently, the microcharcoals testify the pastoral controlled fire regime of the multiple system. The RAX 3 phase has been compared with archival sources and the present vegetation cover of the slope allowing to identify the living—but disappearing—heritage of this historical multiple system in the present high environmental value landscape and its problematic conservation [45–48].

#### 4. Field and sedimentary evidences for past fir wooded pasture ecology

For the purpose of providing information for the implementation of policies concerning the future conservation through the reuse of wooded meadow-pasture systems, an ecological continuity could be established following a regressive observation from the present site ecology tracing back to the first discontinuity. It appears that in Ligurian Mountains, a main general reorganization of pastoral resources occurred in the post-classical age. In many cases, the adoption (or, on the contrary, the reduction) of specific land cover and use is precisely dated by pollen or charcoal samples (e.g., the quoted sites of Prato Spilla, Pian delle Groppere, Rachixina, Pian Brogione, Moglia di Casanova, etc.).

It is almost certain that the wooded meadow-pasture system is related to the common use of land and to the adoption of the new legal access to the collective resources that had been put in place in NW Apennines with the Lombard age customary law system. But each individual landscape of wooded meadow-pasture requires its own biographical reconstruction. On the basis of pollen and microcharcoals evidence, the hypothesis that a wooded pasture populated with silver firs (*Abies alba*) was already in use in the Ligurian-Emilian Apennines during proto and prehistoric ages has been advanced (see [49–51]). This fact could be of interest in pointing out the problem of the ecological continuity within the present vegetation cover of these archeologically reconstructed systems.

The pollen core (**Figure 8**) at “Moglia di Casanova” has been sampled in a pond/peat bog site, located in the common land of the mentioned parish of Casanova di Rovegno on the watershed between the Trebbia and the Aveto Valleys. The collapse of *Abies* spp. percentages recorded in the pollen diagrams obtained in this watershed (Moglia di Casanova site and Mogge di Ertola site) dates at the Roman Age; while in other sites of the Aveto valley (Lago Riane and Prato Mollo), the substitution *Abies-Fagus* appears to be much older (4000 and 3000 BC, see [51–53]). The “Moglia di Casanova” peat bog site offers another significant pollen evidence: fir trees present during the Bronze Age were affected by a clearing phase which resulted in an open wood pasture rather than a closed forest [49]. Gillian Cruise, thanks to the increase in the pollen of Composite, Gramineae, Cyperaceae, and minor occurrences of Liliacee, *Melampyrum*, and *Rhinanthus*, suggested an important phase dating back to the Bronze Age of permanent pasture in (or between) the fir woods. The presence



**Figure 8.** Pollen diagram cored at “Moglia di Casanova” pond/peat bog site ([49], modified [7]).

of *Avena* (oats) pollen in this context had also suggested temporary small-scale fields in woodland clearings and glades, allowed by the functioning of a multipurpose system [7, 49]. Was in pre Classical Age the silver fir population managed as a multipurpose system similar to the local system documented in medieval and post-medieval ages?

In fact, at different sites of this Trebbia-Aveto watershed, silver fir continued to be present even during medieval and post-medieval ages. An interesting example comes from the site of “Pian delle Gròppere” (close to Moglia di Casanova), at 1250 m asl, where archeological documentation indicates the presence of silver fir in the arboreal vegetation during the Early Middle Ages in the context of clearance cairns for temporary fields. The abundance of juniper and fir charcoals fragments found in the basal stratigraphic unity (US) of the excavated stone mound (cairns = dial. “groppere”) indicates, in fact, an episode of fire dating back to 640–770 AD; probably fire practices for agricultural purposes (early medieval practice of temporary agriculture on a wooded soil with controlled fire, called “ronco” in medieval and post-medieval texts [26, 54–57]).

Sporadic silver fir trees are present in continuity with the medieval silver fir population on the same slopes of the Upper Trebbia Valley during the nineteenth century. Textual sources help: Alberto Nota, a deputy in the administration of newly established “Provincia di Bobbio” of the Kingdom of Sardinia in 1822, quoting the trees present in the Casanova mountains, wrote: “they are seen in that surroundings also firs trees which are no longer found in the Bobbiese, although from the old buildings it is recognized that it was once a great use of such wood for construction” [7]. Large scale maps made by military staff in the first half of the XIX century are important documents to reconstruct local land use; on these slopes, the abbreviation “BP”, that means “wooded pastures” (“Bosco pascolato”), was used by the topographers to indicate the importance and extension of this system. Although referred mainly as beech wooded pasture [29, 46, 58]—probably it includes sites of the existing silver fir population. Could an ecological continuity be established concerning the present silver fir population in the nearby Upper Ceno-Nure valleys? Actually, in the botanical literature, the present living populations of silver fir at the site of “Tana di Monte Nero,” between the Ceno and Nure valleys, at an altitude of about 1650 m asl, are considered to be relics. It is not due to twentieth century forestry plantation policy, but rather presenting a biological continuity with the “ancient” populations, as well as with the nearby few individuals of mountain pine (*Pinus mugo* Turra) [59]. These silver fir populations located around Mount Nero had already been described by an eighteenth century surveyor



