Forestry and Traditional Woodland Management in North Dalmatia *c*. 1790 to 1990: An Environmental History

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Abstract

This thesis focuses on traditional management and forestry in coastal areas of northern Dalmatia in Croatia. It considers the time period from the dissolution of Republic of Venice until the end of SFR Yugoslavia in 1990. It is based on archival records on forestry activities, Austrian land surveys from the 1820s, oral histories in three case studies, aerial photographs and analysis of articles and discussions published in the *Forestry Journal* since 1877. The thesis is structured chronologically, and woodland use, policies and management are considered in the context of different administrations – the French (1805-1815), Austrian (1815-1918), first Yugoslav (1920-1941) and second Yugoslav (1945-1990).

Although today they are neglected and considered unproductive, the research emphasises that traditional woodlands and wooded landscapes had a major role in the local livelihoods in the study area. It explores the ways these woodlands were used by local people and how they were shaped by woodland regulation and management which were characterised by strong continuity over the last two centuries. It also investigates how reforestation, the most important forestry policy in Dalmatia, developed in the late 19th century and its implications for land use and tourism.

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1. Introduction

The forests of Mediterranean Croatia cover almost 25% of the land area of the whole country, which makes them one of the most important national assets. A fifth of those are in the Dalmatian coastland and islands, areas with a proper Mediterranean climate, while the rest is in the sub-Mediterranean hinterland of Dalmatia. Today, these forests are not valued for their timber production but mainly for the ecosystem and non-market services important for environment, tourism, recreation and quality of wellbeing. According to the 2005 Forest Act (Zakon o šumama, 2005) they are classified as protective forests, as their primary purpose is protection of soil, water and settlements.

The same Act stipulates that forests in Croatia are areas larger than 0.1 ha which are overgrown with trees in the form of a stand. It also includes areas where forestry is considered as the most suitable land use (Zakon o šumama, 2005). This means it can include landscapes temporarily without a tree cover but where one will be eventually restored through natural processes or forestry management (Kirby and Watkins, 2015). Although the terms forest and woodland can be used interchangeably, the term woodlands will be used throughout this research. I believe it is more suitable because woodlands in Dalmatia do not physically resemble forests in continental Europe which are usually made up of tall trees.

Official forestry statistics data reveal that only 1.2% of Dalmatian woodlands are classed as in 'very good' condition, with 4.6% being 'good' and 60% being 'bad' (Matić, 2011). They are characterised by the absence of older, well developed, tall trees. Instead, they are represented with low-growing trees that physically resemble bushes (Figure 1.1). In coastal areas they form dense patches of maquis most commonly characterised by woody evergreen species such as holm oak (*Quercus ilex)*, mastic tree (*Pistacia lentiscus*), terebinth (*Pistacia terebinthus*) and mock privet (*Phillyrea latifolia)*. Further away from the sea shrubby forms of deciduous species such as pubescent oak (*Quercus pubescens*), European hop-hornbeam (*Ostrya carpinifolia*), oriental hornbeam (*Carpinus orientalis)*, and manna ash (*Fraxinus ornus*) form scrubland known as *šikara.* The forestry literature on Dalmatian woodlands

characterises them as derelict and degraded remnants of previously densely forested landscapes. According to Grove and Rackham (2001), the term 'degradation implies the belief that there has been a change: that the terrain was in some sense better, usually more vegetated, at some point in the past than it is now. It implies a belief that human activity caused the change' (p.15). It is not known for certain at what point in history Dalmatian forests became transformed into maquis and scrubland, as some researchers propose it was thousands of years ago and others place it in the medieval period. However, there is a consensus that this transformation was encouraged by human activities such as cutting, burning and pastoralism.

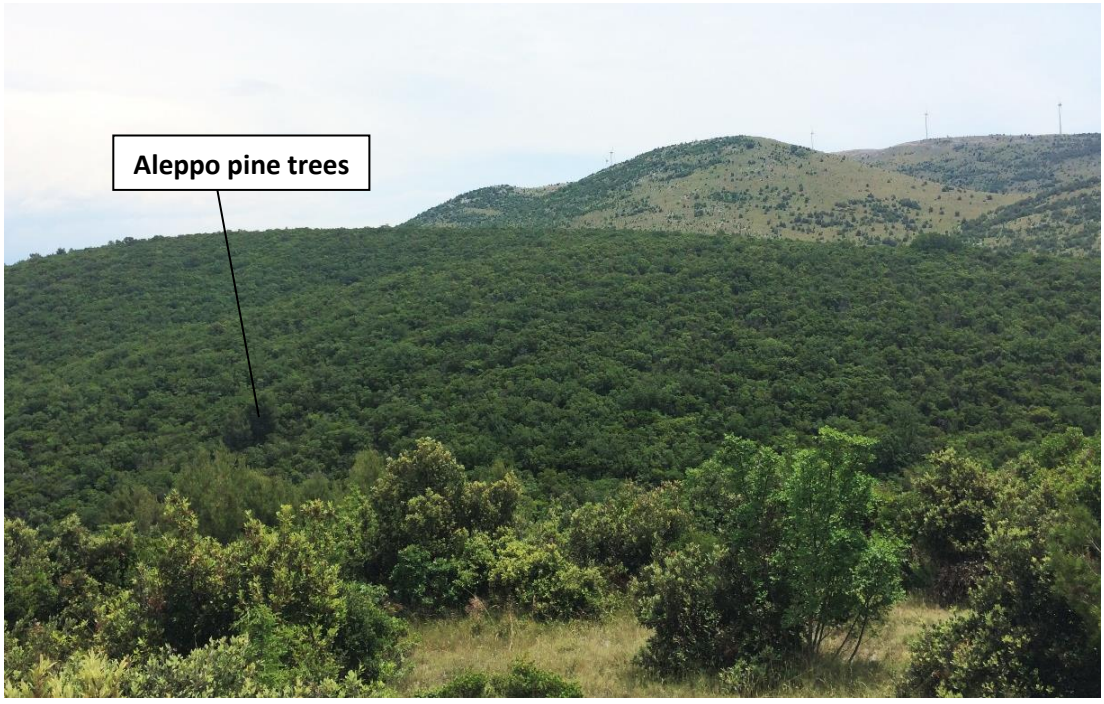


Figure 1.1. Vrpolje gaj woodland north of Grebaštica case study comprised of elements of Mediterranean and sub-Mediterranean vegetation that grow in the forms of bushes. The only tall trees in the woodland, pine trees, are easily distinguishable because of their height (Ivan Tekić, April 2017).

Another process that has been crucial in shaping the development of woodlands in Dalmatia is reforestation. This was started by foresters in the late 19th century in a desire to restore what they believed were ancient Dalmatian woodlands. This is why the term reforestation will be used in this research instead of afforestation because the latter implies that there was never a forest cover on such lands. The main trees used were pine species that do not grow in northern Dalmatia which is why

foresters created a new element in the landscape that influenced socio-economic relations with the local population. Since pine trees were protected by forest law ever since they were planted, the pine plantations quickly became the only tall trees along the Dalmatian coast and a valued landscape feature important for tourism in the second part of the 20th century.

With the development of non-agricultural sectors of economy and the consequent rural depopulation in the late 20th century, centuries-old traditional woodland management and woodland exploitation broke down. The landscape underwent a rapid process of woodland succession on previously cultivated and grazed lands. This also included spontaneous spread of pine from plantations established by foresters. The research on landscape structure of coastal Dalmatia I undertook for my Master's dissertation revealed that pine woodlands had expanded in the coastal area of Šibenik city from 30 ha to 31,750 ha in the last century and a half with most of it happening only in the last 20 years (Tekić et al., 2015). Such dynamic landscape change is causing controversy among local people mainly because of the increasing number of forest fires, which was noticed immediately during collection of oral histories for this research. The regeneration of vegetation also erased much of the evidence of previous land use practices, be it in woodlands, pastures or agricultural areas. With traditional management being almost extinct, the knowledge about the role these landscapes had for local livelihoods is rapidly fading into oblivion with the death of the most elderly in the communities.

The aim of this PhD is to examine and understand the history of Dalmatian coastal woodlands over the last two centuries. 1) I will identify the nature of the traditional woodlands in the study area, how were they managed and how and for what purposes people used them. 2) The history of Dalmatian forestry will be examined and ideas and perceptions within the Croatian forestry community will be analysed in order to understand the reasons for forestry policies. 3) I will also explore what woodland conservation measures were employed by different government administrations in the study areas and how policy changes influenced the implementation of management plans. 4) Since conservation of woodlands also implied the establishment of new ones, I will consider the development and

implementation of forestry policies related to reforestation. 5) I will identify and analyse reasons for the ending of traditional practices and expansion of reforestation in the 20th century. The thesis is structured chronologically, and for each period woodlands and woodland management will be assessed in relation to different government administrations.

Today woodland landscapes of Dalmatia are burdened with complex problems ranging from forest fires to conservation and restoration policies but in dealing with these issues policymakers often overlook the historical development of the landscape. Present day phenomena related to landscapes cannot be adequately understood by simply analysing current events and processes since every process has a historical component (Grove and Rackham, 2001). This is particularly important when studying changes in vegetation cover in which overall landscape changes are most intensively reflected (Robiglio, 2000). Since elements of woodlands change, disappear or develop through interaction with societies and their cultures, long-term changes of vegetation cover also give us the opportunity to study forests as 'biological archives' because they help us understand not only landscape changes but also the changes within the societies themselves (Agnoletti, 2000b).

Understanding changes in woodlands and their relation to human influences falls within the field of numerous disciplines such as environmental and forest history, historical geography and historical ecology (Agnoletti, 2000a, McNeill, 2003). Worster (1988) writes that the topics where people and vegetation come together represent the most flourishing theme within environmental history, a discipline described by McNeill (2003, p.6) as 'history of the mutual relations between humankind and the rest of the natural world'.

The main aim of environmental history is to explore how societies have been affected by natural environments over the course of history and, in return, how they have affected those environments. According to Worster (1988, p. 292), the study of the influence of natural environment on society, socio-economic aspects that arise through such interaction as well as cultural and intellectual factors that drive it 'constitute a single dynamic inquiry in which nature, social and economic

organization, thought and desire are treated as one whole'. As changes occur in one of those components, the relationship of the 'whole' changes as well, 'forming a dialectic that runs through all of the past down to the present'. In other words, in forest history, it is crucial to recognise traditional practices and correlate them with human interactions. The past can help us to understand the present and the future and can help in developing landscape management plans, this being an important aspect of this thesis.

The thesis has six chapters. In broad terms the thesis is structured chronologically and for each period woodlands and woodland management will be assessed in relation to the different government administrations. The reason for the chronological approach is that the different themes studied are too numerous and intertwined for them to be approached individually in an effective and efficient manner. Even the most basic divisions in forestry, for example between traditional management and reforestation, would not suffice as the same social processes and regulations influenced both activities. This would result in considerable repetition when addressing individual themes as each would have to be assessed over the 200-year period and would leave less space for detailed analysis of the sources. This is especially important because the research also explores the development of forestry in Dalmatia as a whole as well as the study areas, and the chronological approach was necessary to track this development, explore themes that followed it and determine how they changed over time.

The literature review (Chapter 2) analyses contemporary studies on vegetation history in the broader Mediterranean in order to understand long-term vegetation changes in Dalmatia where such research is scarce. It also reviews research on Dalmatian woodland history in the Venetian period which lasted from the 15th until the end of the 18th century and the importance of wars with the Ottoman Empire.

Since environmental history is one of the most interdisciplinary fields of study, it relies on a wide array of sources and approaches (McNeill, 2003). Similarly, undertaking research on the history of woodlands requires a combination of different

forms of evidence and work on the edges of different disciplines (Watkins, 2014; 2015). Agnoletti (2000a) explains that only the researcher's ability to combine these different approaches and methods will enable proper identification of evidence and understanding of the complex mutual relationship between society and woodlands. These methods and sources are explained in Chapter 3.

Chapter 4 focusses on the development of forestry and forestry policies in Croatian and Dalmatian karst in the 19th century. Dalmatian woodlands have developed on karst terrain which is characterised by poor soils and lack of water. Mediterranean climate characterised by summer droughts makes environmental conditions even more adverse for forest management. Because of these factors, woodlands on karst demanded a different approach than continental woodland, and policies that developed in the 19th century continued to be adopted by governments and foresters in the 20th century as well.

Chapter 5 examines the period from c. 1790 until 1918. This includes a short period of French administration and a long period of Austrian rule over Dalmatia. Analysis of complex and detailed land surveys and archival sources is used to identify the location, condition and traditional management of woodlands and wooded landscapes. It also analyses the first reforestation activities in the study areas and how these influenced landscape dynamics in the study areas.

Chapter 6 studies the period of Yugoslavia from 1918 until 1990, along with two short post-war occupations by the Italian forces. It continues to analyse changes in woodlands that were identified in the preceding period, both traditionally managed and those established through reforestation. It also considers the influence of rapid industrialisation, tourism and emigration in the post-World War II period, and their effect on traditional land management and reforestation. Whereas theoretical discussions that shaped the development of forestry in Dalmatia and the woodland changes and management until 1918 in the study area were separated in chapter 4 and 5, in chapter 6 these themes are merged. The reason for this is that reforestation as the main policy of Dalmatian forestry had been developed and established as the norm during the Austrian period. There were only minor changes

in reforestation regulations and methods during the Yugoslav period and there is therefore much less scope for a distinct chapter on the development of forestry policy. Moreover, the changes in reforestation policy that did happen in the 20th century were mainly related to the development of tourism which was analysed as a part of overall woodland management in the study area, so there was no reason to separate its influences into an individual chapter.

Chapter 7, the concluding chapter, summarises the main research findings and makes an assessment of the changes that occurred in woodland landscapes during the 19th and 20th centuries and considers implications for current land management and research.

2. Literature review

2.1. Studies in forest history

Studies in European forest history have a long tradition, but the majority of works up to the 19th century were closely related to the history of hunting (Agnoletti, 2000a). Things were different in Germany, where silviculture had rapidly developed during the 18th century, and foresters took a particular interest in a historical approach to German forestry. In Italy, the work of Berenger (1859-1863) was particularly important as one of the first works dedicated solely to the history of forests, in this case during Roman times and the Venetian Republic. Berenger covered many aspects of the interrelation of forests with other economic activities and, according to Farber (1982), he emphasised the integration of different approaches and sources in this early phase of forest history development. However, in Italy, this was not followed by further development of forest history studies (Agnoletti, 2000a).

In Croatia, the literature on forestry started to flourish in the second half of the 19th century. Kesterčanek (1882-1883) was the first author who published specifically on the forest history of Croatia. In a series of papers, he idealised the connection of Croatian people to their forests and wrote about the destructive influence of foreign governments on Croatian forest resources. He is praised by the Croatian Forestry Society today for enriching the literature with publications on national woodland history (Biškup, 2000). His works paved the way for the later writers in forest history, and although biased in the political sense, they had a fundamental influence on their research. In the early 20th century, work on forest history was mostly focused on deforestation of Dalmatia, but just like Kesterčanek (1882-1883), few foresters approached this issue from a broader perspective and most focused on the destructive influence of foreign administrations.

In the second part of the 20th century there was a considerable increase in the study of woodland history at the international level which led to the establishment of a forest history research group within the International Union of Forestry Research Organisations (IUFRO) in 1963 (Agnoletti 2000a). This was one of the prominent themes in broader research into human impacts on the environment and it was

central to the work of historical geographers who studied evolution of the cultural landscapes. In Britain, this research was represented in the work of H.C. Darby (1956; 1977), a historical geographer whose scholarship was based on the geographical interpretation of major historical records and whose approach to the spatial analysis of documentary sources formed the basis for the conceptually wider-ranging work of historical geographers in the second half of the 20th century. Darby also studied woodland clearance in both the UK and continental Europe and drew on a wide range of sources from both France and Germany. Goudie (1982) explored historical trends that have changed the nature of human society on a global scale and dedicated one large chapter of his book to vegetation changes.

In the United States, woodland history was widely studied in the newly emerged discipline of environmental history. Smout (2008) argued that whereas research in this theme in Britain could be viewed more as a history of relatively benign and gradual changes to an agricultural landscape, in America rapid and violent misuse that led to deforestation was one of the most important themes. This is particularly apparent in Williams' (1989) acclaimed work on American forests in which he focuses on the relationship of people with forests, and how this natural resource changed as different demands were made on it. More recently, Williams (2002) expanded his research with his landmark study on the history and geography of deforestation at the global scale.

Another prominent theme widely studied by historical geographers and environmental historians has been the influences and interests that shaped colonial forestry policies and the impact this had on land management. In the first part of the 20th-century, scientific forestry introduced by colonial powers in Asia and Africa was widely seen as beneficial for stopping deforestation and uncontrolled exploitation (Ribbentrop, 1900; Stebbing, 1921). More recently, Grove (1992; 1997) argued that scientific forestry was implemented because colonial administrations feared that deforestation was causing desiccation, flash floods and soil degradation while Barton (2002) explores the strong links between colonial forestry and the rise of environmentalism. Other scholars, most notably Guha (1983) and Gadgil and Guha (1992) emphasise how scientific forestry was an exploitative instrument

implemented by the colonial state to exploit the forests of India. This led not only to the exploitation of forests but also alienated forest-dependent communities from nature.

The second half of the 20th century was also a period when research in forest history was increasingly linked with historical ecology. Kirby and Watkins (1998) argued that historical ecology had developed particularly after the publication of Oliver Rackham's *Trees and woodland in the British landscape* in 1976, where he emphasised 'the importance of linking a thorough knowledge of historical documents with a practical understanding of plant ecology' (p. ix). This new approach of studying forest history, by integrating ecological and historical information in order to understand landscape and forest changes, further expanded the field. However, even though McNeill (2003, p.9) argued that the subject matter of historical geography and historical ecology 'is essentially the same as that of environmental history', according to Smout (2005), historical ecology is pursued more by scientists while environmental history and historical geography are pursued by humanists, consequently creating a division that is unhelpful for collaboration and exchange of methods. According to Butzer (2005), who studied Mediterranean environmental history, identification of the cause-and-effect relationships in environmental change demands an understanding of ecological behaviour for which humanistic insights are indispensable.

Watkins and Kirby (1998) and Watkins (2015) argue that the approach of historical ecology is based on an understanding of history and development of a particular place through a combination of different forms of evidence such as surveys of flora and fauna, archival records, oral history, pollen and soil analysis, photographs and paintings, etc. A considerable body of research was influenced by this approach after Rackham's (1976) publication. In the UK notable works include those of historical geographers Langton and Jones (2005) who explored royal and non-royal forests and chases as well as enclosures (Langton, 2015) of England and Wales after the Middle Ages. Using a variety of historical sources Langton effectively emphasises how such landscape elements were not only a transient feature of medieval times which disappeared because of development of commercial economy; rather many of

them continued to flourish afterwards. Barker (1998) used local history, pollen analysis and present vegetation status to reconstruct the history of the Coniston woodlands in Cumbria in the UK. Tsouvalis (2000) analysed changing attitudes toward forests, their functions, development of the Forestry Commission, traditional woodland management practices in Britain and how they became supplanted by scientific forestry. Griffin (2010) examined the impact of 18th and 19th-century government-led initiatives of silvicultural plantation creation in order to shift the focus of state forests from being remnant medieval hunting spaces to spaces of income generation. The effect of this state scheme influenced the biophysical and cultural geographies of the forest and created places in which human and non-human lives assert their own visions. Griffin (2008) also explored plant maiming, or malicious cutting of flora, as a form of protest in 18th and 19th century rural England. A different approach, which emphasises oral history, was taken by Stewart (2016) who explored the creation of new tracts of forest in Scotland through the thoughts, experiences and reflections of a wide range of individuals from all levels and all sectors of the forestry industry. At the focus of her research are people and communities for whom forestry was the most important source of income and employment.

In continental Europe a considerable body of research also emphasised the use of various methods and sources from different disciplines for studying woodland history. Guidi and Piusi (1993) used oral history, geological data, field observation, and current forest distribution and concluded that current vegetation dynamics of forest landscapes are partially determined by past rural activity. Traditional management practices which generally include controlled grazing, burning and wood cutting in Italy were widely studied by Moreno et al. (1993) and Cevasco et al. (2009). Saratsi (2003) focused on oral history in her study of the cultural history of woodlands in Greece and past management practices that affected them as did Arvanitis (2011) in his study of traditional forest management in Psiloritis, Crete.

The need to include past human activities in the study of current vegetation characteristics are by now well recognized as important (Kirby and Watkins 1998; Moreno 2004; Rackham 2006; Vogiatzakis et al. 2006). Grove and Rackham (2001)

concluded that contemporary issues and processes in the landscape cannot be properly understood without addressing their historical components. Robiglio (2000) argued that this was particularly important when studying vegetation changes as vegetation cover is the component of the landscape in which overall landscape changes are the most intensively reflected. Because of the long-life cycle of trees, researchers have the opportunity to study forests as 'biological archives' as they help to understand not only landscape changes but the changes within the societies themselves (Agnoletti, 2000b).

In Croatia, on the other hand, this opportunity has been missed, and the interrelation of people and woodlands poorly studied. Whereas some research on historical landscape change, particularly deforestation in the 18th century, does exist (discussed later in the chapter), foresters and geographers mostly focus on the modern issues of post-socialism. This leaves the whole period of the Austrian and Austro-Hungarian Empire as well as that of early Yugoslavia under-researched. It is here that this thesis aims to make a contribution as it will analyse traditional management and the implementation of imperial forestry policies and explore the consequent woodland changes.

2.2. Mediterranean vegetation history

2.2.1. Degradation narrative

The history of Mediterranean forests is very often presented as the history of Mediterranean land degradation. It is largely based on written records about Mediterranean landscapes and human activities that affected them which can be traced back to scholars of ancient Greece and Rome, such as Plato or Pliny the Elder. However, interpretations of these works by modern scientists can vary significantly. Grove and Rackham (2001, p.18) point out that 'history of the landscape must not be confused with the history of the things that people have said about the landscape'. They warn about the generalisations that can mislead our conclusions, authors that had no scholarly background to understand the processes that they were writing about and ambiguity of their words. Most of the ancient documents have been

translated, and words often get lost or change meaning in translation. Even today, differences in perspective can mean that the same landscape is described as deforested by one author (McNeill, 1992) while it is deemed forested by another (Grove and Rackham, 2001).

The study of ancient records about landscape usually results in works that are very critical of human impacts on nature. One of the most influential works on this topic was the book *Man and Nature* by George Perkins Marsh (1864). Historical geographer David Lowenthal, who edited the reprinted editions of 1965 and 2003, wrote that few books had had more impact on the way people look at and use the land, while Drake (2004) stated that reading *Man and Nature '*is a bit like reading the Bible or Shakespeare*'.* The publishing of this book stirred a lot of emotion and made people rethink their behaviour towards nature and especially forests. In the foreword of the 2003 edition (p.X) Cronon claimed that 'It is no exaggeration to say that *Man and Nature* launched the modern conservation movement'. Although Marsh was not a scientist in a field related to ecology or forestry, but a lawyer and a politician, he argued that the nature of Mediterranean ideally was a thick, unbroken forest cover and anything less than that would be a result of degradation. This view was supported by Ferdinand Braudel (2002, p.17) as he argued that 'Ravaged forests declined fast: maquis and scrubs, with their rocky outcrops and fragrant plants and bushes, are decadent forms of these mighty forests, which were always admired in the ancient Mediterranean as a rare treasure'.

J. Donald Hughes (2014) who has based his environmental history research primarily on works from ancient Greece and Rome argued that the environmental history of the Mediterranean is, in fact, a history of deforestation and its consequences. His views strongly influenced by those of scholars such as Marsh (1864), Sears (1935), Lowdermilk (1943) and Osborn (1971) who blamed the decline of ancient civilisations on deforestation, erosion and agricultural exhaustion. However, Hughes takes a step further claiming that 'While it would be incorrect to blame the ancient Greeks and Romans for all the defects of the present-day Mediterranean lands, which have been subjected to successive pressure in medieval and modern times, in many instances ancient peoples initiated a process of wearing

away the environment that had supported them' (p.3). However, this statement shows that environmental historians such as Hughes (2004) and McNeill (1992) often perceive the environment as stable and static and they fail to consider changes that took place before ancient times.

Grove and Rackham (2001) take a very critical approach to this so-called '*Ruined landscape'* theory which blames ancient civilisation exclusively for the destruction of the once pristine, wooded Mediterranean landscape. They manage to trace the origins of these ideas to various authors from the 15th century onwards and critique their works, whether they are paintings or writings, for often placing ancient Greek and Roman themes into a lush landscape that is little different from ones in France, England or Germany. European travellers that travelled to the Mediterranean saw tree-less, rocky landscapes and were usually left disappointed as they expected beauty seen in paintings or described in famous books. Grove and Rackham also blame scholars for their theories that lacked any empirical evidence, such as those that destruction of forest reduces the amount of rainfall, or that floods are caused only by removal of forest cover. Hughes (2014), for instance, claimed that deforestation had contributed to the aridisation of some areas and although he took into account that climate change could have accelerated desertification of North Africa during the Roman period, without providing empirical evidence he concludes that 'human disturbance of the natural environment, particularly deforestation, seems the primary cause' (p.120). These theories, Grove and Rackham (2001) argue, have influenced laws, policies and consequently human attitudes and actions toward landscape. They claim that the culmination occurred with the writings of George Perkins Marsh and from the middle of the 19th century the Mediterranean was identified as an example of massive ecological degradation. 'Scrub and scattered trees are interpreted, without evidence, as the debased forms of the forest' (p.10). Degradation, they continue, has become a term that is loaded with value-judgement and is attributed to areas that do not meet preconceived criteria and expectations. They also argued that the term degradation has become very generalised and not based on scientific evidence, so people do not differentiate lands that are deforested because of human influence from those that do not support forest cover because of

ecological factors. Butzer (2005) stated that 'environmental history must be grounded in sound empirical data, acquired by theoretically informed research, and tempered by repeated reflection on the validity of assumption' (p.1774) and that researchers should spend less time debating over paradigms of environmental degradation and concentrate on acquiring skills on ecological understanding of the processes. Blumler (2007) and Davis (2007) also support the idea that deforestation and degradation reports widely found in the scientific literature are 'narratives' that often lack concrete empirical support.

2.2.2. Vegetation history and climate change in mid-Holocene

Pollen analysis is considered one of the most precise ways of analysing vegetation cover in historical times although there are considerable risks of misinterpretation (Grove and Rackham, 2001; Blumler, 2007; Harriet, 2014). Bogs and lakes are very rare in the Mediterranean, so the sites suitable for pollen analysis are also scarce (Grove and Rackham, 2001; Blumler, 2007), although improvements in technology increasingly allow extraction of pollen grains from marine sediments (Sadori et al., 2013). Grove and Rackham (2001), Blumler (2007) and Harriet (2014) also point out that pollen analysis does not reveal anything about the size of the trees, so oaks that grow as shrubs in maquis under grazing pressure produce the same pollen as fully-grown oak trees. This way an area covered with maquis can be interpreted as a high forest. Another problem is that many Mediterranean species are self-pollinated and are not well represented in pollen diagrams (Grove and Rackham, 2001) while some wind-pollinated species, such as pines, produce much more pollen than others which leads to their stronger representation in diagrams (Neils, 1998). Blumler (2007) emphasises the biases in pollen analysis by showing how different authors interpreted the same pollen samples from lakes and bogs in Greece and Turkey in different ways, some showing an increase in forest cover, others deforestation.

However, pollen records, often supplemented by charcoal analysis and archaeological research, offer a plausible method for the reconstruction of past environments. Based on a range of research carried out throughout the

Mediterranean, its vegetation history was very complex and has gone through rapid changes sometimes in very short periods.

The end of Pleistocene can be detected around 10,000 BCE, and vegetation was marked by the spread of arctic trees such as willow and birch at first, followed by elm and oak. Paleo-annual rainfall estimates indicate that climate was very humid and warm until 5,000 BCE (Grove and Rackham, 2001; Fuchs, 2007), with deciduous oaks becoming the most common trees from 8,000 BCE. The typical Mediterranean trees and shrubs spread from 6,000 BCE onwards (Grove and Rackham, 2001). These climate conditions were very favourable for the development of extensive tree cover which peaked around 5,000 years BCE (Kirby and Watkins, 2015), but even then it was not complete (Rackham, 1998; Vera, 2000; Grove and Rackham, 2001; Nielsen et al., 2012) and questions regarding the openness of landscape and the role of herbivores in its creation have sparked much debate (Vera, 2000). The great herbivores such as elephants and mammoths that maintained the savanna landscape at the end of last glacial period disappeared during the early Holocene which presumably enabled the spread of forests (Rackham, 1998). However, Vera (2000) argued that smaller mammals such as the wild ox, bison and the wild horse continued to influence the vegetation and landscape structure by maintaining a diverse landscape with patches of open areas, patches of regeneration and patches of mature trees instead of a landscape with forests characterised with a closed, dense canopy.

Many authors today are developing studies that will help to understand the distribution of open-landscape vegetation in palaeolandscapes and in one such study Nielsen et al. (2012) estimated that between 6,000 BCE and 2,000 BCE openness of landscape in Germany and Denmark was between 10 and 40%. While sandy soils were one of the main determinants of the non-forest landscapes identified in that study, in the Mediterranean region drought is the most limiting factor for tree growth (Rackham, 1998). In dry parts of the landscape, trees grow only in places where water is collecting, and between these areas, there is a wide zone which can promote the growth of individual trees but not extensive forest. If trees are not widely spaced, they are often reduced to the stature of maquis which is further modified by browsing

and fires. Also, there are many tree (and animal) species that are evolutionarily adapted to life in savanna and its periodical fires that characterise these landscapes, with cork-oak (*Quercus suber*) being one of them. Out of 250 endemic species on Crete, only eight are shade-tolerant forest species which indicates that forest was abundant only in brief periods during interglacial periods and even then, there had to be substantially open areas for today's endemics to survive (Grove and Rackham, 2001).

The period after 5,000 BCE is marked by two very important events: an abrupt decrease of rainfall throughout the Mediterranean and vegetation change from the dominance of deciduous oaks to evergreen oaks with the almost complete disappearance of winter tolerant species. In southern Greece, Butzer (2005) finds that the decline of deciduous oak forest started about 3,500 BCE with the decrease in their pollen from 60-80% to 40% by 2,500 BCE. This was followed by a further decrease resulting in only 25% deciduous oak pollen by 1,000 BCE. Meanwhile, evergreen oak pollen increased from 5-8% to 10-20%. In the southern and the Adriatic part of Italy deciduous oak forests started to decline around 2,500 BCE with a progressive opening of the forest cover happening at first in the southwest and then spreading northeast (Di Rita and Magri, 2009). There are no traces of cereal pollens, increases of charcoal deposits or any other anthropogenic pollen markers which would relate the decrease of forest cover to human impact (Di Rita and Magri, 2009; Mercuri et al., 2011). In Albania, vegetation change was marked by the disappearance of beech (*Fagus)* and its replacement by firs (*Abies)* in around 2,000 BCE. Beech usually grows in areas that receive more than 1,200 mm annual rainfall, but present climate records estimate that the same regions nowadays receives only 800-1,000 mm (Fouache et al., 2001).

The progression of rainfall decline throughout the Mediterranean around 3,000 BCE is not disputed by any author considering the available paleoclimatic evidence. For example, Fuchs (2007) estimated the annual amount of rainfall in the eastern Mediterranean for the last 15,000 years and identified decreases in rainfall at 7,000 BCE, 5,000 BCE and 3,000 BCE (Figure 2.1). The gradual drop of annual rainfall from 700 mm to 200 mm definitely affected the vegetation cover in the

Mediterranean. However, this period also coincides with increasing human activities such as the use of fire, clearance of forests for agriculture and grazing by domestic animals which provides various interpretations as to why the Mediterranean forests declined. As Fuchs (2007, p.352) explains 'In the absence of clear and independent paleoclimate information, pollen cannot be used to interpret the vegetation changes regarding climatic or anthropogenic factors'. Sadori et al. (2013) support this view by arguing that identifying 'human impact on Holocene plant communities is rather complex as the spread of sclerophyllous vegetation can be both a response of human clearance and grazing/pastoralism and shift toward drier climates' (p.147).

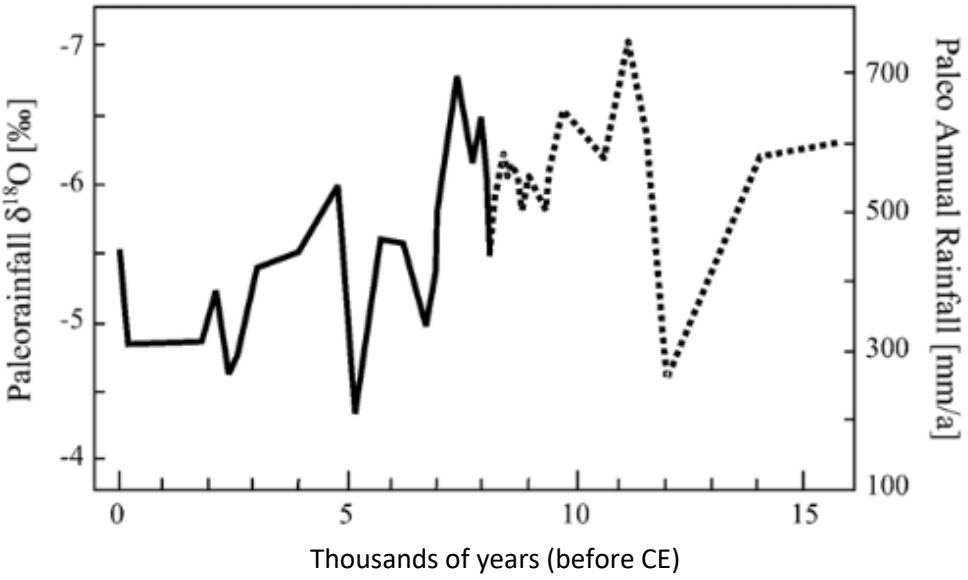


Figure 2.1. The estimated annual palaeorainfall amount for the eastern Mediterranean (from Bar-Matthews et al. 2003, in Fuchs 2007, p.352).

There is a broad consensus that the effect Neolithic people had on vegetation is still hard to determine. Grove and Rackham (2001) warn against the tendency to ascribe vegetation change up to the Neolithic solely to climate and after the Neolithic solely to human activities. The climate did not become stable at any point and is constantly changing.

Previously mentioned studies show that the Holocene was marked by a complex pattern of climate change across the Mediterranean basin. Peyron et al.

(2011) write that present-day Mediterranean conditions were established between 500 BCE and 1 CE, while Grove and Rackham (2001) concluded that the present vegetation is still adapting to aridisation that started between 3000-1000 BCE. Even before that, there was probably never a dense, closed forest cover spanning the whole Mediterranean, and the Mediterranean elements now often regarded as degraded stages of the forest, such as steppe, savanna and maquis, have probably been a part of Mediterranean landscapes for thousands of years. This is why many authors critique the 'imprinting' of the American vegetation succession model on the Mediterranean region (Grove and Rackham, 2001; Blumler, 2007). Human component in the landscape change has been present for thousands of years, and it is problematic to reconstruct an image of the environment before human intervention as well as to derive any clear baseline against which to measure changes caused by humans (Goudie, 2013). Butzer (2005, p.1795) argues that in order to reveal the cause-and-effect interrelationships of social and environmental variables in the landscape change 'Natural and social science must be combined; each theoretically informed but inductively engaged, with both vantage points working in complementary concert'. Only then theories such as degradation narrative about the Mediterranean landscape are going to be demystified.

2.2.3. Human impacts on vegetation

The transition from hunter-gathering economies to agro-pastoralist ones represented a significant step in human history with radical effects on vegetation and landscapes. Goats, pigs, cattle and sheep were domesticated in the period between 9,000 and 8,000 BCE and it is believed primarily pastoralist economies preceded agricultural ones. With the spreading of emmer wheat cultivation, the basic form of the Neolithic economy was formed. The expansion of these basic economies in the Mediterranean was completed around 5,000 BCE when several waves of seafaring colonists from the Near East established farming enclaves there (Butzer, 2005; Zeder, 2008).