[60] during his itinerary exploring the economic resources of Piacenza's mountains. In the summer of 2005, a field visit part of the "Wetlands Archaeology Project," a regional research project on wetlands of Liguria considered as cultural heritage sites [61–64], permitted the attribution of the oldest surviving firs aged between 200 and 300 years confirming the continuity of the observed population. On M. Nero, a rare Apennine fragment of ancient pasture with silver fir is so present, in continuity with the historical populations. The interest of this area is exceptional from an historical ecology and archeological point of view. Indeed, comparisons are possible with the "fossil" fir trees conserved in many wetlands sites located in the Trebbia-Aveto Upper valleys, and in particular the site of "Mogge di Ertola." This site preserves several waterlogged trunks buried in the peat, mainly of silver fir and beech. Excavation showed that the trees fell into the peat bog approximately 4000 BP. Some of the dated tree trunks bear marks of fire and shredding practices. The trees at the "Tana di monte Nero" site present a browsing tree line (whose inferior branches still have a scorching line). Thanks to the presence at the easily accessible site of this living specimens and recently deceased specimens, it is possible to make detailed ecological observations that also analyzes the particular "candelabrum"



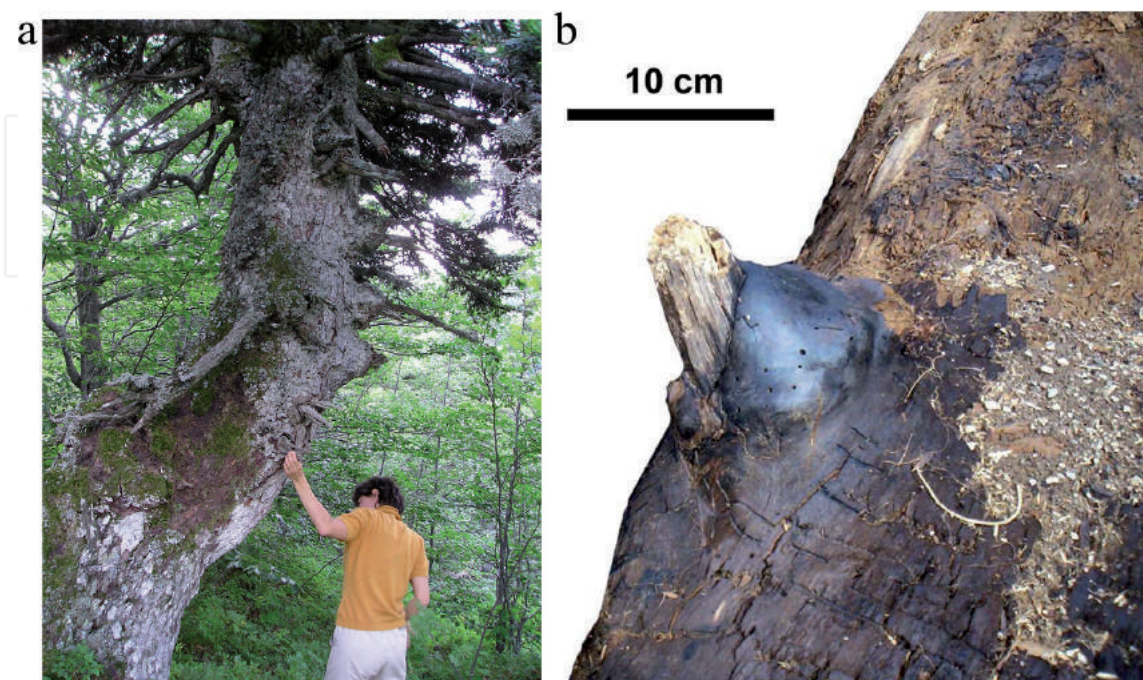
**Figure 9.** *Tana di Monte Nero, Upper Ceno Valley, Bedonia, q. About 1650 m asl: one of the living "ancient" white firs that populate a surviving strip of wooded pasture (A. Cevasco, 13.08.2005).*

morphologies (**Figures 9 and 10**); those with more vegetative apices had probably been chewed during the trees younger years.

The most important observation is represented by lateral swellings of reaction tissues due to the practice of shredding adult trees in order to collect branches for fodder (**Figure 11A and B**): this feature, due to the repeated cutting scarf, can be compared with those found on the Bronze Age silver fir trunks of Ertola. It is a well-known feature to the local woodmen still practicing the cut of lateral branches (dial. “skravaa”/shredding) in the turkey oak wooded pasture (the repeated cutting scarf “husks” called dial. “bucci”).