Estimating the impact of the first farmers on the Mediterranean vegetation is more difficult than it is for the climate. The pollen of crops such as wheat, barley and

other cereal groups does not disperse well by wind and is weakly represented in pollen diagrams until historical times, so other indicators are needed to identify human impact during the Neolithic (Roberts, 1998; Grove and Rackham, 2001). Roberts (1998) writes that evidence of prehistoric agriculture comes from the pollen of some ruderals (weedy plants), but the problem is that these species spread on the disturbed ground regardless of the cause and thereby create ambiguity when looking for traces of human activity. Also, early agricultural impacts happened at the same time as significant vegetation changes following the last glacial period.

Climate change affected not only vegetation but also human societies and their relationship with the environment. Mercuri et al. (2011) write that in the Mediterranean 'The history of cultural–environmental relations under changing climate was so complex that there are serious difficulties in distinguishing climate change from human impact in many proxy-data records' (p.189) and they identify three critical phases of synchronous climatic-cultural changes at 6,200 BCE, 4,000 BCE and 2,200 BCE which correspond to dryness oscillations and archaeological findings in the Mediterranean basin. The drying of climate after the Atlantic period (the warm, wet period between 6,000 BCE and 4,000 BCE) encouraged the keeping of cattle, goats and sheep. When water and plant resources fell below a sustainable level, the people and animals moved to new places (Mercuri et al., 2011; Mercuri, 2014). Palynological records of this period show abrupt disturbances in vegetation, and many authors interpret the decrease of arboreal pollen as a consequence of human activities such as forest clearing or anthropogenic fire while ignoring the major shift in climate.

Berger and Guilaine (2009) propose that deforestation due to natural fires caused by extremely dry climatic conditions offered a major opportunity for the Mediterranean Neolithic people because wide open areas favoured the expansion of agriculture and domestic animals. This is supported by Vanniere et al. (2008) who showed that drier climatic conditions increased fire frequency in the Mediterranean whereas burning as a consequence of human activities became more prominent only with the onset of the Bronze Age in 2,800 BCE. An increasing number of authors warn that the distinction between the natural and human causes of change in this period

cannot be made and suggest that landscape and vegetation change should be viewed as a combined and synergic effect of drier climate and increasing human pressure (Grove and Rackham, 2001; Butzer, 2005; Mercuri et al., 2011; Sandori et al., 2013). Roberts et al. (2011) share this view but they conclude that climate change stimulated development of complex societies and vegetation change, but during subsequent millennia human land use patterns became the significant agent of landscape change and 'by the mid-first millennium BCE, increased human impact and a drier and more variable climate had combined to create typical sclerophyllous vegetation and landscape ecosystems around much of the Mediterranean basin' (p.11).

Some authors also stress the importance of metallurgy and shipbuilding as driving forces of deforestation. Hughes (2014) stated that the overall effect of ancient industry on forest cover was bigger than during the Industrial Revolution. For instance, he estimated that fuelling the silver mines of Laurion in Greece resulted in yearly deforestation of 52 km² or cumulatively 8,476 km² for the 160 years it worked. When taking into consideration that some of this was managed as coppice and that vegetation regenerates (though it could be hampered by grazing and fires), the deforested area was estimated to 3,466 km². During the same time, Attica peninsula could provide only 952 km² of the forest, so 80% had to be imported from elsewhere. Wertime (1983, p.448) argued that 'mines of Laurion inflicted a great scar upon the Attic landscape' and 'by the time of Strabo the forest cover was completely bared in order to provide timber for the mines and charcoal for the smelting of the ore'. However, Grove and Rackham (2001) believe this is exaggerated and not based on firm evidence because wood as a fuel is renewable when managed through coppicing and industries lasted for several hundreds of years so 'industrialists' had every reason to preserve their forests. They compare this with the industrial period when the best-preserved forests were located exactly near the industrial facilities so could be carefully managed to avoid fuel shortage. Grove and Rackham (2001) also attempted to critically reassess the negative impact on forests by the shipbuilding industry. They suggest that forests cut for shipbuilding were not cut faster than they regenerated, and they base their argument on a study in modern Turkey where a local shipyard

produced 30 big ships each year which consumed only 18 km² of forest in a period of 50 years.

Vegetation was modified through its use as a resource for firewood collection, grazing and other forest products. Firewood was usually derived from coppicing and pollarding which represents sustainable exploitation of trees as young shoots develop again from the stool. The shoots can also be used as a food for domestic animals either by allowing browsing or through a collection of leaves. Pollarding and shredding were often practised in areas where animal browsing was present and are considered conservation practices because they enable wood and leaves to be harvested without killing the tree which then lives longer than it would if it were left alone. Conifers, particularly pine, however, are a poor wood producer and cannot be managed by coppicing since they do not sprout after cutting and were more often used as timber (Roberts, 1998; Grove and Rackham, 2001; Kirby and Watkins, 2015). Kirby and Watkins (2015) argued that the concept of multiple uses and multiple benefits from the same patch of trees is new today only in its terminology, and there is strong evidence that people harvested trees deliberately and repeatedly since the Neolithic. This is also supported by Grove and Rackham (2001) who concluded that by the 3rd millennia BCE many forests were transformed into coppice woodlands while much of the browsable land had already been browsed for millennia, although with varied intensity. Woodland management was accompanied by arboriculture and tree crops such as olive and grapes (and later on peach, apricot, chestnut, walnut and others). This further reduced economic risks since each component of sustenance was vulnerable to different hazards at different times of the year (Braudel, 2002; Butzer, 2005).

Since forests were so often used for pasture, animal browsing is considered to be the main factor contributing to human-caused deforestation. Grove and Rackham (2001) and Hughes (2014) describe how the negative effect of pastoralism manifests itself and leads to forest degradation. Deforestation through cutting and burning enables domestic animals to enter the forests, and intensive grazing consequently prevents regeneration of vegetation. Without forest cover to protect it from the rain, the soil is carried down from highlands with water leaving the rocky

ground that is unsuitable for forest recovery. Hughes (2014) therefore identifies grazing by cattle, sheep, goats and pigs as one of the main factors of environmental degradation in the Mediterranean, but singles out the goat as far more damaging than other animals. This is because they eat small branches along with leaves, they are also very adaptable and relatively easy to care for which makes them common and widespread. Shepherds also contributed to this cycle by frequent burning of the landscape in order to induce the growth of new grass cover. Hughes's work (2005; 2014) was based on conclusions derived from the works of the Ancient Greek writers who also blamed goats and shepherds for the destruction of the aboriginal, pristine, forested landscape. However, Grove and Rackham (2001) argue that whatever landscape transformation occurred because of animal browsing had already taken place by the end of the Bronze Age, and Greek writers lived in a landscape more similar to the present one than to the one that existed long before them. However, Grove and Rackham could also be wrong in their argument, as various subsequent palynological studies (Butzer, 2005; Di Rita and Magri, 2012; Kouli, 2012; Baker et al., 2013) have shown that landscape change was very dynamic also in the 1st millennium BCE and during the Roman period afterwards. The composition of forests often changed towards the dominance of pines, but even pines experienced periods of advance and retreat. However, climate change could have had an impact there, as people had to adapt to periods of abrupt aridisation. In such conditions, they often placed more emphasis on pastoralism than agriculture causing pronounced land degradation. That is why human societies had an important role in the shaping of the landscape especially during dry climate (Baker et al., 2013).

As the climate changed from drier to wetter, as happened during the Roman Warm Period (or Roman Climatic Optimum), pollen records show that an increase of agricultural activity started along with the spread of deciduous vegetation (Kouli, 2012). It is from this period onwards that the climate and vegetation show similar characteristics with the Mediterranean as is known today.

Discussions about human impacts on vegetation through clearing, browsing and burning are always looked at in close connection with soil erosion that follows as its consequence. Hughes (2014) argues that deforestation and consequent erosion

started in the Greek and Roman periods which is supported by McNeill (1992) who claimed that 'without a doubt, a substantial measure of Mediterranean deforestation and consequent erosion happened in classical times, say between 500 BCE and 500 CE' (p.72-73). However, the research on erosion in Argolid in Greece carried out by Butzer (2005) showed that the most widespread erosion in this region happened during the Bronze Age with five major erosional events in total, compared with only one such event happening between the Archaic and Roman periods. Sediment analysis of southern Greece carried out by Fuchs (2007) showed that sedimentation rates during the Classical period were of the same level as rates in the Neolithic. Extremely high sedimentation also occurred during the Middle and the Late Bronze Age, but in contrast to the Argolid region, here the Roman period was marked by even higher sedimentation.

There is considerable debate whether soil erosion and deposition were brought on by climate change or by human land abuse (Van Andel et al., 1990; Roberts, 1998; Grove and Rackham, 2001; Pope et al., 2003; Fuchs et al., 2004; Butzer, 2005). Roberts (1998) argues that in most cases historical soil erosion was caused by the combined effect of natural and cultural forces. The research of Fuchs et al. (2004) correlated episodes of enhanced soil erosion with the peaks of cultural activities, declines of societies due to the abandonment of land and soil protection measures or to pure climate factors. As Goudie (2013) puts it, **'**in many cases of environmental change, it is not possible to state without risk of contradiction that it is a man rather than nature which is responsible' (p.336).

2.3. Forest history of Dalmatia

2.3.1. Postglacial vegetation reconstruction

There is very little research on Dalmatian postglacial vegetation reconstruction, and most of it originates from some thirty or forty years ago. Beug (1967) published the earliest reconstruction of postglacial vegetation development in the Croatian coastal region based on the pollen analysis of the lake deposits of the

Malo jezero on the Mljet island in south Dalmatia. Brande (1973) sampled the nearby mainland, along with the Neretva valley. More recent work includes pollen analysis from Bošnjačko jezero near Zadar by Grüger (1996), Jahns and van den Bogaard's (1998) analysis of pollen from Mljet island which confirmed the results of Beug's research, Šoštarić's (2003) analysis of pollen from Roman times near Šibenik and Smith et al.'s (2006) work in the Cetina valley in central Dalmatia. Several coastal locations in Istria in the north Adriatic were also sampled by Beug (1977).

Šoštarić (2005) describes the postglacial development of Croatian coastal vegetation as having a basic pattern, which was set out by Beug (1967). He distinguished four forest periods in the southern-Dalmatian Mljet island. The first period lasted from 7,000 BCE until 5,600 BCE and was dominated by deciduous oaks which was followed by their retreat and the onset of the true Mediterranean climate conditions and *Juniperus-Phillyrea* period that lasted until 4,300 BCE. Jahns and van den Bogaard (1998) described the vegetation of *Juniperus-Phillyrea* period as unusual and not of natural growth as it is often associated with human activity. However, there is no archaeological evidence of human settlements or impact from this period while similar vegetation change is observed in the mainland which is why the authors attributed it to climate change.

A drier climate, which was proven by Schultze (1988/1989), in combination with an increase in temperature favoured evergreen taxa over deciduous. This period lasted approximately until 200 BCE and was marked by slow migration and consequential domination of evergreen holm oak (*Quercus ilex)*. In the process, however, parts of the landscapes underwent a phase when they were semi-open. The described climate change also correlated to the aridisation period that occurred throughout the Mediterranean basin. Brande (1973) showed that during the same period holm oak was slowly spreading to the nearby coast of the mainland where the more cold-tolerant species retreated and were replaced by deciduous oaks (Smith et al., 2006). From 200 BCE the vegetation of Mljet island and southern Dalmatian coastal mainland has been characterised by the *Quercion ilicis* alliance which is considered to be the 'natural' vegetation of the Dalmatian coast (Horvat et al., 1974; Jahns and van den Bogaard, 1998).

Beug (1967) stated that this latest period of vegetation development was marked by the increasing spread of pines and they became a major component of forest cover from 10 CE. Jahns and van den Bogaard (1998) explained that low amounts of pine pollen that were recorded in pollen diagrams from early Holocene probably originated from forests on the mainland and that they belonged to black pine (*Pinus nigra*). However, they attributed the rise of pine pollen from 1,300 BCE and especially from 1 CE to the introduction of Aleppo pine (*Pinus halepensis)* on Mljet island by Greek or Roman settlers. They assumed that *Pinus halepensis* was introduced to the Balkans by the Roman settlers while *Pinus nigra* grew as a part of natural vegetation. Romans also introduced chestnut and walnut, while greatly increasing the cultivation of olives and grape vines, albeit not as much as in other Mediterranean countries due to the relative lack of arable land (Brande, 1973).

Human influence on the mainland can be traced back to 3,000 BCE with agriculture being a minor economic practice in comparison to pastoralism (Grüger, 1996). Landscape already showed signs of open canopy forests, but it was during the Roman period that humans caused significant landscape modification with the spread of agriculture and transformation of forests to maquis (Šoštarić, 2003; Smith et al., 2006).

Modern Dalmatian vegetation was described by Horvat et al. (1974) who concluded that the coastal area of Dalmatia represents a part of the Mediterranean evergreen forest zone which is in the Balkans formed by the *Quercetum- ilicis* alliance. In Dalmatia, this alliance is characterised by the *Orno-Quercetum* association. This evergreen woodland grows only as a narrow belt along the coast of the mainland up to 350 m and on the islands. The dominant species in all relics of natural forests is holm oak (*Quercus ilex*) which forms a dense canopy with minor undergrowth. In forests that were transformed to maquis, holm oak is replaced by other woody taxa such as *Myrtus comunis, Arbutus unedo* and *Pistacia lenticus*. Today most holm oak woodland is replaced by Aleppo pine trees while in the peaks of coastal mountains patches of autochthonous Dalmatian black pine (*Pinus nigra ssp.Dalmatica)* can be found as a relict.

Further inland, the evergreen taxa are replaced by sub-Mediterranean deciduous mixed woodland which is represented by the *Ostryo-Carpinion* alliance with different oak species (mostly *Quercus pubescens*)*, Fraxinus, Carpinus* and *Ostrya*. Similar to the holm oak forests in the coastal area, Dalmatian sub-Mediterranean forests can only be found in small patches, while most of it was reduced to *šikara* or permanently anthropogenically influenced low-growth coppice with trees deformed in forms of shrubs and with lots of bushes (Šumarski list, 1957). Under further human pressure, these woodlands transformed to *šibljak,* in which most of the tree species have disappeared and only shrubs that cannot be converted into trees remained (Horvat, 1965; Horvat et al., 1974).

2.3.2. Landscape history of Dalmatia and Šibenik area before the 15th century

The first vegetation survey of Šibenik area dates from the 19th century when Roberto Visiani (1842) collected plant samples and surveyed several locations in the vicinity of the city in his journey through Dalmatia. However, this research, and studies that followed afterwards focused on contemporary vegetation structure.

Archaeological findings provide evidence of human settlement in the Šibenik area back to the 5th and 4th millennia BCE (Korošec, 1955). What used to be small scale farming with people living in scattered hamlets later developed into dominantly pastoral communities with a series of defensive hill forts being erected from the Iron Age onwards (Krnčević et al., 2000). The people that lived here, the Ridits, represented the most western municipality of *Dalmatae* tribe which settled a wider area of inner Dalmatia and contemporary Bosnia. Throughout the period, small scale farming and pastoralism remained the basis of the economy. Pastoralism had a major role in the local life and the landscape change and during the summer people relocated with their herds from the coastland to the wetter mountainous hinterland, while during winter, they moved back closer to the sea where temperatures were milder. This type of pastoralism, called transhumance, became the dominant way of life for centuries to come and in some areas of Dalmatia carried on until the late 20th century (Gušić, 1976; Magaš and Blaće, 2010; Fuerst-Bjeliš and Kale, 2018).

With the advent of Roman rule, a network of Roman roads was established, and there was an expansion of olive groves and vineyards. The permanent presence of the Roman population is evident from remains of numerous *villae rusticae* which possessed a thermal system for house heating and bathing (Krnčević et al. 2000). After the 5th century and the fall of the Western Roman Empire, the major settlements in the area were also destroyed, but much of the local population remained and continued small scale farming and particularly pastoralism. During the Great Migrations in the 8th century, Croatian tribes settled in the area making it a part of a larger Croatian state (Gunjača, 1976). Šibenik, which was first mentioned in documents in 1066, became the principal city in the area. The town and its municipality soon found itself in a war with Venetians who burned Šibenik to the ground in 1116. The settlement was later rebuilt and repopulated, but conflicts with neighbouring dukes impeded the economic development of the area although Šibenik managed to acquire the status of *civitas* (city) and became a seat of a diocese in 1298. War did not cease to ravage the area though as Venice burned the town again in 1378 while in 1390 for a brief period it was conquered by Bosnian king Tvrtko (Dumović, 1976). In 1409 the history of the following four centuries was determined when Ladislaus of Naples, the titular King of Hungary and Croatia, sold his rights to rule over Dalmatia to Venice. After a short war, Šibenik recognised Venetian rule in 1412 and remained a part of Venetian Dalmatia for the next 377 years.

Very little is known about the Dalmatian landscapes of this period, but taking into consideration the several millennia-long traditions of agriculture and transhumance pastoralism, a cultural landscape similar to ones in other Mediterranean areas was probably well developed. Open areas without forest cover and the existence of barren, karst landscapes in coastal Dalmatia had already been mentioned by Greek historian Strabo in 1st century BCE (Kosović, 1914b). Nikolanci (1989) argued that forest cover was a dominant feature of Dalmatian hinterland because texts dating to the 13th century mentioned the Crusaders passing through lush, impassable forests of Dalmatia. However, forester Kosović (1910; 1914b) believed historians misinterpreted the writings of medieval writers because the borders of Dalmatia changed over time and when, for example, the Crusaders passed

through what was known as Dalmatia, they could have been passing through western Bosnia, which is more mountainous and forested. On the other hand, despite the lack of properly developed tall trees, shrub-like vegetation of maquis is abundant with plants and forms an almost impassable obstacle which hinders the movement of troops. Kosović also discredited those who believed forests covered medieval Dalmatia because coastal towns had an abundance of shipbuilding timber. He argued that this could have been misinterpreted as timber made from tall trees since timber from small, crooked trees that were common in Dalmatia was considered especially valuable in historical times for building different parts of ships.