**Figure 10.**  
*Tana di Monte Nero, Upper Ceno Valley, Bedonia. About 1650 m asl: bi-secular dead specimen of silver fir presenting a candlestick shape. Possibly an effect of grazing during his youth (R. Cevasco, 13.08.2005).*



**Figure 11.**  
*(A) Tana di Monte Nero, Upper Ceno Valley, Bedonia, q. 1650 m asl: detail of the lateral swelling/reaction tissues (“husks”) in a living silver fir (effect of shredding) (D. Moreno, 13.08.2005). (B) Reaction tissues in a sub-fossil bronze age silver fir from the Mogge di Ertola site [52, 65].*

Information collected in Bergamo Alps—Central Alps Chain—would confirm the presence of “bucci”/scarf also in the grazed silver firs of Val Brembana, thanks to oral sources that experienced direct observation of the cyclical shredding of the lateral branches of the silver fir (production of fodder) and its environmental effects (lighter) on the herbaceous layer. A first survey (M. Calegari, personal communication) conducted in Schilpario (Val Brembana) has revealed, in fact, that still in the years 1950–1960, silver fir populations were subjected to “scalvo” (dial. = shredding) by shepherds. For a reference to a similar practice and similar production in the late nineteenth century Savoy Alps, see [66].

Also the cored site of Pian Brogione is part of the common land of the parish of Casanova: the pastoral resources of the slope where disputed since the end of eighteenth century by the inhabitants of the adjoining Fontanigorda parish [26]. The core section (between 74 and 174 cm) proved the abundance of silver fir trees during fourteenth to seventeenth centuries continuously living in the site from the Middle age population. The expansion of the chestnut from c. 1650 to c. 1800 appears to occur at the expense of the previous landscape classified as silver fir wooded pasture [67]. Actually, the curve of the presence of fir trees drops to zero exactly when the chestnut population appears. There are high levels of microcharcoals in this period, which are probably associated with controlled fire that reduces Ericaceae in favor of silver fir “savannah.” In addition, higher levels of microcharcoals associated with clayey silt with gravel indicate that there was active erosion of the slope [55]. It is likely that the high level of charcoal and erosion correspond to episodes of cultivation in fir wooded pasture of savannah type, which appears in these slopes during the Early Middle Ages (640–770 AD) as indicated by the study of charcoal and soil stratigraphy at Pian delle Gròppere (1250 m) [7, 55, 57, 67]. A Natura 2000 project has been developed in the common land of Casanova and specifically in the site of Pian Brogione in order to reintroduce experimentally the use of controlled fire to examine the effects on local historical biodiversity and as a tool for reactivating the wood pasture system [20, 67].

## **5. Post-medieval beech wooded pasture: first records from charcoal hearth soils**

Located in the Colline Metallifere district (Tuscany—Italy), Montieri (as well as many other settlements in the area, for example, Gerfalco, Massa Marittima, etc.) has been an important mining area for century. During the Middle Ages, mine-workings were especially concentrated on exploiting deposits of mixed sulfides of copper, lead, and silver, used for coin production. Since the 1980, several archeological investigations (for a bibliographic summary see recent papers: [68–73]) have demonstrated the important role of these activities in the development and transformation of local settlement and economic systems until the fourteenth century, when the metallurgical economy gradually collapsed. As demonstrated by recent environmental resources archeology research [22], in the post-medieval age, the wooded resources of Montieri appears to have been exploited in a multiple land use systems based on pasture that characterized this area until the nineteenth century. Investigations have been carried out on the Poggio di Montieri (the hill where the village of Montieri is located) in order to achieve a realistic insight of the past practices of woodland resources uses and of the historical and environmental dynamics which affected this area. Using a regressive and multi-proxy approach, it was possible to characterize the historical ecology of the ancient beech wooded pasture and past land management practices. It has been possible linking

archeological survey, anthracological, and dendro-anthracological analyses with historical texts and cartographic information concerning charcoal hearth soils. According to textual sources, between the sixteenth and eighteenth centuries, the Poggio di Montieri was characterized by the presence of a multiple land use system based on a complex ovine, caprine, cattle and pig rearing system. These activities were strongly integrated with chestnut growing, viticulture, and agriculture (wheat, flax and hemp). Access rights to these resources were expressly regulated by time and planned (i.e., collective use, reserve, emphyteusis, etc.) by local bylaw. Texts described a complex environmental resource management system commonly used in Poggio di Montieri, named “bandita,” which consisted of a temporary renting of common land that was mainly used for grazing. The pig rearing clearly had great importance in the woodland resource management: in the Montieri “bandita” system, a mixing of chestnut wood and oak trees (most of all turkey oak and English oak) is commonly defined—in sixteenth and eighteenth century documents—as “bandita di janda” namely bandita of/for acorn. Using the information provided by textual sources, woodland management practices can also be identified: for example, in the studied area collecting branches from the chestnut tree was forbidden but only during the period of the chestnut fruit harvest (starting in September until February) and so as for leaves collection or burning (in fact leaves were used for fodder). This multiple land use means that, for example, the chestnut grove could be subjected, in different periods of the year, to different practices: chestnut harvest, pruning (cutting non-interesting branches), collection of the leaves (fodder production), temporary sowing of cereals, grazing, and use of controlled fire (to encourage the re-growth of the herbaceous layer useful for grazing). These included pig pannage in oak and chestnut woods. This system was also commonly applied to beech wood, vineyards, and cultivated fields according to their respective uses. However, the “bandita” system gradually disappears between the end of eighteenth century and the beginning of nineteenth century. Indeed, in this period, general changes in the political, economic, and social patterns in Tuscany, left the way open to land privatization causing the legal end and subsequent erosion of the local collective land management system and practices [30, 74]. Signs of the last beech wooded pasture can be detected on the upper part of the Poggio di Montieri hill (between 1051 and 900 m asl): here, present vegetation stand is characterized by a high beech wood showing evidence of past coppicing and shredding (**Figure 12**).

Archeological evidence of the past beech trees management practices in the “bandita” system is concealed in the charcoal hearth soils discovered on top of the Poggio di Montieri hill (for an in-depth study of archeological and anthracological studies related to charcoal hearth soil at Poggio di Montieri see [22]). Anthracological and dendro-anthracological analysis has been conducted on C-46 site (one of the 80 charcoal hearth soil found in different areas of the Poggio di Montieri hill) located in the present beech wood at 1000 m asl (**Figure 13**).

Stratigraphic observation shows the presence of one charring phase (testified by a dark layer of 25 cm thickness) started between 1724 and 1815 AD (**Table 1**).

**Figure 14** shows the percentage of wood species found in C-46, while **Figure 15** shows the results of the diameter quantification (for the method used in this research see [75–77]). Finally, **Figure 16** shows the results of a dendro-anthracological analysis intended to gain information on wood condition before carbonization (i.e., presence of fungal hyphae, anatomical deformations, etc.) [78–82].

The C-46 charcoal fragments corpus (sum of 102 fragments) is largely dominated by beech (*Fagus sylvatica*) reaching 83%, followed by Common hornbeam (*Carpinus betulus*) (8%), field maple (*Acer campestre*) (5%), juniper (*Juniperus* sp.) (3%), and wych elm (*Ulmus* sp.) (1%). Juniper has been indicated as evidence of



**Figure 12.**  
*Ancient shredded beech in the Montieri hill (V. Pescini 21.03.2017).*

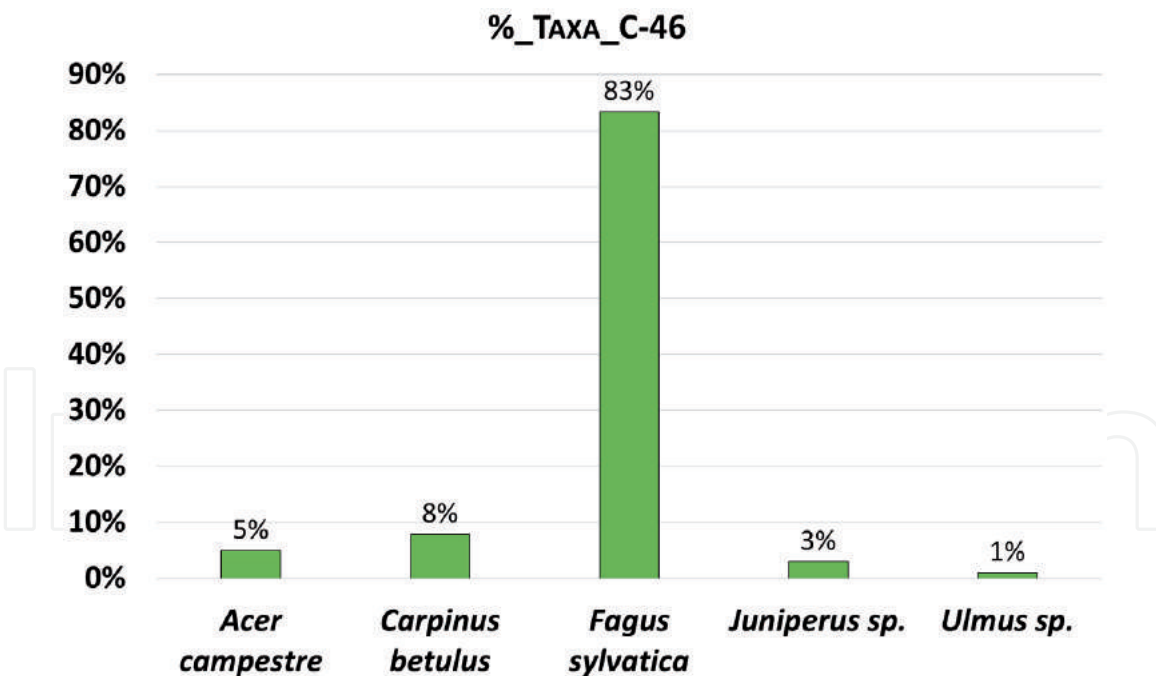
charcoal burning practices, as it was probably used for covering the charcoal kiln structure; this evidence fits perfectly with the hypothesis of a past savannah-type ecology for this site (according to [24]). The 36% of fragments show bark while a hyphae contamination is poorly represented. Radial cracks are scarce as well as their frequency per  $\text{cm}^2$  indicating a probable use of dry/seasoned wood. This can be related to the greater use of good state branches (i.e., no use of rotten wood). It could also be of interest to note that the prevailing cutting season is summer (41%): the precise time characterizing the fresh fodder production (the cutting season are as follows: Spring: 16%; Summer: 41%; Autumn: 8%; and Winter: 35%). Anthracological and dendro-anthracological analyses reveal the use of beech branches for making charcoal. The C46 site provided evidence—when information are contrasted with coeval textual and historical map contents—of a wooded pasture with a scattered beech population. Probably, branches used for charcoal