2.3.3. Dalmatian forestry in the Venetian period (1412-1797)

The Dalmatian coast was within the Venetian sphere of interest since the creation of the Republic in the 7th century because the Adriatic Sea was the main gate for its trade routes with the rest of the Mediterranean and the world. After several centuries of fighting and competing with Croatia, Hungary, Byzantium, Normans and Mongols, in 1420 the coastal Dalmatia was conquered by Venice. This rule lasted until 1797, but although a part of the Republic, Dalmatia was under frequent threat from the Ottoman Empire which conquered and ruled some of its parts for more than two centuries.

Notwithstanding considerable historical research on Dalmatia in this period, there has been little research on landscape history. The work of Dušan Jedlowski (1975) represents the first research about Venetian influence on Dalmatian woodlands and forestry policies. Using various archival documents from Croatian and Venetian archives, Jedlowski studied the condition of Dalmatian woodlands, Venetian orders related to usage or protection of forests and the impact of Venice on the conservation or disappearance of forests in the Dalmatian territory. Since his research covered 350 years of Venetian rule and the whole territory of Dalmatia, it represents a valuable overview with numerous examples of woodland management.

Jedlowski (1975) emphasised the archival evidence of laws, rules and regulations as well as reports on the use of forests. He explained that during

Byzantine rule Dalmatian cities had a considerable autonomy concerning interior governing of cities and these regulations were written in the form of statutes (*statuti*) which were made up of elements of Roman law, Slavic customs and orders implemented by the Church. The statutes varied between cities and each city had its own sets or regulations concerning the cutting of trees, animal browsing, use of woodland products, etc. With the conquest of cities by Hungary or Venice, some of this autonomy was lost, but the statutes generally remained in use with new regulations added in. Through these regulations, it is possible to examine human interaction with their surrounding environment and economic activities that influenced vegetation.

The towns on Korčula island had many regulations concerning woodland use as the island was heavily wooded (and still is today) and woodlands had an important economic value. Pine bark was used for greasing of fishing nets, pine resin for fires during night-fishing, timber for a well-developed shipbuilding industry and branches for manufacturing minor fishing equipment. Regulations were very strict, and timber exports were heavily taxed. In comparison, regulations from neighbouring Hvar island had much less emphasis on woodlands as they were not a significant part of the island's economy. The largest Dalmatian island, Brač, had many regulations concerning browsing. There were specially designated areas where browsing was forbidden during certain months of the year or even in the event of rain so that the vegetation could recover. Also, there were agreed periods when goats would be allowed to browse and when sheep could do so. Fines were prescribed for cutting timber on someone else's property or cutting branches or trees that had a purpose of providing shade for domestic animals. The burning of fires near pastures or worked fields was also subject to high penalties (Jedlowski, 1975).

Venice, like other European countries, gave special attention to forestry and was a leader in developing regulations for the purpose of conservation, protection and maintaining of forests (Jedlowski, 1975; Appuhn, 2009). In his research on Venetian forestry Apphun (2009) argued that the Venetian forestry bureaucracy developed a unique view of the relationship between humans and the natural world in which the preservation of nature was stressed. However, Jedlowski (1975) stated

that Venice never had one law or rulebook that would apply to all of its forests. Laws were a series of regulations of often local character issued to deal with a particular problem, at least in the Dalmatian part of the Republic, though there were attempts to implement general rules.

The management of forests in Venice was subjected to different institutions with different levels of jurisdiction. One of the most important bodies was Magistrature of Superintendents for wood and forests (*Magistrato dei Provveditori sopra le legne e boschi)*. In 1480 it set in motion a series of laws which included: the establishment of oak reserves; the proclamation of municipal woodlands as undividable common goods with a ban on their clearing for purposes of creating farming areas or pastures; the ban on cutting of timber in woodlands that are younger than 10 years; the ban of browsing in woodlands younger than 5 years, etc. (Jedlowski, 1975). In 1476 the Venetian Senate identified that the free-roaming of domestic animals and the use of fire to clear forests were the two main causes of deforestation in municipal woodlands. Therefore, all forestry regulations tried to suppress these two actions as much as possible (Apphun, 2009).

Due to significant cutting of municipal woodlands and other events at the beginning of 16th century that increased the need for wood and timber, such as the war with the Ottomans, decline in trade with the East and the need for building materials because of flood damage in Venice, new forestry regulations were proclaimed by the Venetian Council of Ten. The Dalmatian town officers now had to issue permits for woodcutting; woodlands were cut in rotations with oaks being left out from cutting; timber was not allowed to be exported without a special permit, etc. Despite this effort, the local people did not abide by these rules and there was a considerable amount of corruption. That led the Council to issue an order to all owners of forest parcels to report about each parcel that was felled in the previous 40 years and to reforest 8% of the recent barren areas with oak or other forest species in the following eleven months (Jedlowski, 1975). Oak forests were of special importance to Venice as oak was used for shipbuilding and crooked parts of oaks from Dalmatia were especially valuable in the construction of ship frames (Lazzarini, 1998). In the mid-16th century, a specific cadastral survey of oak forests was made, and these

forests became fenced, separated by a moat and a bridge with doors at the entrance. The collection of acorns was forbidden and a special regime of management was implemented. This rule was implemented in all forests that had at least one oak tree in the stand (Jedlowski, 1975).

Sometimes the Venetian governing bodies would make extreme proclamations such as the one from 1559 when all cutting was banned for six years, after which woodlands were supposed to be divided into eight sections with each section worked in a different year (Jedlowski, 1975). This is also supported by Apphun (2009) who elaborated that Venice established a system of rotational harvesting in municipal stands. On the nearby mainland of Venice, these sections were called *prese,* and each *presa* would be used for one season and then allowed to rest. Depending on the size of woodland and the norms of the village, there could have been as few as six and as many as fifteen *presa* in a given stand. This would, in theory, prevent overexploitation of any single section of the stand while the total forest would be preserved.

Jedlowski (1975) also detailed a series of reports from various lords, captains, generals and other officials who served in Dalmatia which provides useful evidence about the condition of Dalmatian woodlands in that period. For instance, reports from the 16th century show that fires caused by shepherds were very common throughout Dalmatia. Reports from the 17th century indicated that woodland areas were scarce, while a report from 1775 described the area in the central Dalmatia as almost completely barren. In the area between Šibenik and Trogir to the south woodland was represented only with scattered patches of oak groves. The islands in southern Dalmatia were more wooded, especially Korčula island. At the end of the 18th century, the Zadar area was described as without woodlands, with only shrubby vegetation and oaks not usable as a building material.

Furthermore, Jedlowski (1975) translated various reports that provide evidence of practices common among Dalmatian rural communities. For instance, reports from 1549 show that illegal clearing of woodland through cutting and burning was common even on Korčula Island where regulations were stricter than elsewhere.

People were also fined for the barking of pine trees and exporting firewood from the island. There is also evidence of practices such as resin production from pine trees, cutting of trees for charcoal production and firewood collection for fuelling lime kilns. Documents from the 17th century showed that uncontrolled animal browsing was a constant issue between the local authorities and the people. By the mid-18th century, overexploitation of woodland was so excessive that some villages such as Nadin in Zadar hinterland had completely lost their municipal woodlands. Between 1756 and 1760 there are numerous reports of reckless cutting not only for everyday purposes but also selling wood and timber to foreigners in Austria.

In addition to local malpractices, the Venetian government attributed deforestation to goat browsing. The problem grew to the point where a ban on goat keeping was passed in 1760 followed by an order to eliminate all goats (Jedlowski, 1975). Appuhn (2009) acknowledges that Venetians viewed all pastoralism as threatening to their forests, especially oak stands. Dalmatian people, however, kept a large number of goats as they were the most versatile of all domesticated animals, more resilient and adapted to the harsh karst terrain. They were useful for milk and cheese production and were relatively cheap to keep so were often kept by the poorest people (Jedlowski, 1975).

Jedlowski (1975) avoided blaming either Venice or local populations for the condition of Dalmatian forests, but the reports he related emphasise that most of the damage was caused by the local practices. Although there were several cases that indicated the Venetian government ordered the cutting of oak stands for shipbuilding, the documents show that regulations were passed to promote forest protection and the growth of trees in order to achieve a continuous supply of timber. Also, Appuhn (2009) emphasised that in 1569 a team of Venetian foresters completed a first comprehensive survey of oak forests in the Venetian territory and according to their observations Appuhn concluded that forests on the Venetian mainland territory and in Istria contained more than enough oak to meet the Venetian demands. He also argued that the Venetians were not keen on shifting their demand for timber to more distant sources which included Dalmatia and the Peloponnese. Apphun dismisses those remarks that interpret strict Venetian forestry policies as a sign of timber

shortage and rather attributes them a conscious political calculation which justified the aggressive legislation aimed at removing forests from local control and placing them under the supervision of the Republic's institutions. His claims are supported by the fact that Venice, despite not having access to plentiful timber trade from the north or east Europe, never actually experienced a crisis of timber shortage.

In addition, Appuhn (2009) attempted to disprove 'Venice's reputation as the locus of major deforestation' (p.25) and supported his claims with archival evidence that emphasised Venetian efforts to preserve forests. However, he focused his work on the immediate mainland on Venice and Istria while making fewer remarks about Dalmatia. Nevertheless, the valuable information he provided complements the work of Jedlowski (1975) and clearly show that the Venetian mainland forests faced similar problems as the Dalmatian forests.

2.3.4. The influence of the Ottomans on landscape change in Dalmatia between 15th and 18th century

Venetian governance and local practices had a crucial role in shaping the Dalmatian cultural landscape in this period, but Appuhn and Jedlowski failed to take into consideration another external factor. Between the end of the 15th and the beginning of the 18th century, six wars between Venice and the Ottomans were fought and Dalmatia was one of the main battlegrounds (Chapman et al., 1996).

The Ottoman intrusions into Dalmatia started at the beginning of the 15th century when most of the Dalmatian hinterland was part of the Hungarian-Croatian Kingdom while the coastal area was part of the Republic of Venice. The first Ottoman raids on the territory of Šibenik district occurred in 1414, or just two years after Šibenik recognised Venetian rule. The first major attack on the city itself happened in 1468, and this marked the beginning of two centuries of constant Ottoman threat. Šibenik district lost most of its hinterland, and the number of settlements under its jurisdiction dropped from 120 before the wars in the 15th century to only 15 by the end of the 16th century. Out of these only one, Vrpolje, was not located on the coast while six were on islands (Peričić, 2016). According to Mayhew (2008), the Ottomans

used the tactic of applying constant pressure on Dalmatian cities through constant attacks and destruction of their resources. The Venetian offensive, on the other hand, relied on a scorched earth policy which focused on the destruction of fortresses, villages and valuable resources to make them unusable if they fall back into the Ottoman hands. Novak (1976) argued that the Ottomans specifically targeted woodlands as they were used as hideouts.

The borderland, which in certain periods laid only several kilometres from the sea, was exposed to daily violence and plundering of the land around cities and villages (Figure 2.2). However, it was also an area where exchange in people and land practices occurred (Chapman et al., 1996; Mayhew, 2008). The area conquered by the Ottomans was quickly repopulated by the Morlachs, also called Vlachs. Those were Orthodox and Catholic pastoralist communities from the hinterland of Dalmatia and Bosnia and Herzegovina whose livelihood was traditionally linked with transhumance.

The Morlach lifestyle and the dynamics of landscape and people on the borderline of Venice, the Habsburg Empire and the Ottomans have been the subject of considerable research among Croatian historians, historical geographers and later eco-historians. These themes were brought together in a project called Triplex Confinium. Prominent authors such as geographers Fuerst-Bjeliš (1998), Magaš (2003) and Faričić (2003) as well as historians Slukan Altić (2005; 2008a) and Petrić (2003) used a variety of historical sources, mostly maps, travel accounts and land surveys, in order to analyse the relationship between the people and the environment of the borderland area. The project, led by Roksandić (2003) and Kaser, was a joint undertaking between several universities from Croatia, Austria and

Figure 2.2. Map of Croatian lands in 1526 with the legend edited by the author (Source: Lučić et al., 1998).

Budapest. This Triplex Confinium research focused on the period from 1500 to 1800 and in Dalmatia considered hinterland areas that were closer to the modern Bosnian border. Although valuable for understanding the general processes of early-modern Dalmatia, the coastal area of Dalmatia and its woodlands were largely out of its scope.

According to Šarić (2010), who studied historical texts on Morlach lifestyle and traditions, the Venetian governor for Dalmatia described the Morlachs as 'people whose livelihood is supported by pastoralism and who do not know any economic activity other than pastoralism'[1] (p.70). Fuerst-Bjeliš (2000) argued that the climate and terrain features of karst meant that pastoralism was the most convenient and most adaptable form of subsistence economy. These communities used to descend

[1] *Ovaj narod izdržava se stokom i ne poznaje drugi rad osim stoke*.

from the Velebit and Dinara mountains during the winter and would pay a fee for the use of coastal pastures. This was in contrast to shepherds from the islands which used these pastures year-round (Chapman et al., 1996). During the Ottoman conquests, many people fled the hinterland and settled in abandoned villages near the coast, accepting Venetian rule. The integration of the newcomers, who had arrived from a different environmental setting with a specific way of life, was not an easy process, especially under the constant threat of war. This is why pastoralism had even greater importance in the life of people in the borderland (Fuerst-Bjeliš, 1998).

The importance of Morlach immigration was even greater for Šibenik area. In 1647 Šibenik faced a long siege from the Ottomans only to be struck with a devastating plague two years later, which killed approximately 80% of the city's population, with thousands of deaths in its rural areas. It took the city almost two centuries to again reach the population levels it had in the 17th century (Novak, 1976). With most of the Italian elite in the city dead, the population was eventually replaced with farmers from nearby villages and Morlachs from the hinterland. Slukan Altić (2008a) argued that the increased pressure from pastoralism-oriented immigrants led to serious degradation of the landscape in the area. In his study of the northern-Dalmatian Pag island, Brgles (2014) also concluded that pastoralism and the settlement of Morlach people caused the complete devastation of woodlands on Pag. Fuerst-Bjeliš (1998) argued that the intensity and range of degradation from pastoralism varied in accordance of social development and longer and shorter periods of general stability or insecurity, and any conclusion about this relationship would have to include research of much earlier periods to understand the basis of the relationship between the natural environment and subsistence economy.

2.4. Conclusion

The woodlands of the Mediterranean region, including Dalmatia, are often considered as being in a 'degraded' form as a consequence of overexploitation. However, a considerable amount of research on the evolution of Mediterranean vegetation shows that the forest history of this region is very difficult to determine. Some influential historical ecologists, such as Grove and Rackham (2001) oppose the views of some historians from the 19th and 20th century that the Ancient civilisations caused the devastation and argue that shrubby woodlands of maquis may actually be a 'natural' state of Mediterranean vegetation, or at least of some of its regions. According to them, the development of Mediterranean cultural landscapes had occurred already several millennia BCE.

With the development of research methods such as pollen analysis and carbon dating of sediments, evidence shows that delineating the effect of climate, human pressure and hazardous events in the BCE period is very difficult and each method has some downsides which can lead to misinterpretation. This is especially the case when the records show that climate change, increased human pressure and erosion events all date from the same period, which makes identifying causality very difficult.

The small amount of palaeoecological research on Holocene vegetation in Dalmatia indicates probable long-term existence of shrubby vegetation in the coastal areas. Landscape change in the medieval times is also difficult to estimate because historical data are very rare for the vast borderland areas where the conflicts between the Venetian Republic and the Ottomans went on for more than two centuries. This leaves room for a lot of speculation on the type of vegetation that characterised Dalmatia, and many authors claim that high-forests dominated the landscape. According to them, most of the forest clearing had occurred already by the Roman period, while others are placing it in more recent history. There is considerable evidence that Venetian administration carefully managed woodlands for shipbuilding but most of the records are related to islands and coastland of southern Dalmatia. And while Venetians are often blamed for overexploitation of

Dalmatian woodlands, some authors alleged that it was the malpractices of local people, especially pastoralists that destroyed the forests. Their research asserts the crucial importance of intermixed pastoralism and firewood cutting for much of Dalmatian woodlands until almost the present day. Many of these views coalesce in the writings of historian Vajda (1954) who argued that the Venetians indeed had a crucial role in the management of woodlands in Dalmatia, but non-sustainable and rapid exploitation by local communities led to degradation.

3. Methodology

3.1. Research area and period

This research focuses on the woodland history of the selected area in the Croatian coastal region of Dalmatia from the 1790s to 1990. The 1790s represented the final years of almost four centuries of Venetian rule over Dalmatia, which ended in 1797 when the Republic of Venice was dissolved by Napoleon. Woodland changes that occurred over the following two centuries have been analysed. Table 3.1 shows the sequence of different governments in Dalmatia which included the French (1806-1814), the Austrian (1815-1918) and two Yugoslav (1920-1991) administrations.

Table 3.1. List of different administrations that ruled Dalmatia from the 15th century onward.

Venetian administration
• 1412 - 1797 – part of the Venetian Republic
• Ottoman occupations in the 15th, 16th and 17th century
First Austrian administration
• 1797 - 1806 – part of the Habsburg Monarchy
French administration
• 1805 - 1809 – part of Napoleonic Kingdom of Italy
• 1809 - 1814 – part of Napoleonic Iliryan Provinces
Second Austrian administration
• 1815 - 1866 – Kingdom of Dalmatia within the Austrian Empire
• 1867 - 1918 – Kingdom of Dalmatia within Austria-Hungary
First Yugoslav administration
• 1918 - 1929 – part of the Kingdom of Serbs, Croats and Slovenes
• 1918 - 1920 – Italian occupation of greater part of Dalmatia
• 1929 - 1941 – part of the Kingdom of Yugoslavia
Second World War
• 1941 - 1945 – part of the Independent State of Croatia (under German control)
• 1941 - 1943 – Italian occupation of islands and coastal parts of Dalmatia
Second Yugoslav administration
• 1945 - 1963 – part of Federal People's Republic of Yugoslavia
• 1963 - 1991 – renamed to Socialist Federal Republic of Yugoslavia
Croatian administration
• 1991 - present – part of the Republic of Croatia
• 1991 - 1995 – War of Independence

The study area includes the Šibenik district located in the transitional zone between central and northern Dalmatia (Figure 3.1). This area shares many environmental and social characteristics with the rest of coastal Dalmatia making it a good study example for the whole region. In addition, pine woodlands that can be found in southern Dalmatia did not exist in this area until reforestation in the late 19th century making it possible to study the beginnings and consequences of these activities.