**Figure 13.**  
 General view of charcoal hearth site 46 (C-46) in the beech wood (V. Pescini 21.03.2017).

Site	Acronym	Mesh Ø	Depth	Curvature	n°rings	Pith	Bark	Cutting season	Taxa	14C BP	14C AD (calibrated; 2σ)	Observation
MTPG '17	C-46 US 1	4 mm	20 - 25 cm	1	12	1	1	Winter	Fagus sylvatica	182 ± 35	1650 - 1697 AD (19.2%) 1724 - 1815 AD (48.2%) 1834 - 1878 AD (6.3%) 1916 - 1950 AD (21.7%)	Branch Ø 0,9 cm

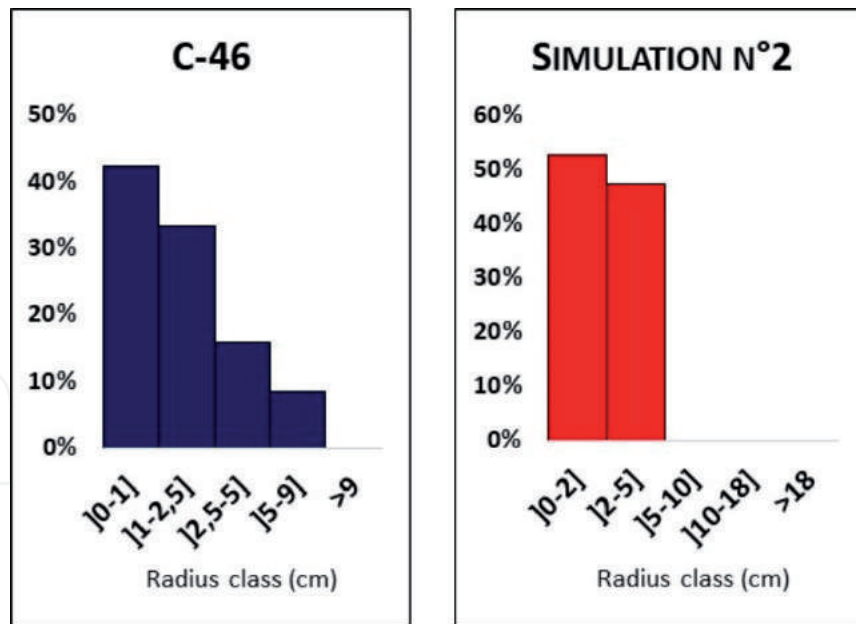
**Table 1.**  
 Radiocarbon results with description of the dated charcoal fragment. Dated charcoal fragment come from the bottom of the charcoal layer.



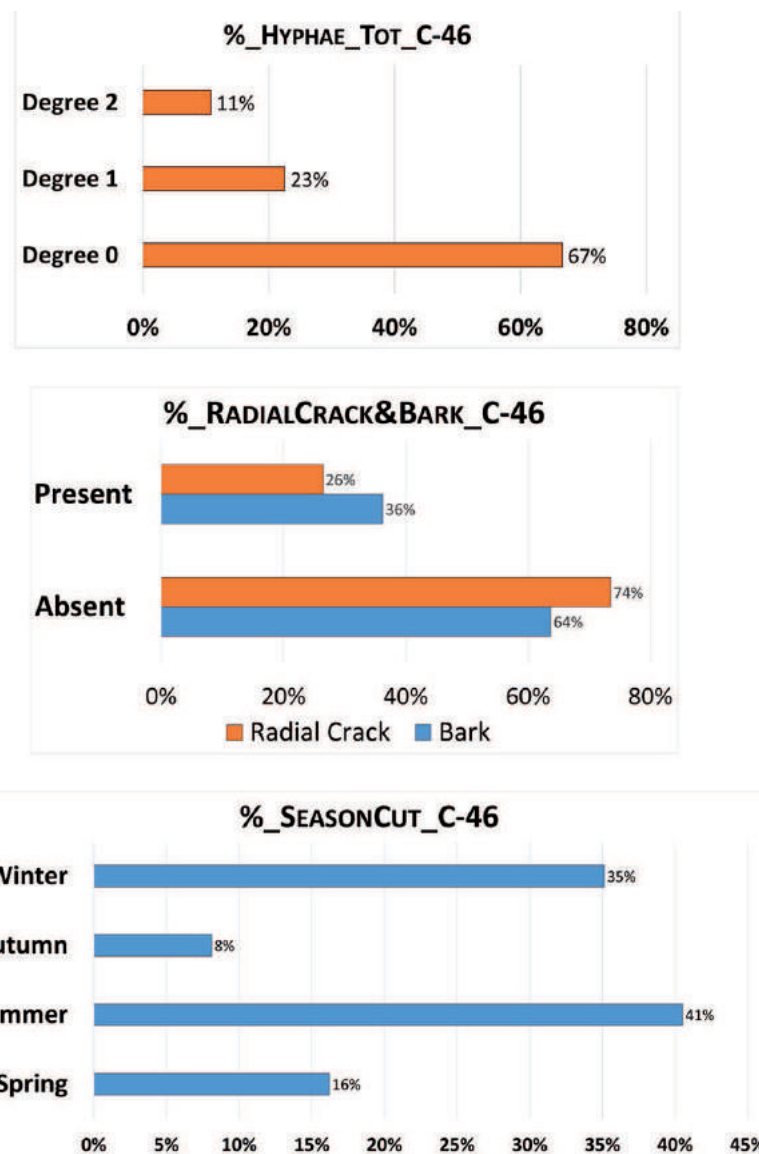
**Figure 14.**  
 Anthracological results. Graphical representation of the percentage of the species found in the C-46 charcoal hearth soil.

production derived from shredding practices: leaves were used for animal fodder or bedding and branches were burned to make charcoal. This system was documented at the Poggio di Montieri site since at least the sixteenth century, and the consequences of an intensive pastoral land use must be considered.

A similar beech wood management system has also been detected at Urbiarrate, in the Basque Country in Spain. This research is included in a wider



**Figure 15.**  
Results of the wood diameter studies attesting a dominance of small wood diameters.



**Figure 16.**  
Dendro-anthracological results. For hyphae results: degree 0 = missing feature; degree 1 = rare feature; and degree 2 = common feature.

Marie Curie project (2015–2016): “ARCHIMEDE—Archaeology of Commons: Cultural Heritage and Material Evidence of a Disappearing Europe.” It involves different laboratories such as the Research Group of Cultural Heritage and Landscapes (GIPYPAC—University of the Basque Country), the Laboratory of Environmental Archeology and History (LASA—University of Genoa), and the FRAMESPA Terrae Laboratory (University of Toulouse Le Mirail). This project aimed to connect structures and forms of the possessory actions and the rights of use on public lands known through multiple sources (i.e., toponymy, text, cartography, etc.) with archeological evidence, including those recognized by historical ecology and sedimentary sources (palynology, anthracology, etc.) [83, 84]. One of the case studies of this project was Urbiarrate (UTM 30 N ETRS89—Lat. 42.9640769; Long. 2.3690675) in the municipality of Oñati in the Gipuzkoa province. Currently, this area is mainly occupied by pastures (used for sheep, cattle and equine grazing), mountain meadows, moors, and acidophilous beeches managed as high-standard woods. Some areas have been subjected to repopulation of coniferous species, i.e., Austrian pine (*Pinus nigra* Arnold), Douglas fir (*Pseudotsuga menziesii* Mirb.), and larches (*Larix* spp.). This area was subject in the past to a land management system providing a collective use of environmental resources, but at the same time, forms of temporary appropriation by private social actors, through the establishment/exercise of the so-called “seles.” Seles are defined and circumscribed spaces inserted within the common lands and linked to specific uses that were, at least in the post-medieval period, the subject of various conflicts and which today are mostly privatized ([85, 86], in [83]). Archeological investigations were carried out inside the beech forest, in an area of about 1.4 hectares and included between 1200 and 1000 m asl, highlighting the presence of a dozens of charcoal hearth soils of different size (minimum 3–4 m of diameter and maximum 6–7 m). Two charcoal hearth soils (C-1700 and C-7000) were subjected to stratigraphic and anthracological analyses, revealing four charcoal layers identified and interpreted as different charring phases (the succession between dark layer and red/yellow clay layer show phase of production and subsequent abandonment) (Figures 17 and 18).

Two radiocarbon dating were made, one for each charcoal hearth soil (see Figure 18 for the stratigraphic sequence and location of the dated charcoal fragments) in order to have a chronological range that indicates the first carbonization activities and the last ones (Table 2).