Figure 3.1. Location of Dalmatia and Šibenik-Knin county where study area is located.

The study area corresponds with the administrative borders of historical Šibenik municipality, which until 1991 used to include modern Primošten, Rogoznica and Bilice municipalities (Figure 3.2). In order to analyse woodland changes in more detail, three case study areas were selected. The borders of these were based on the cadastral survey from the 19th century with the aim of covering three economically and environmentally different areas within the study area – the islands, the coastland and the hinterland. Zlarin case study corresponds with the historical area of Zlarin commune which included Zlarin island and several smaller nearby islets. Grebaštica

case study covers the territory of the historical commune (settlement) of Krapanj that was divided into Grebaštica and Krapanj settlements in the late 19th century. Boraja case study covers the area of the historical commune of Boraja in the hinterland These three case study areas also cover the distribution of two types of climate and corresponding vegetation that occurs in the area – the Mediterranean and sub-Mediterranean.

Figure 3.2. The territory of the historic Šibenik district with borders of the study areas.

The Mediterranean climate of the narrow coastal strip is characterised by evergreen plant communities dominated by holm oak (*Quercus ilex*) and maquis. The sub-mediterranean climate is characterised by deciduous species, most notably pubescent oak (*Quercus pubescens*) which dominates in the colder hinterland area reaching all the way to the border with Bosnia and Herzegovina (Trinajstić, 1998, 2011). In Šibenik district the border between the Mediterranean and sub-Mediterranean climate passes through the middle of lake Prokljan lake and Bilice municipality (Marković et al., 1993, according to Mitić, 2009). This border is not clear-cut as elements of Mediterranean and sub-Mediterranean vegetation often mix, but

the selection of case studies covering an area from the islands to the hinterland allows the study of all types of woodland.

Historically Šibenik municipality used to be a part of Šibenik district along with Tisno and Zlarin municipalities. Until 1868 Skradin area used to be a separate district after which it was included in Šibenik district as a separate municipality (Table 3.2).

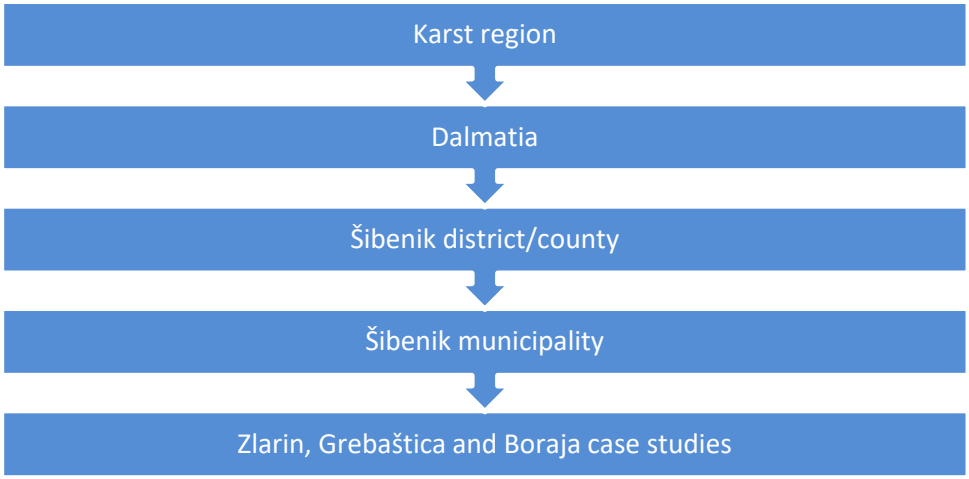
Table 3.2. Administrative division of Šibenik area from 1816 to 1918 (Raccolta delle Leggi…, 1824; Ivković, 1992).

<table>
<tr><th>Year of division</th><th>County</th><th colspan="2">Districts</th><th>Municipalities</th></tr>
<tr><td rowspan="2">1816</td><td rowspan="2">Zadar</td><td colspan="2">Šibenik</td><td>Šibenik, Tisno, Zlarin</td></tr>
<tr><td colspan="2">Skradin</td><td>Skradin</td></tr>
<tr><td rowspan="5">1822</td><td>County</td><td>District</td><td>Municipalities</td><td>Settlements</td></tr>
<tr><td rowspan="4">Zadar</td><td rowspan="3">Šibenik</td><td>Šibenik</td><td>Šibenik, Rogoznica, Primošten, Boraja, Vrpolje, Jadrtovac, Mandalina, Zaton</td></tr>
<tr><td>Zlarin</td><td>Zlarin, Prvić, Krapanj, Kaprije, Žirje</td></tr>
<tr><td>Tisno</td><td>Tisno, Murter Betina, Pirovac, Tribunj, Vodice, Jezera</td></tr>
<tr><td>Skradin</td><td>Skradin</td><td>Skradin, Visovac, Rupe, Ićevo, Vačane, Sonković, Dubravice, Zulišić, Prispo, Plastovo, Bribir, Kakanj, Krković, Piramatovci, Dobričić, Lađevci, Pečane, Međane, Čista Velika i Mala, Grabovci, Dragišić, Velim, Gaćelezi, Bratiškovci, Smrdelje, Gračac, Ždrapanj, Velika Glava</td></tr>
<tr><td rowspan="5">1868</td><td>District</td><td colspan="2">Political municipalities</td><td>Tax municipalities</td></tr>
<tr><td rowspan="4">Šibenik</td><td colspan="2">Šibenik</td><td>Boraja, Crnica, Danilo-Biranj, Danilo-Kraljice, Donje Polje, Dubrava, Jadrtovac, Konjevrate, Krapanj, Lozovac, Mandalina, Primošten, Rogoznica, Slivno, Sibenik, Vrpolje, Vrulje, Zaton</td></tr>
<tr><td colspan="2">Zlarin</td><td>Prvić-Luka, Zlarin, Žirje</td></tr>
<tr><td colspan="2">Skradin</td><td>Bratiškovci, Bribir, Čista, Đevrske, Dubravice, Ostrovica, Piramatovci, Rupe, Skradin, Smrdelje, Vačane, Velika Glava</td></tr>
<tr><td colspan="2">Tisno</td><td>Betina, Jezera, Pirovac, Tribunj, Tisno, Vodice</td></tr>
</table>

Similar administrative division was carried on to the Yugoslav periods. Since many archival records originated from the work carried out by the district authorities, historical Šibenik district can be regarded as the broader study area.

Additionally, this research considers many documents, articles, books and travel writings that deal with Dalmatia as a whole. Similarly, as the research area is a part of the karst environment that covers the area from Slovenia to Bosnia and Herzegovina and Montenegro, which were all a part of Yugoslavia, many findings also consider woodland areas of the karst as a whole (Table 3.3).

Table 3.3. Different levels of study areas in the research.



3.2. The archives on forestry

Kirby and Watkins (1998) discuss the rich range of written records about woodlands and forestry including descriptions of species, local forms of management, different censuses, woodland management policies and maps. For 19th century Dalmatia, where woodlands were scarce and often located in remote areas, the majority of such content was limited to government regulations and reports as well as letters of correspondence between different levels of authority. Unfortunately, the great majority of such documentation was lost due to the numerous military conflicts that occurred and repeated changes of administration.

For instance, when in 1805 Austria lost the war against Napoleon, Dalmatia became a part of the French Kingdom of Italy and later in 1810 one of the seven

French Illyrian Provinces. The French allocated resources for the development of forestry in the newly acquired territories and established three forestry departments, including one for Dalmatia. However, due to the brief period of the French rule and with the return of the Austrian army to Dalmatia most of the associated local documentation was lost (Šumarski list, 1886a). Up to the 1870s, there was no forestry department within the district authorities, so the forestry-related documents for historical Šibenik district were scattered among other departments within the district authorities. However, the State Archive in Šibenik has a reasonable collection of forestry-related documents that cover the period from the start of the 19th century to the 1960s (Figure 3.3).

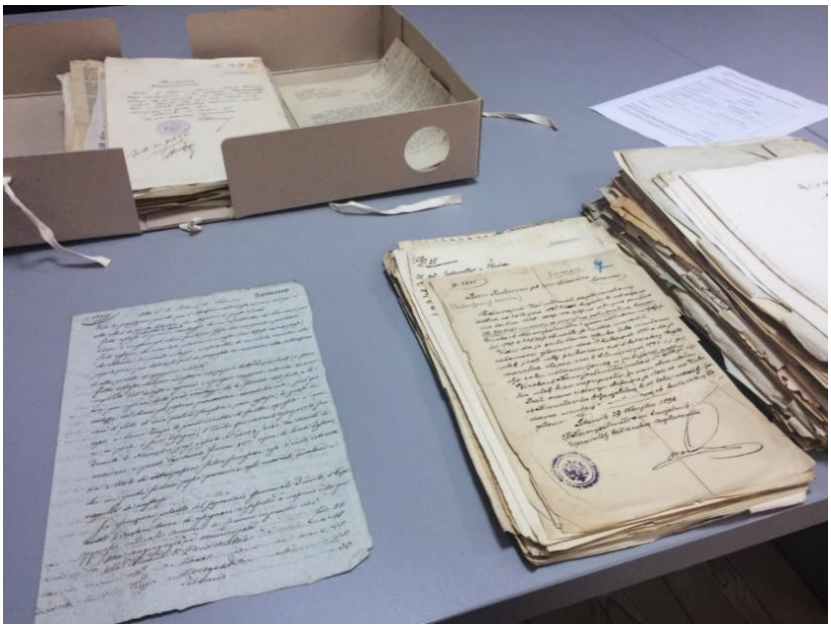


Figure 3.3. Documents on forestry history in the State Archive in Šibenik (Ivan Tekić, March 2016).

This archive includes regulations and orders that were circulated between the higher officials of Dalmatian authority with Šibenik district authorities as well as letters and complaints sent by the municipalities and communes to the district authorities (Figure 3.4). Most valuable, but few in number, were reports from the field by the district officials as they represent the only evidence of the activities that happened on the ground in woodlands. Rackham (2006) specifically warns about using only forest laws and regulations as direct evidence of what was or was not happening and classifies such attempts as pseudo-history, although many studies

make excellent use of forest laws to show the complex interplay between governance and local uses (Thompson, 1975). The archival reports from the ground can be used to explore the effectiveness of regulations, especially in this period when evidence outside laws and regulations is scarce.

These documents were handwritten in Italian as it was the official language used by government administrators and aristocrats in the cities. Some of these documents were difficult to read and translate. Throughout the thesis, citations that have been translated into English from Italian were written in the original form in footnotes. For translations from Croatian, only citations that were written in old-Croatian were written in the original in footnotes. The Italian language was a limiting factor in analysing records of village councils where a substantial amount of information is stored and because of the number of documents and information stored they were selected on the basis of keywords such as *bosco* (forest), *albero* (tree) and *comunale* (municipal, communal).

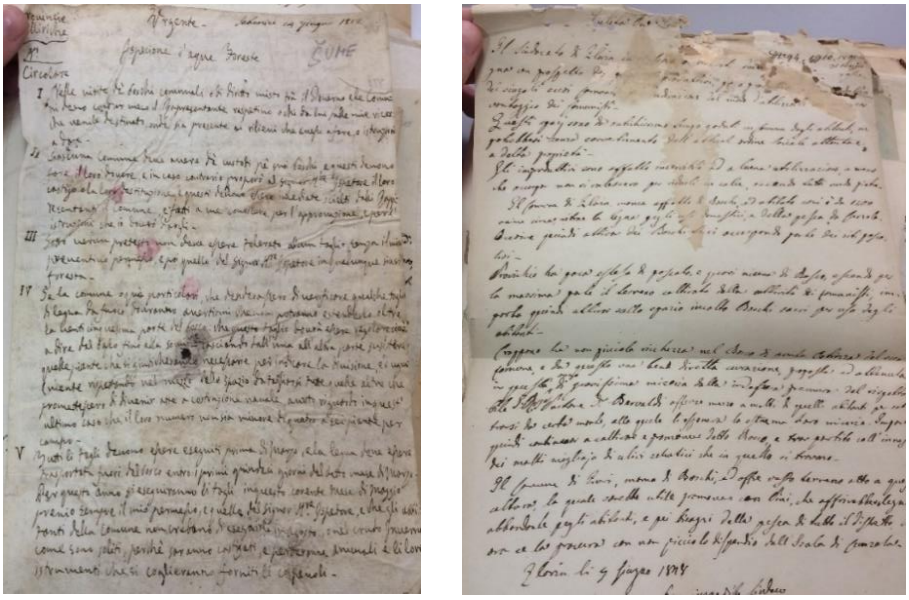


Figure 3.4. Example of archival documents from the early 19th century. Left: Woodland condition report for Šibenik district from 1812 written by a local forest guard which described observed woodland damage caused by illegal cutting and uncontrolled pasture and delivered a set of regulations to mitigate this damage. Right: Report from 1848 on the distribution of woodlands and availability of firewood on islands belonging to Zlarin municipality (Source: HR-DASI-Šibenik 19-20. st. Šumarstvo, 14th June 1812. *Ispezione d'ogne foreste*. N. unknown; HR-DASI-Šibenik 19-20. st. Šumarstvo. 4th June 1848. Šumarstvo*. Prospetto degli spazi poco produttivi, produttivi ed improduttivi…del Sindacato di Zlarin.* N. 1394).

From the 1870s onwards, woodland records became more numerous. This is because in 1872 the first forestry officials were employed within district authorities in Dalmatia and they become responsible for supervision of municipal woodland management, reforestation and the work of forest guards. Over time the number of forestry staff increased and professional foresters began to work within municipal authorities. Important sources of information for the late 19th century are letters of correspondence and reports from the first municipal forester Mate Baranović. His reports reveal the location of municipal woodlands along with their characteristics, management and use. His service also corresponds with the first reforestation activities in the district which provides insight into how reforestation areas and tree species were selected.

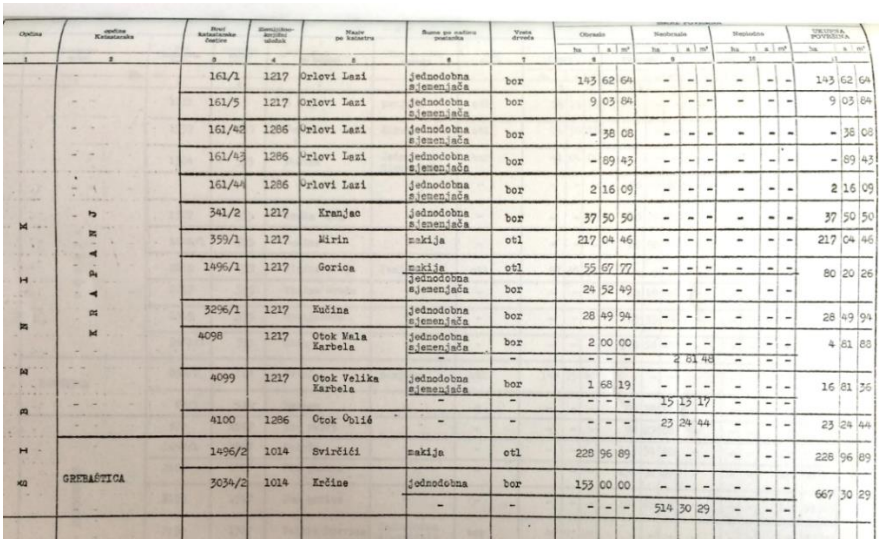
Other important documents include correspondence between district or municipality authorities with village elders, correspondence between county and district authorities, reports on woodland crimes, letters and orders from the Dalmatian National Government and reports on the activities of forest guards. Despite forestry staff being a part of the district and municipal authorities, a separate department specifically for forestry was not established. This is why the existing documents derive from a variety of different offices, departments and organisations.

The documents on forestry from the 1870s onward were written in Croatian rather than Italian making their analysis easier. This is because in the 1849 election nationalists, mainly the poorer citizens of Šibenik won the municipal election for the first time. The pro-Italian urban elite that used to rule became a minority in the municipal councils. The progress of nationalists was halted during a political crackdown in the whole Empire in the 1850s, but in 1871 they secured the majority again and ruled that the Croatian language was to become the official language and since then it replaced Italian in the work of administrations (Obad, 1976).

After the dissolution of the Austro-Hungarian Empire in 1918 and during the first Yugoslav period, forestry was still a part of the county and district administration and not a special department. During the late 1940s forestry records were kept by the Committee on Agriculture and Forestry which operated within the county

authorities. The documents related to woodlands from the Yugoslav period are not gathered into a single archival collection. Rather most of it is mixed with the documents from the earlier period. A substantial amount is also stored in the archival collections on the economy of the district, especially after the Second World War. Here, records on pastoralism were also found which were very relevant for the analysis of the impact of domestic animals on the woodlands.

With the creation of Dalmatia Forestry Enterprise (*Šumarsko poduzeće Dalmacija*) in 1950, the work of forestry was separated from the work of Šibenik district authorities. Foresters worked in newly established 'Forestry Office Šibenik' (*Šumarija Šibenik*). Most of the surviving documentation for the Forestry Office from 1950 to 1980 was related to its correspondence with the district authorities and was also stored in the Šibenik archive, along with the documents from the preceding periods. From the 1980s it was mandatory for each Forestry Office to develop a ten-year management programme called 'Management programme for forest and forest land' with precise details of all executed and planned activities. Management plans for 1981-1990, 1991-2000, 2001-2010 and 2011-2020 were obtained from the Forestry Office and were used to acquire information on the extent of different woodland types, reforestation activities, and woodland management by foresters as well as revenues from woodland products (Figure 3.5).



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							ha	a	m²	ha	a	m²	ha	a	m²	ha	a	m²		
	KRAPANJ	161/1	1217	Orlovi Lazi	jednodobna sjemenjača	bor	143	62	64	-	-	-	-	-	-	143	62	64		
		161/5	1217	Orlovi Lazi	jednodobna sjemenjača	bor	9	03	84	-	-	-	-	-	-	9	03	84		
		161/42	1286	Vrlovi Lazi	jednodobna sjemenjača	bor	-	38	08	-	-	-	-	-	-	-	38	08		
		161/43	1286	Vrlovi Lazi	jednodobna sjemenjača	bor	-	89	43	-	-	-	-	-	-	-	89	43		
		161/44	1286	Vrlovi Lazi	jednodobna sjemenjača	bor	2	16	09	-	-	-	-	-	-	2	16	09		
		341/2	1217	Kranjac	jednodobna sjemenjača	bor	37	50	50	-	-	-	-	-	-	37	50	50		
		359/1	1217	Mirin	makija	otl	217	04	46	-	-	-	-	-	-	217	04	46		
		1496/1	1217	Gorica	makija	otl	55	67	77	-	-	-	-	-	-	80	20	26		
					jednodobna sjemenjača	bor	24	52	49	-	-	-	-	-	-					
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		4098	1217	Otok Vela Karbela	jednodobna sjemenjača	bor	2	00	00	-	-	-	-	-	-	4	81	88		
					-	-	-	-	-	-	2	81	48	-	-	-					
		4099	1217	Otok Velika Karbela	jednodobna sjemenjača	bor	1	68	19	-	-	-	-	-	-	16	81	36		
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		4100	1286	Otok Oblić	-	-	-	-	-	23	24	44	-	-	-	23	24	44		
		1496/2	1014	Svirčići	makija	otl	228	96	89	-	-	-	-	-	-	228	96	89		
	GREBAŠTICA	3034/2	1014	Krčine	jednodobna	bor	153	00	00	-	-	-	-	-	-	667	30	29		
					-	-	-	-	-	514	30	29	-	-	-					

Figure 3.5. Statistical data on woodland plots in Krapanj and Grebaštica sections with information on the name of the location, vegetation composition and area (Source: Management programme for forest and forest land in Šibenik area of karst for period 1980 to 1990).

3.3. Land surveys from the 19th century

With the acquisition of new territories at the end of the 18th century the Austrian government planned many administrative reforms, but the main precondition for this was a land survey which required a detailed cadastre of the Habsburg Monarchy (the Austrian Empire from 1806). In the early 18th century there had already been attempts to implement a detailed cadastre, with the cadastre of the Duchy of Milan based on the 1720-1723 land survey being the first. In the second half of the 18th century, the need to establish a reliable land taxation basis for the whole Monarchy led to a land tax reform which required the survey of all land units. For this purpose, a land survey was carried out between 1785 and 1788 and the 'Josephine Cadastre' was created. However, this survey did not include Dalmatia which was still under Venetian rule and, due to inaccuracies and complaints from wealthy landowners who were dissatisfied with the tax reform, the cadastre was abolished in 1790 (Lisec and Navratil, 2014).

In 1806 the Austrian Emperor Franz I initiated the second land or military survey of what was now the Austrian Empire. This survey, called the 'Franciscan' survey, was based on a dense network of triangulation stations similar to the Milanese Cadastre from 1720 and was carried out exclusively by educated and experienced military and administrative surveyors in order to secure precision (Slukan Altić, 2008b; Gjurašić, 2014). The survey was not implemented in all regions simultaneously but in one at a time. Due to the outbreak of war with France, the start of the survey was delayed until 1817, and it ended in 1861 with the survey of Tyrol. The survey of Dalmatia, which fell under Austrian rule in 1815, started in 1823 and ended in 1838 (Slukan Altić, 2005; Gjurašić, 2014). The territory of each political district and municipality was divided into cadastral sections which corresponded with the territory of individual settlements called communes (*comune*). The territory of Šibenik district was surveyed in 1825 except for Žirje and Murter communes which were surveyed in 1824. The survey resulted in cadastral plans and cadastral records (*operato*) for each commune.

Cadastral plans were made at the scale of 1:2,880 with city plans being made at the scale of 1:720. The basic measurement unit was the *klafter.*[2] Each commune was shown on several separate sheets that were numbered. A schematic figure of the whole commune with numbers of sheets was shown on the first sheet to enable their identification. Borders of parcels and other signs were noted in black ink, while an identification number for the individual land parcels other than buildings was noted in red. Names of locations were written in Italian. These plans are especially valuable in landscape studies because the land use of each parcel was depicted in a specific colour (Figure 3.6) and this was standardised for all communes (Table 3.4). Additional important features such as threshing floors (*aja*) and ponds (*stagno*) were also drawn in.

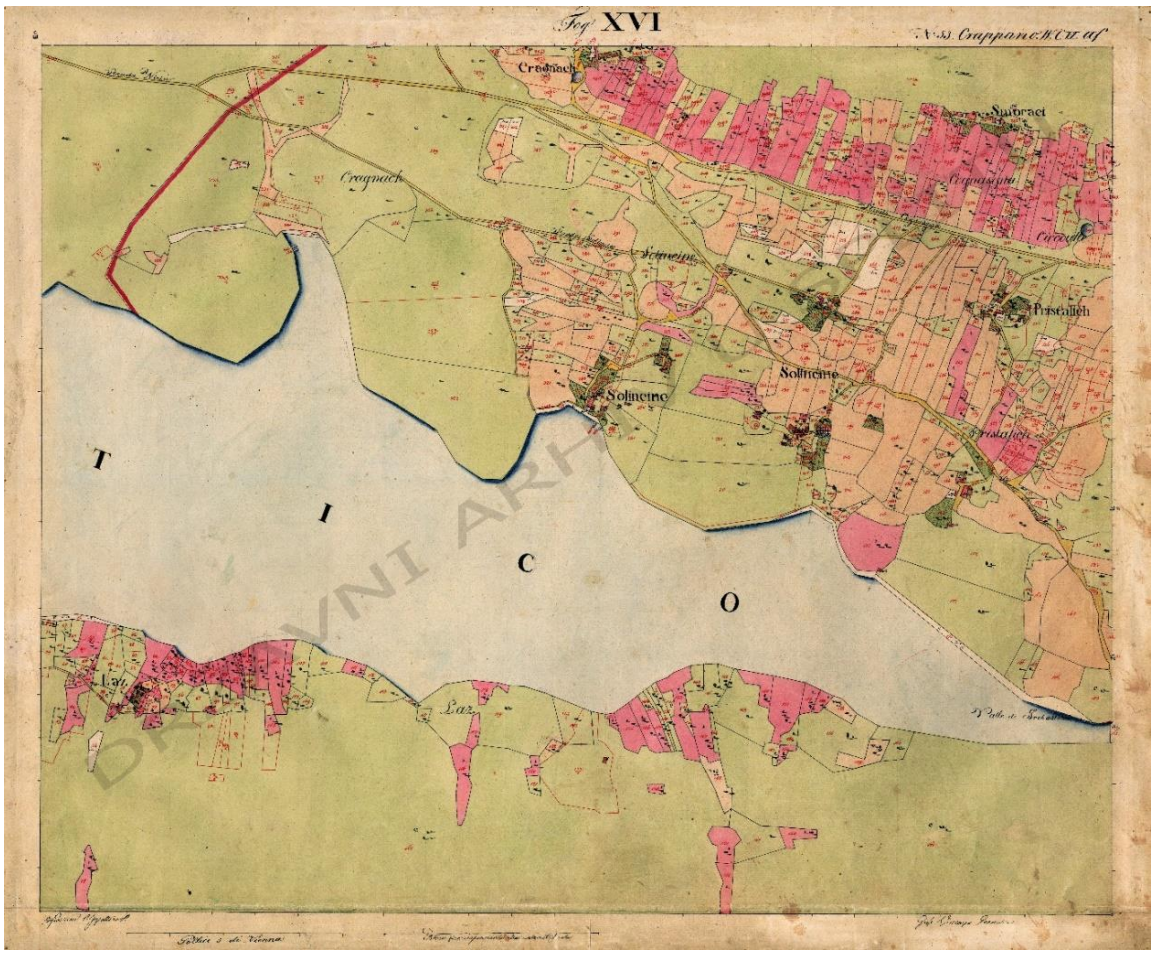


Figure 3.6. Scanned sheet XVI of 1825 cadastral plan of Krapanj commune showing Grebaštica settlement (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmaciju, KO. 279 Krapanj. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

[2] 1 klafter = 1.896 m

Table 3.4. English and Italian names for land use categories and their corresponding colour as shown on cadastral plans.

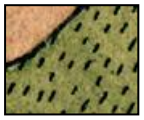
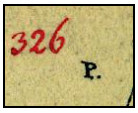
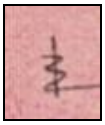
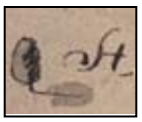
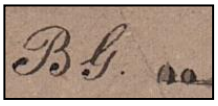
Type of land use	Italian term	Colour
Pasture	*Pascolo*	green
Fields	*Arativo*	light orange
Vineyard	*Vigna*	pink
Woodland	*Bosco*	dark grey
Garden	*Orto*	darker green with black dashes
Road	*Strada*	yellow
Uncultivated	*Incolto*	white with letters Inc.
Barren rocky coast	*Scoglio nudo*	white with letters Sc. N.
House	*Casa d'abitazione*	dark red

In addition to depicting land use with colours, surveyors also noted additional information about crops on individual parcels through the use of stylized symbols (Table 3.5). This use of the combination of colour and a symbol emphasised a specific land use in the parcel, with colour depicting the dominant use and a symbol the additional use. For instance, a green parcel (a pasture) with a symbol of an olive tree indicates that the dominant land use was a pasture with olives being a supplementary one, while a light orange parcel (an arable field) with a vine symbol indicates that it was a sowed field with some vines. Instructions the Austrian government published for the surveyors further elaborated the situation when more crops were grown within the same parcel. In such case, each noted crop had to occupy at least a tenth of a whole parcel; otherwise, it was disregarded by the surveyors (Raccolta delle leggi…, 1847). This means, for example, that parcels depicted as vineyards (pink) with olive trees had at least a tenth of the plot covered with olive trees.

Although surveyors did not specify plant species in the plans, the fact that they made a distinction between bushes and coppiced trees, even though they can both have an appearance and shape of a bush, makes it possible to derive conclusions that some parcels specifically had tree species and others not. Also, while some pasture parcels were additionally marked with bushes, others were not, which may indicate the latter lacked any type of vegetation other than grass. In the case of

woodland parcels, they all had the same symbol of a tree, but the distinction between types of woodland was made with letters, as described in Table 3.5.

Table 3.5. Symbols used by surveyors to depict crops in parcels in cadastral plans.

Symbol	Type of crop/cultivation	Italian name	Comments
	Fields	*Arativo*	Parcels used as fields and gardens are the only ones that can appear without any symbology, in which case they indicate a parcel is not used for any other purpose. When this is the case for a pasture, a parcel is marked with the letter 'P.' meaning pasture (*pascolo)*.
	Vegetable garden	*Orto d'erbaggi*	
	Pasture	*Pascolo*	
	Vines	*Vigne*	Parcels used primarily as vineyards (pink) are always marked with the symbol for vines.
	Fruit trees	*Frutta*	Symbols for fruit and olive trees are not related to any specific colour and are used to indicate the presence of these crops on other parcels that are marked as fields, vineyards or pastures.
	Olive trees	*Olivi*	
	Bushes	*Cespugli*	Bushes can appear on all types of parcels.
	Coppiced trees	*Piante cedue*	The symbol in the form of a tree changes meaning depending on the type of land use in a parcel. In pastures, it depicts the presence of coppiced trees. In woodland parcels, additional letters are written to depict the specific type of trees in that woodland. In the written records of the cadastral survey woodland with mid-sized trees and young woodland are additionally always characterised as consisting of broadleaved trees (*con alberi frondosi*).
	Woodland for poles	*Bosco di stanghe*	
	Woodland with mid-sized trees	*Bosco con alberi mezzani*	
	Young woodland	*Bosco giovine*	

Finally, the ownership of the parcels can also be read from the plans. The parcels that were in municipal ownership ('commons') were marked with a large letter 'C.' (*comunale*) which was, in the case of a pasture, followed with a 'P.' *(pascolo*). Only pastures and woodlands were in municipal ownership while the rest were in private ownership. There were no state-owned parcels in the research area.

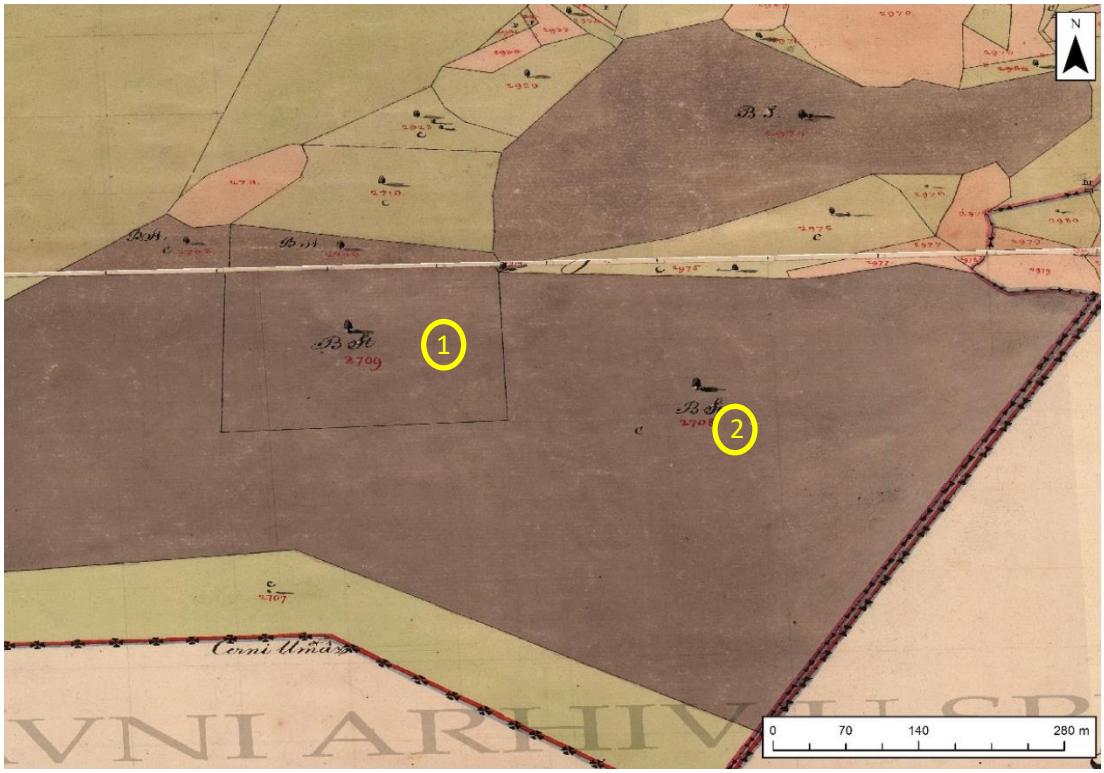


Figure 3.7. Example of private (1) and municipal (2) woodland parcel as shown in sheets VII and XI of Boraja commune cadastral plan from 1825 (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmaciju, KO. 52 Boraja. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

Each cadastral plan for a specific commune was also supplemented with written records written in Italian. For this research, the most important are 'Registers of land parcels' (*Protocollo delle particelle dei terren*) and 'Census estimates' (*Operato dell'estimo censuario*). Besides general information about the parcels such as its number and location, a Register of land parcels noted information about ownership of a particular parcel (*del Proprietario* columns) as well as additional details about terrain and crops (*del Terreno* columns) (Figure 3.8). Details about terrain are particularly important for understanding landscape and woodland characteristics in

the research area and further emphasise the landscape complexity that was noted by surveyors.

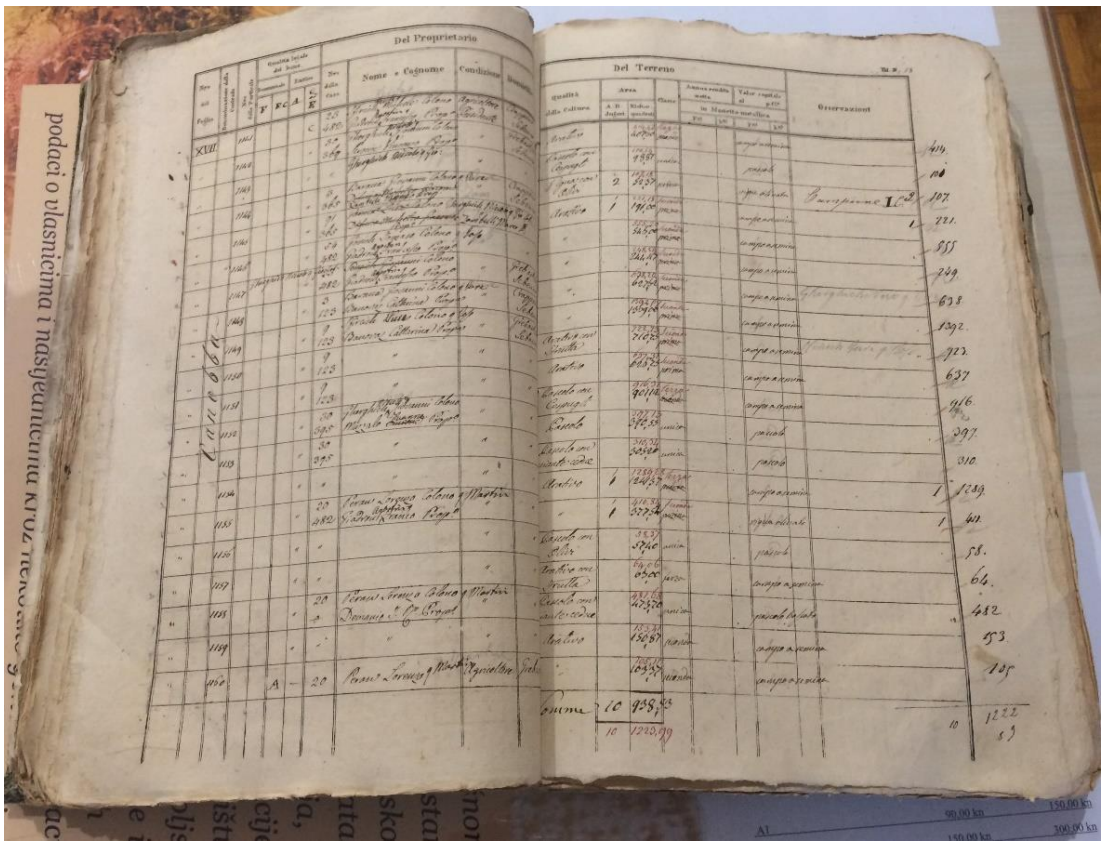


Figure 3.8. Register of land parcels for Konoba area in Krapanj commune. The first page brings general information about parcels and details of their ownership, while the second page detailed terrain features and value of crops (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmaciju, KO. 279 Krapanj. *Protocollo delle particelle dei terreni*, 1825).