**Figure 17.**  
*General view of charcoal hearth soil C-7000 (V. Pescini 21.09.2016).*





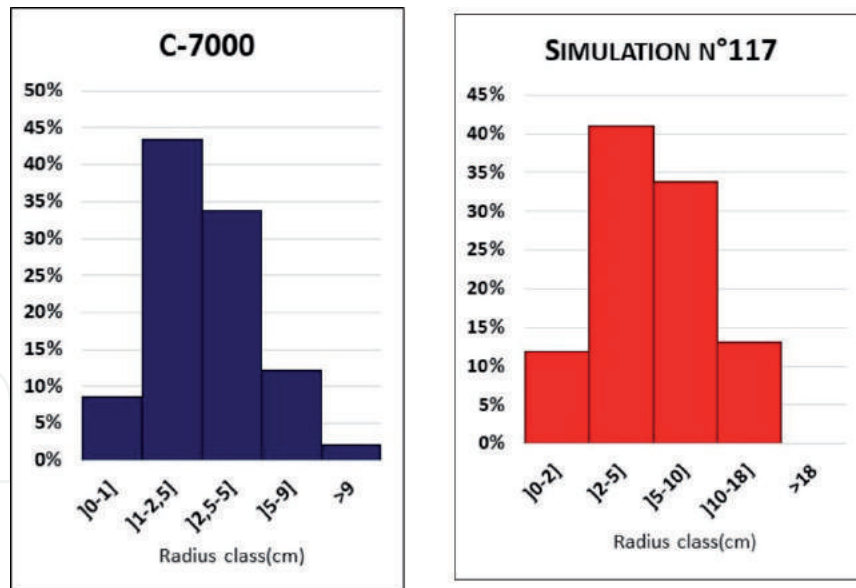
**Figure 18.** Charcoal heart soil section. On the left: C-7000. On the right: C-1700. Red point indicates the dated charcoal fragment (V. Pescini 21.09.2016).

Site	Acronym	Taxa	Depth	14C BP	14C AD (calibrated; 2σ)
Urbiarrate	UR15_1	<i>Fagus sylvatica</i> (branches)	10/15 cm	150 ± 35	1665–1785 AD (46.6%) 1795–1895 AD (31.5%) 1905–... AD (17.5%)
Urbiarrate	UR15_2	<i>Fagus sylvatica</i> (branches)	60/70 cm	275 ± 50	1465–1680 AD (84.7%) 1760–1805 AD (8.3%) 1935–... AD (2.4%)

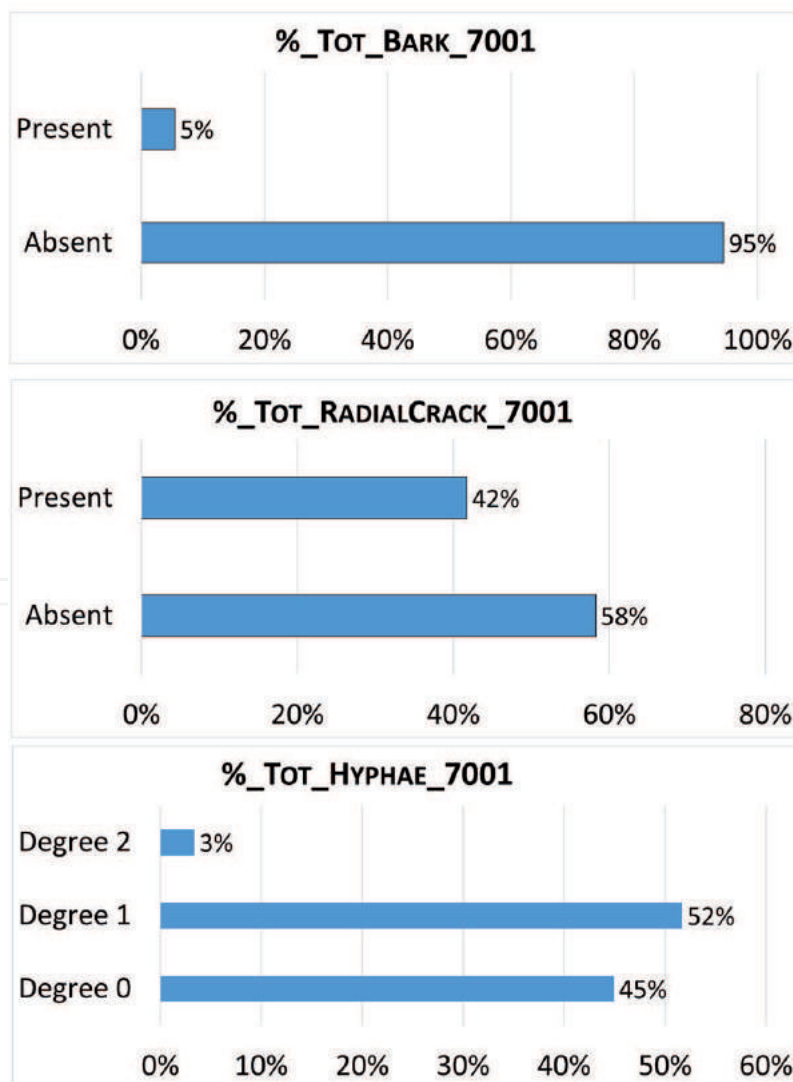
**Table 2.** Radiocarbon results showing different phases of charcoal production from the post-medieval period up to the nineteenth century.