The registers reveal all land parcels were categorised according to the 'Land use type' (*Specie della coltura)*. This land use type corresponds with what surveyors depicted on cadastral plans with a colour and the crop symbols. For instance, a green parcel with symbols for bushes and coppiced trees will have a land use type of a 'pasture with bushes and coppiced trees' (*Pascolo con cespugli e piante cedui*). Each parcel was also assigned a class according to the value of the terrain or products in those parcels. For instance, pastures were distinguished with three classes based on the quality of the pasture and the fertility of the terrain with those suitable for conversion to agricultural areas being of the first class. An explanation for the division of classes for every land use type is provided in the 'Protocol for determining types

of cultivation' (*Protocollo di determinazione dei generi di coltura*) which is attached to the back of Census estimates.

Finally, each parcel was also described through 'Money value' (*Valor capitale al per Ct*). This monetary value of products from the parcel was supposed to be expressed in monetary terms but instead, surveyors used written categories. In most of the cases 'The land use type' and the category of 'Money value' would be similar. The Register of land parcels for Boraja commune (Figure 3.9) shows how the 'Money value' of all pastures, whether the 'Land use type' is 'Pastures with bushes' or 'Pastures with coppiced trees' is always expressed as a 'Pasture' (*pascolo*). However, it is not the same with all woodland parcels.

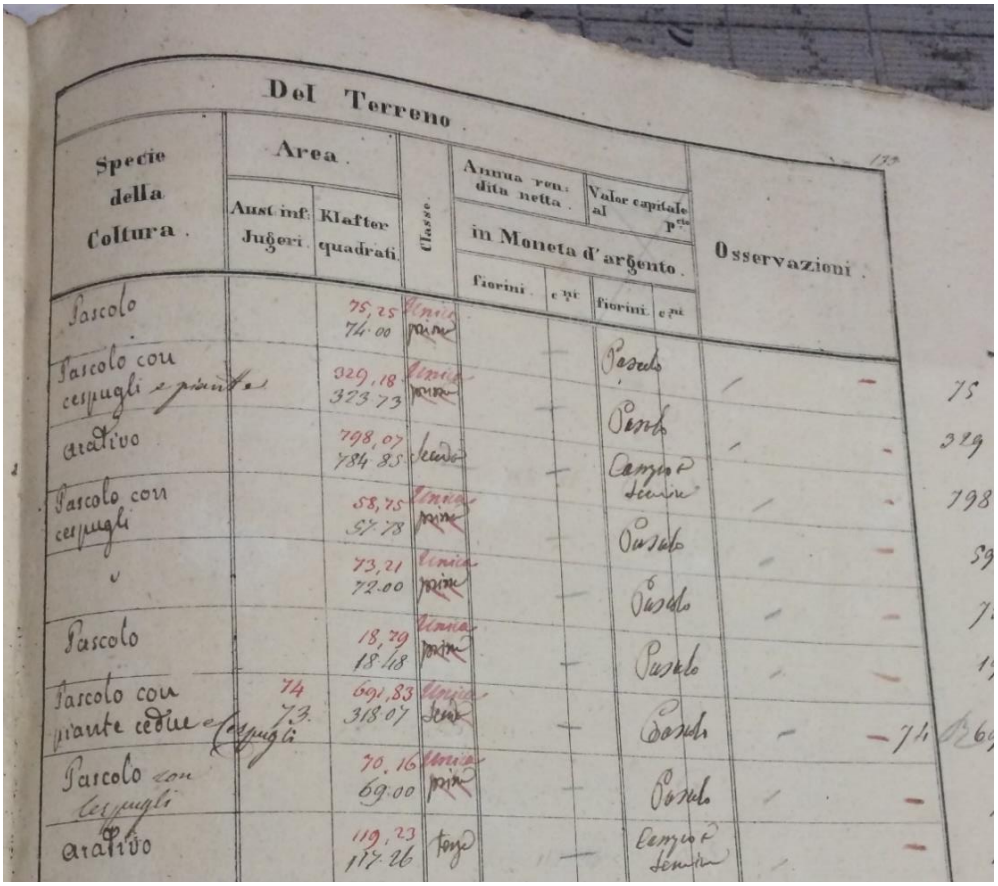


Figure 3.9. A section of the register of land parcels for Boraja commune showing the relation between the 'Land use type' and 'Money value' of specific parcels (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmaciju, KO. 52 Boraja. *Protocollo delle particelle dei terreni*, 1825).

Another example from the Register of land parcels from Boraja commune shows that the 'Land use type' of one woodland parcel was indicated as 'young

woodland with medium sized broadleaved trees' (*Bosco giovane d'alberi mezzani frondosi)* (Figure 3.10). However, the 'Money value' was not expressed as 'Woodland' which is what would be expected from a woodland parcel, but rather 'Wooded pasture'. The explanation for the meaning of a wooded pasture from the 'Protocol for determining types of cultivation' reveals that the mentioned woodland parcel was important for pastoralism and firewood collection and despite its 'Land use type' being classified as a woodland, it had no economic value in timber. This was likely due to the 'degraded' condition of the woodland and lack of developed trees.

This 'double description' with the 'Land use type' and the 'Money value' means that understanding the land use and cropping information provided is more complicated than might be expected. However, it also means that a richer and more detailed assessment of land use is possible. Since the cadastral plan for the mentioned parcel would indicate only the existence of the woodland, an understanding of the 'double description' of land parcels is crucial for their proper interpretation.

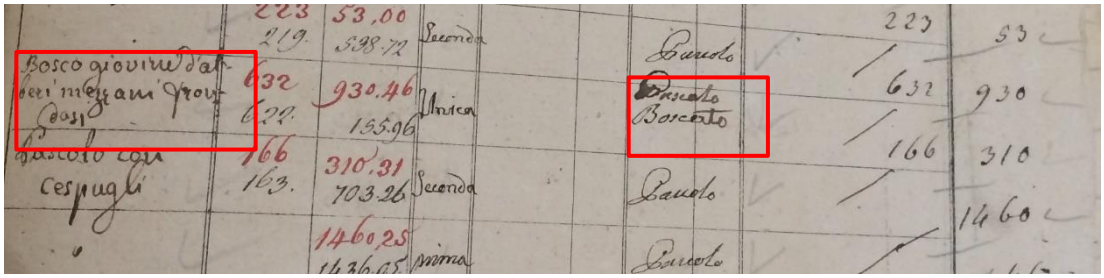


Figure 3.10. An example of a parcel in Boraja municipality where 'Land use type' is designated as a 'Young woodland with leafy mid-sized trees' but with a value of 'Wooded pasture' (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmaciju, KO. 52 Boraja. *Protocollo delle particelle dei terreni*, 1825).

Census estimates, on the other hand, represent an important historical account of the environmental and social characteristics of a certain area that is delivered through descriptions and statistical data. The census estimate document is divided into chapters on topography, borders of the commune, population, animals, water surfaces, roads, description of terrains, types and quality of agricultural products and practices, settlements, etc. While the cadastral plans for Dalmatia were made between 1823 and 1838, the written records including Census estimates were

made in the 1840s. This means that the descriptive data on land parcels in the censuses is derived from the 1820s, while the statistical data on population and agricultural yields are two decades older.

Additionally, cadastral plans and registers were updated as changes occurred in the land division and documents to record these were added to the plans. Also, from 1869 to 1887 the Austro-Hungarian government carried out a third military or land survey of the Empire. Šibenik district was mostly surveyed in the late 1870s, so the Register of land parcels was renewed while the changes in the borders of parcels and their numeration were marked on the original cadastral maps from 1825 in red colour (Figure 3.11). This enables analysis of landscape changes throughout the whole 19th century.

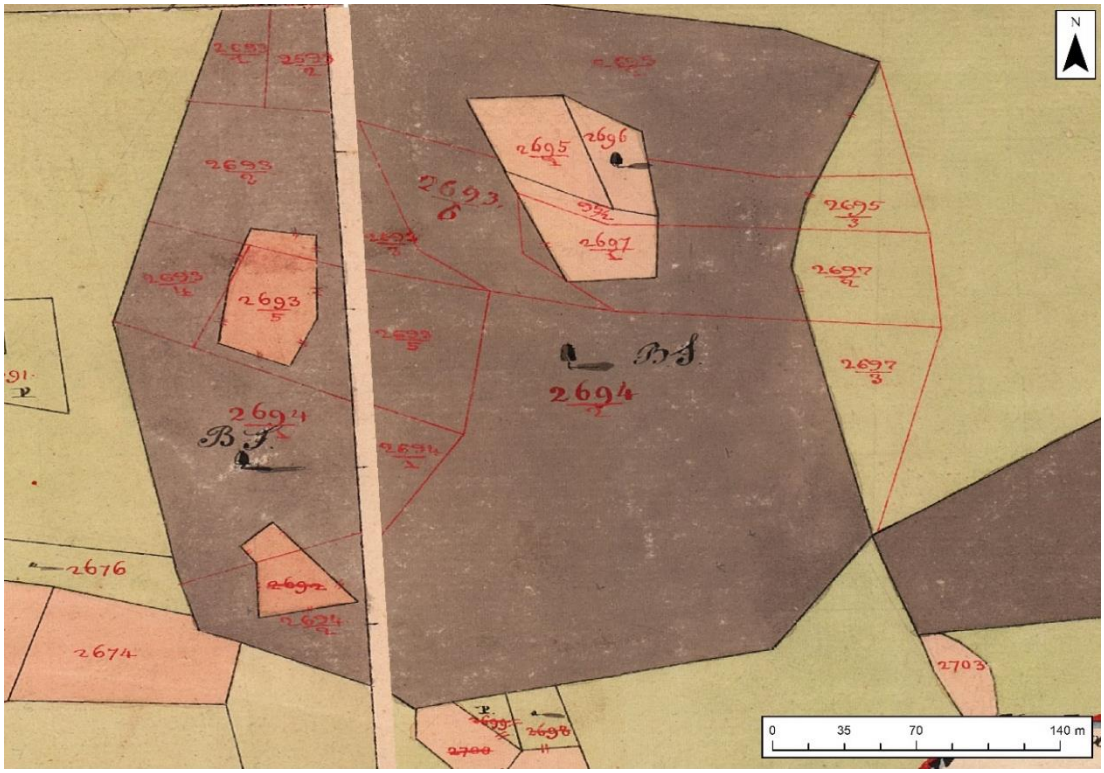


Figure 3.11. Original sheets X and XI of the cadastral plan of Boraja commune from 1825 with changes in borders from the third military survey in 1876 marked in a lighter shade of red (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmaciju, KO. 52 Boraja. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

The combined use of cadastral plans, census estimates and registers of land parcels provides a detailed insight into the state of cultural landscapes of this part of

Europe. According to Bičík et al. (2015, p.70), these represent 'the most valuable source of landscape data for the mid-19th century'.

For this thesis, the cadastral plans and records were retrieved from the State Archives in Split where they are stored in the section Archives of maps for Istria and Dalmatia. These include cadastral plans for three case study areas, i.e. for Krapanj (*Crappano)* section, Zlarin section and Boraja section. Digital copies were obtained in JPG and TIFF formats in high-quality resolution for processing in ArcGIS. In the program, sheets for each commune were connected into a single file, georeferenced using identifiable locations and maps of land use type were created. This enabled further analysis of the landscape as well as overlaying with landscape data from the later periods. The process revealed that plans have minor areal distortions of locations that are more distant from populated places, such as hills, coastline and islands, but overall, the plans show remarkable precision (Figure 3.12).

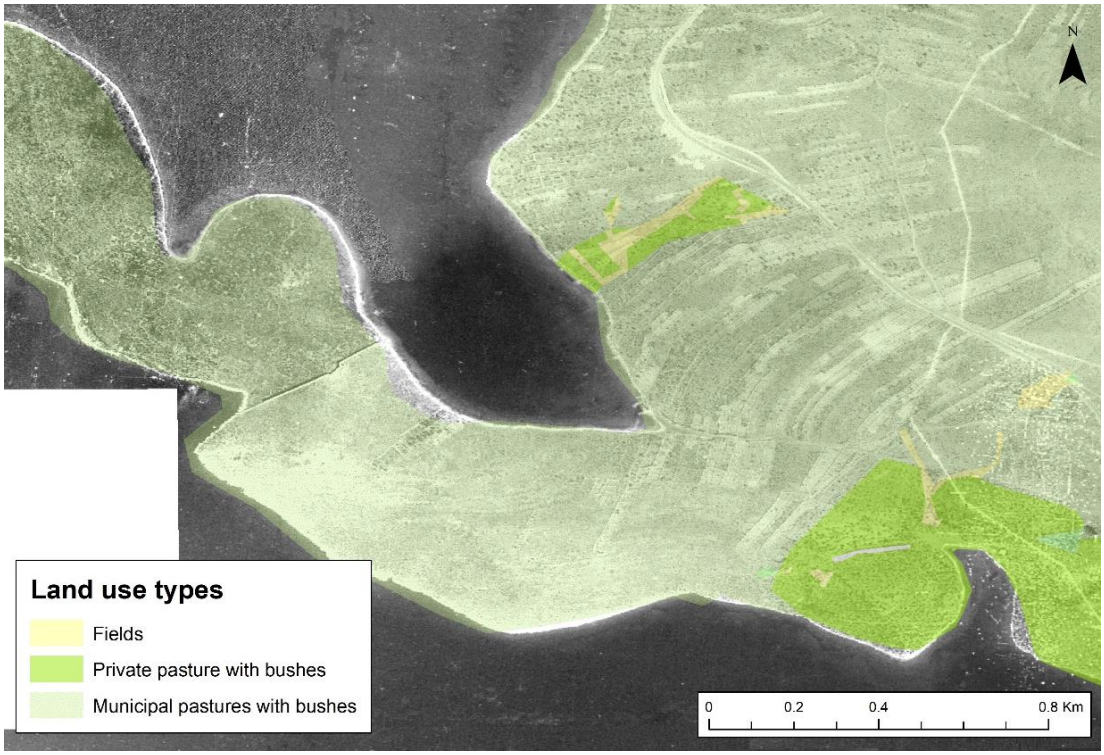


Figure 3.12. Map created in ArcGIS which shows an example of disparities between 1825 cadastral plan and 1968 aerial image of coastal area to the east of Grebaštica village. Deviations are more pronounced in unhabitated areas, but do not significantly affect compairson between land uses in these two periods.

The cadastral plans for the remaining territory of Šibenik district were analysed through the MAPIRE map portal which was created as a collaboration of several central European institutes dedicated to publishing georeferenced cartographic material from the 18th and 19th-century central European countries in an online form. Over time the project has expanded and now covers many countries throughout Europe (Biszak et al., 2017). As a part of a collaboration with the Croatian State Archive, the portal has published a browsable map of Dalmatia made from combined cadastral plans of all communes. Despite claiming that the map is based on original cadastral plans, several notable differences were observed when comparing them with the original plans obtained from the State Archive in Split. There are three main differences between the plans. Woodland parcels on MAPIRE are not marked with additional letters but only with the symbol of a tree, while the symbol for bushes that appears on plans from Split is replaced with a tree symbol making it impossible to distinguish between bushes and coppiced trees. The plans on MAPIRE also do not show corrections from the 1870s. This leads to the conclusion that cadastral plans have been altered in the digitalisation process for MAPIRE or, more likely, they were made from lithographic black and white versions of cadastral plans that can also be found as a part of the original cadastral records. Nevertheless, the land parcels and the type of land use that appear on plans published on MAPIRE are exactly the same as the original plans for Split which enables further analysis of landscape in the 19th century for the whole of Dalmatia. This analysis emphasises the importance of consulting the original coloured plans when studying land use and woodland changes.

In addition to cadastral plans, the Franciscan military survey also produced topographical maps. The original sheets from 1851-1854 covering the territory of entire Dalmatia were digitised by the MAPIRE maps portal, and a single, browsable map was produced. Although made at a smaller scale than the cadastral plans, topographical sheets still show the most important features in the landscape, including private and municipal woodland parcels, which allows comparison with the ones shown on the cadastral plans (Figure 3.13). Little change can be observed in such comparison, so it is likely that since the topographical sheets and cadastral plans were

a part of the same survey, they were made based on the same data. Some of the observed differences include changes in roads, railroads and the area of woodland parcels.

Finally, the third military or land survey carried out from 1869 to 1888 also resulted in topographic maps. These were produced at the scales of 1:25,000 and 1:75,000 and can also be accessed through the MAPIRE maps portal. Whereas the former depicts woodland areas in a simple grey tone, making it easy to locate them and their borders, the latter uses symbols of trees allowing analysis of the density of woodlands (Figure 3.14).