The anthracological spectrum shows a very precise image in both charcoal hearth site: 90% of the analyzed fragments correspond to beech, while the remaining 10% is represented by indeterminable fragments (too vitrified, deformed, etc.). Diameter measurement made on the most recent charcoal layer (US 7001) reveals the use of small and medium size log (**Figure 19**). **Figure 20** shows dendro-anthracological results made on US 7001.

Only 5% of the charcoal has bark; wood cut was made during winter. 58% of the total charcoal does not have radial fracture: dried wood seems to be the most used (testified also by the absent of cellular collapse). 52% of the total charcoal has only few hyphae, so wood was scarcely attacked by mushrooms. Thanks to these information, it is possible to hypothesize the use of beech pruning wood (i.e., pollarding and shredding) in a multiple beech wood management system, which provides the contemporary presence of grazing and charcoal production. An evidence of this practice is still visible in the bearing of some old beech specimens (**Figure 21**).



**Figure 19.**  
 Results of the wood diameter studies attesting a dominance of small wood diameters.



**Figure 20.**  
 Dendro-anthrological results. Percentages are calculated on a sum of 91 charcoal fragments. For hyphae results: degree 0 = missing feature; degree 1 = rare feature; and degree 2 = common feature.



**Figure 21.**  
*Ancient shredded beech at Urbiarrate Gipuzkoa province (A. Stagno 21.09.2016).*

## **6. Conclusions**

There is an urgent need to address the problem of Mediterranean woodlands: in the last decades, the idea of rewilding and afforestation in rural areas to replace abandoned agricultural lands has been put into practice in several parts of Europe despite some criticisms. Ecologists, such as [87, 88], discussed the idea of a pristine “natural forest” across the continent, suggesting the presence of a shifting mosaic of open areas, patches of mature trees, and patches of regeneration. Moreover, as a consequence of rural depopulation and land abandonment, Mediterranean and Alpine areas have been subjected to a rapid spread of spontaneous woodlands. While some scholars value this process as a welcome return to a past before the

agricultural and pastoral human activities started to manage the land, others consider that the new woodland disguises the loss of traditional woodland knowledge and the reduction of biodiversity associated with pastures and meadows [20, 89]. In the case studies presented above, the medieval and post-medieval history of the wooded resources of the Mediterranean mountains appears to be dominated by animal production; a complex agro-sylvo-pastoral system concealed by the development of nineteenth and twentieth century forestry sciences and allied forestry law regime that bring the end to the customary regime, which was used to regulate woodland and commons resources access.

Thanks to the research presented in this chapter, some observations can be made.

1. If we abandon the models of interpretation of the structural ecology—where the reference is to an untouched, pristine ecosystem—and adopt the perspective of historical ecology, an unsuspected historical dynamic of transformations processes (intensifications/abandons, bio-diversification, etc.) that have affected Mediterranean mountain woodland resources systems emerges. As a consequence, the importance of past economics relating to a number of different local farming/breeding systems can be revealed, applied in their management as is the case of wooded pasture-meadows systems. This evidence can have a great significance in the identification and managing of many aspects of the present landscape and resource heritage. For example, for the rural and the gastronomic heritage of an area, discarding the ambiguous concept of a bio-cultural heritage.
2. The recent development of the Environmental Resource Archaeology (ERA)—an environmental archeology that includes the historical ecology regressive approach—requires precise historical models for the understanding of the past functioning of resources system. Conversely, it offers documentation that enables the geographer to identify the historical practices of production and activation coupled with the management system of pastoral resources. Generally, a new historical understanding of the evidence produced by field research is possible by assuming ERA procedures. On the other hand, the contrast between sedimentary sources (field sources) (palynology, anthracology, archeozoology, etc.) allows a “realistic deciphering” of the content of the texts themselves.
3. Comparing sources is apparently an obvious methodological achievement of multidisciplinary research, but it is exclusively possible through the adoption of a local, topographical, observation scale both for the environmental and for the social context network as suggested by the microhistorical approach. Unfortunately, this is a choice that does not seem desirable in the fields of cultural geography and history [16]. Cultural history (and geography or historical-cultural geography) offered for years effortless—but highly misleading—generalizations based on a rather symbolic or metaphorical “cultural decipherment” of evidence and from the perspective of a global scale history. Cultural history and geography have a real difficulty in coping with and assimilating developments in historical ecology [90].
4. Local systems for the production and activation of the Apennine wooded resources are (agro-sylvo-pastoral) multiple systems. During the customary regime—until the adoption of the Forestry Codes and Civil Codes of laws in the mid-nineteenth century—fodder production was therefore ubiquitous in

agricultural and wooded use of land. Specialized forms operating with particular production/control practices have existed to achieve an intensification and improvement of the mere fodder production of adding hay, grass, and fruits for human and animal nourishment, as is the case of wooded meadows and pasture discussed in this chapter.

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## **Author contributions**

While the study has been started by D.M., this paper is the result of common work by all authors: R.C the Sections 2 and 4, N.C the Sections 1 and 6, and V.P. the Sections 3 and 5.

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