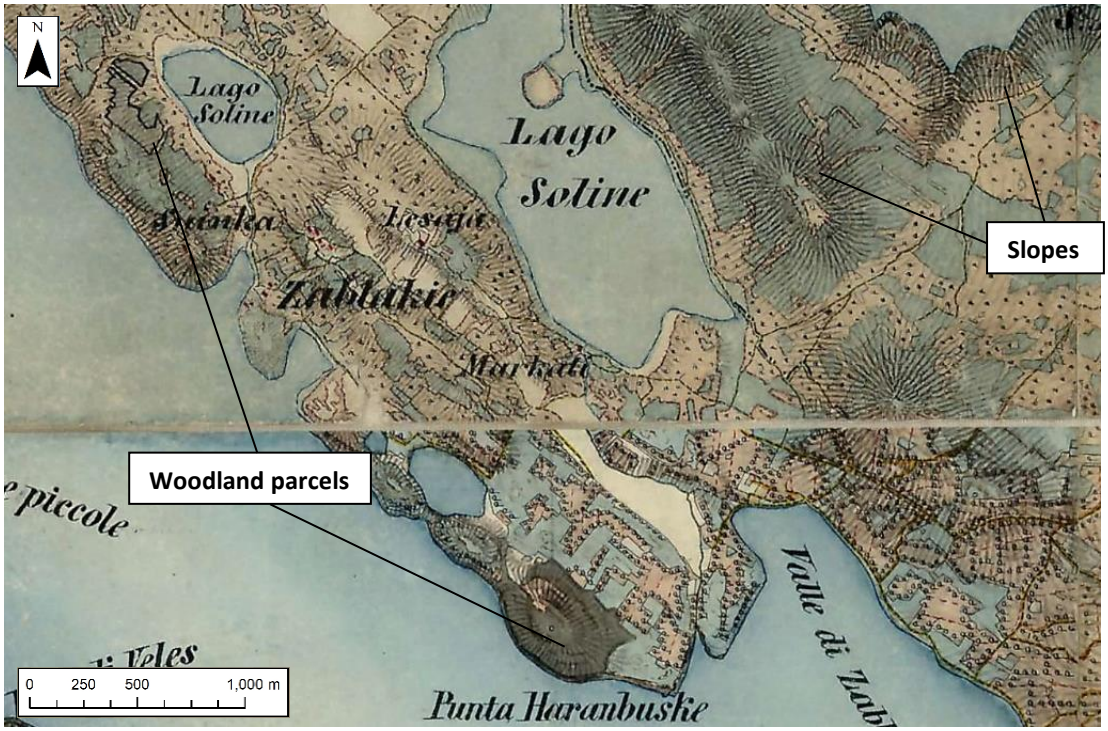


Figure 3.13. The village of Zablaće shown on the second military survey topographic map (1851-1854). The woodland parcels are depicted in dark grey colour, pastures in light green, agricultural areas in orange and slopes by hatching (Source: MAPIRE.eu).

Figure 3.14. Section of woodland near Gaćelezi village shown on third military survey topographical map (1869-1887) in a scale of 1:75,000. The northwestern section of woodland is much denser and was a part of the protected woodland area, while the southern part used to be a municipal pasture that was categorised as woodland in the 1870s (Source: MAPIRE.eu).

3.4. Croatian Forestry Journal

While the archives and cadastral records focused mainly on the territory of Šibenik, one of the major sources for studying the development of forestry in Dalmatia was the *Forestry Journal*. Its first issue was published on 1st January 1877 under the title 'Šumarski list' (*Forestry Journal)* and has been continuously issued each year up to today. With 142 volumes and 1086 issues, it is considered to be one of the oldest forestry journals in the world among those that are still being published (Becheru, 2012). In total 15,865 articles were published with 2,942 authors contributing (Šumari, 2019).

The relevance and context of *Forestry Journal* for this research are strongly tied with the political situation in Croatia since the mid-19th century. In that period, the regions that constitute modern-day Croatia were administratively separated despite all formally being within the Austrian Empire, and this included Dalmatia which was a separate kingdom (Figure 3.15).

Figure 3.15. The political division of Croatia in the Austrian Empire (1815-1868).

When in 1867 the Austro-Hungarian Empire was formed, the Kingdoms of Croatia and Slavonia became the Kingdom of Croatia-Slavonia, and in 1881 Military Frontier was joined with its territory. Since Dalmatia was given promises that it would be reunited with Croatia-Slavonia, the newly formed Kingdom comprising of these three regions was officially named the Triune Kingdom of Croatia, Slavonia and Dalmatia. However, during the fight for power between Austria and Hungary, the Kingdom of Croatia-Slavonia was included in Lands of the Crown of St. Stephen or 'Transleithania', i.e. group of territories under the Hungarian administration within the Empire. Dalmatia, on the other hand, remained politically and administratively distinct and was included in 'Cisleithania', i.e. lands which were under the direct Austrian rule within the Austro-Hungarian Empire.

In these political circumstances, the development of forestry in Croatia proper and Dalmatia was also separated, and this was reflected in the development of the forestry association as well. The association of Croatian foresters officially started to

work in 1876 under the name Croatian-Slavonian Forestry Society. During the first general assembly, a change of name into Croatian-Slavonian-Dalmatian Forestry Society was suggested and immediately accepted by its members. However, for political reasons this was immediately forbidden by the national government, the name reverted and Dalmatian and Istrian foresters were left out of the membership (Šumarski list, 1902). No such association was created in Dalmatia until the mid-20th century.

The *Forestry Journal* was issued by the Society immediately after its formation. Although Dalmatian foresters could not take part in it, their reports and articles, although few, were accepted for publication. They were viewed as 'brothers' by the Society's committee members (Šumarski list, 1878, p.27) and occasionally. Dalmatian forestry was discussed by Croatian-Slavonian foresters as well. However, the lack of content on Dalmatian forestry was supplemented with rich material about forestry of other karst areas in the Empire. As shown in Figure 3.15, the karst environment was distributed across several regions, so the content on karst of Lika, Gorski Kotar near Rijeka and from the Trieste hinterland was very relevant and applicable to Dalmatia. In fact, the forestry management methods adopted in Dalmatia, especially reforestation methods, were first developed in other karst areas of the Empire. The value of content from these areas in the *Forestry Journal* is even more evident since the mountainous territory of Military frontier was under direct rule of the Austrian government, just like Dalmatia.

The *Journal* did not develop its modern scientific and professional form until the mid-20th century so, besides several articles per issue, the other content before the second Yugoslavian period was often informally written. Since the Journal also represented the Society's gazette it was used for communication and exchange of information between foresters in the Croatia-Slavonia Kingdom. This is why much of the content was news regarding the Society itself and the broader forestry community, with membership details, reports from Society's annual assemblies, biographies of notable foresters and news about forestry schools often being published. This makes the *Journal* a particularly valuable source for the study of changing ideas of what constitutes forestry. Other major categories of content

included forestry market reports, sections on hunting, overviews and discussions on government laws and other regulations, book reviews and translations of chapters from foreign languages, reports on international forestry, various discussions and letters from prominent foresters. The last section of each issue brought very short pieces of news from the whole Empire, stories and reports from foresters and local residents as well as valuable statistical data about the whole Empire. Articles and book chapters concerning Dalmatia were mostly written by Croatia-Slavonian foresters and less often by Austrian foresters.

With the dissolution of the Austro-Hungarian Empire in 1918 and unification of Croatian territories under the Yugoslav administration, the Croatian-Slavonian Forestry Society was renamed the Croatian Forestry Society and soon assembled other forestry associations in the new state around itself to form the Yugoslav Forestry Society transforming the Croatian *Forestry Journal* into the Journal of Yugoslav Forestry Society. Although the *Journal* covered a much larger territory than before 1918, there was more content on Dalmatia. In addition, since all the karst areas were again under the rule of one state, it becomes possible to analyse how the problem of karst forestry was approached by the new administration.

During the Second World War the Yugoslav Forestry Society broke up, but immediately after the war in 1946, the Croatian Forestry Society joined the forestry section of the Society of Engineers and Technicians of the People's Republic of Croatia. Because of the long tradition and large readership, the *Forestry Journal* became the gazette of all the forestry sections from all the societies of engineers and technicians across Yugoslavia. In this period the Croatian Forestry Society reported that the *Journal* had failed to meet the needs for professional articles that deal with specific problems forester encountered in the field. Rather, the majority of work was scientific research and theoretical discussions (Šumarski list, 1955). This is why the content of the *Journal* became more practical and technical after the 1960s, which was also reflected in its front covers (Figure 3.16). However, the focus on theoretical content was especially beneficial for this research as one of the goals was to analyse the ideas and concepts the foresters had in the development of forestry in Dalmatia.

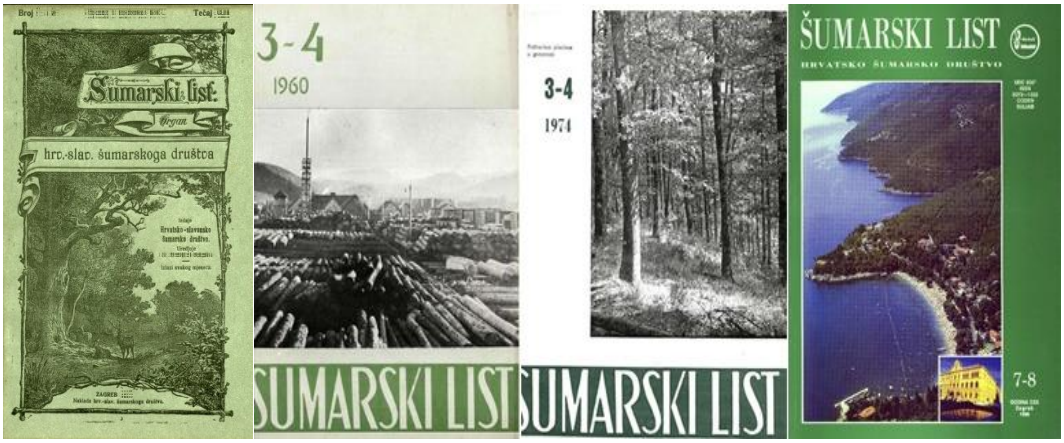


Figure 3.16. Front covers of Forestry Journal issues from 1918, 1960, 1974 and 1996 (from left to right). The cover from 1918 reflects the focus of foresters on the Croatian oak woodlands. Covers from 1960 and 1974 reflect the focus on timber industry while the cover from 1996 reflects the importance of coastal woodlands for tourism.

Recently all 1,086 issues of *Forestry Journal* were digitised by the Croatian Forestry Society and were made available to the public. The issues are sorted by volume and stored in PDF format. In order to find the information relevant for the research, each issue was opened and the contents page analysed. In addition, the PDF tool 'Find' was used to search keywords through the documents on all issues to locate information that was undetectable through article titles and other headlines. Only roots of the keywords were used to include possible variations of a specific word[3], for instance '*Dalm*' was used to search for all variations of the keyword Dalmatia (Table 3.6).

The content published in the *Forestry Journal* represents an excellent source of information for studying Dalmatian forest history because it enables research on ideas in forestry to be traced back 140 years. Although not all content is explicitly related to Dalmatia, it provides valuable details about forestry policies developed during the Austrian and Yugoslav administrations as well as themes and ideas that were influencing foresters and government officials who developed these policies.

[3] In the Croatian language words are declined through seven cases and have three grammatical genders so the proper noun Dalmacija (Dalmatia) could be written for instance as 'Dalmacijom' or 'Dalmaciji' while the possessive adjective would be dalmatinski (Dalmatian) which makes the search of content with the exact word 'Dalmatia' limited.

Table 3.6. Keywords and their root word which were searched throughout issues of *Forestry Journal.*

The root word used through the 'Find' tool	Keyword in Croatian in its nominative case	Keyword in English
'Dalm'	*Dalmacija*	Dalmatia
'Pošum'	*Pošumljavanje*	Reforestation
'Šiben'	*Šibenik*	Šibenik
'Krš'	*Krš*	Karst
'Primor'	*Primorje*	Littoral
'Alep'	*Alepski (bor)*	Aleppo (pine)
'Crnik'	*Crnika*	Holm (oak)
'Česmin'	*Česmina*	Holm (oak)
'Makij'	*Makija*	Maquis

Also, numerous reports from the field and published statistical data make *Forestry Journal* a valuable historical document. This is even more important when considered that professional forest management in this area begun with the appointment of first forestry staff in 1872 and the first issue of the *Forestry Journal* was published only five years later, therefore providing the opportunity to study Dalmatian forestry virtually since its professional beginnings.

3.5. Other sources

A variety of other historical, statistical and photographic sources were also used in the study of Šibenik's woodlands. Travel accounts were especially valuable for analysing landscape in the late 18th century where other types of sources are scarce. This was necessary to understand the state of the Dalmatian landscape and woodlands before this research's study period. The focus was placed on writings by three travellers. The two-volume *Travels in Dalmatia* written by Venetian traveller Alberto Fortis (1778) represents the most important work on Dalmatia for that period. While the first volume focused on the idealised perception of the lives of Morlachs who were largely unknown in western Europe, the second volume provides extensive data on the geography of the visited places. His work compelled Ivan Lovrić,

who studied in Venice but was born in Sinj in the Dalmatian hinterland, to comment and refute some of Fortis' claims, so he published *Observations on 'Travels in Dalmatia' of Abbot Alberto Fortis* (1786) in which he writes about this region from a more local position. Finally, from 1959 to 1966 the Croatian historian Novak (1959; 1960; 1962; 1966) published a series of papers with text from travel accounts of an unnamed Austrian official who was dispatched to Dalmatia by Empress Maria Theresa in 1775 and 1776. The original report in German was kept in Haus-, Hof- und Staatsarchiv in Vienna, but Novak transcribed it in Italian and made it accessible to wider audience. The travel log provides a rich account of the livelihood of the people in Dalmatia in 1775 and 1776 and is regarded as more 'objective' and thorough than that of Fortis as the official's travel was part of a survey that was commissioned by the Austrian government in an effort to identify valuable resources of what they hoped would be a part of their Empire. It is referred to in this thesis as 'Austrian Official 1775/6' with the date of the relevant Novak reference.

Considering statistical data, the data on population and pastoralism were the most crucial for understanding the pressure that was exerted on the woodlands. Mather (1992) concluded that temporal and spatial trends in population change are one of the main factors influencing the woodland changes. In the same time, woodlands in the research area were dominantly used for pastoralism so understanding their interrelation was crucial. To obtain quantitative data, monthly and yearly censuses and reports photographed in the archival collections on the economy of Šibenik district were studied.

Certain issues were observed with data on pastoralism as county officials themselves noted that people would often under-report the number of domestic animals in order to evade taxation. This was particularly the case with goats which were often the target of restrictive government policies. Additionally, quantitative data could not have been obtained for every area of the Šibenik district, so the numbers were often assessed on the level of the district or the municipality. This is because at certain periods there were no official censuses, but rather estimates made by different officials. Additionally, sometimes the statistical data from the municipal authorities varied from that of district authorities even though it was collected for

the same year. This data was nevertheless valuable for the research as it allowed me to analyse and keep a record on the general trends in the area.

Valuable information on woodlands was also obtained from old newspapers which are digitised and stored in City Library Juraj Šižgorić in Šibenik within the Homeland section. Although the majority of written content was political or related specifically to the city itself, occasional news relating to agriculture, pastoralism, tourism or woodlands in general, were used to supplement the findings from the archive. The most valuable among the newspapers was *Šibenski list* (*Šibenik Magazine*) which was issued from 1952 until 1967 and then again from 1978. It was a weekly newspaper of the district and city authorities, so it contained an overview of activities that happened in the whole district, among which the most important for this study were reports on the work of the Šibenik Forestry Office and reforestation activities.

In the process of data collection, postcards and old photographs of landscapes were also collected from individuals, publications and institutions. The oldest photographs are dated to the end of the 19th centuries. Most of the photographs depict the immediate surroundings of the city of Šibenik as this was the biggest settlement in the area while rural areas were not easily accessible due to the lack of roads until 1964. Photographs from later periods are infrequent as cameras were very rare in poor rural communities, especially in the hinterland. The tourist appeal of some locations such as Krka waterfall or Šibenik channel made it possible to acquire repeat photographs of panoramic shots from vantage points, which is most useful for studying broad-scale landscape change (Kull, 2005). The case study of Zlarin island is also more represented on photos as it was a residence of wealthier citizens and had a large international diaspora which visited the island occasionally. Photographs rarely focused on the landscape and woodlands itself, but many showed some woodland in the background and were useful for supplementing written records with visual evidence.

Finally, aerial photography has become a very useful source for identifying different types of vegetation cover over the last century and its application in the

study of landscape changes, and particularly woodland change is highly valued (Watkins, 1985; Rackham, 1992). Often these photos originate from periods characterised by a lack of written records such as war times and are especially valuable for images of remote landscapes that would otherwise rarely be photographed (Rackham, 1992). This is why they were particularly important for visualising remote rural areas of Šibenik municipality.

Aerial photographs used for this research were taken in 1968 by the Yugoslav military and kept in Belgrade, Serbia, until 2013 when they were released to the Republic of Croatia. In 2015 they were made available digitally to the public by the Croatian Ministry of Construction and Physical Planning through the portal 'Information System of Spatial Planning' (www.ispu.mgipu.hr). All the aerial images were georeferenced and combined into a single browsable map (Figure 3.17). The resolution on the images is 5 to 10 metres, with larger deviations in mountains, forests and rocky areas. In some cases, there are indistinguishable areas due to damage or lower quality of the input photos but in general, 98% of the territory of Croatia that is included in the images is of good quality (ISPU, 2018). Images of three case studies were obtained from the portal and georeferenced in ArcGIS. This enabled overlay with land use maps derived from the 1825 cadastral plans and the analysis of woodland change.

Figure 3.17. Digitised aerial view of Vrsno area, Boraja section, from 1968 in the scale of 1:10,000 as seen in ISPU geoportal (Source: ISPU, 2018).

3.6. Oral histories

Forestry in Dalmatia over the last two centuries did not exist as a distinct economic activity in the same way as in the continental parts of the country. Therefore, besides the theme of reforestation, foresters rarely published any work on Dalmatian woodlands. The written material on the interaction of people and woodlands in Dalmatia is covered even less, although the people there used municipal woodlands for centuries for either firewood or animal browsing and pasture. This is why oral histories represent an important method for retrieving knowledge about these interactions. They focus on the micro-scale, that is, a person's intimate knowledge of a particular place in a short time scale (Riley et al., 2005) and are particularly useful in understanding how landscapes and woodlands were used by local residents in their everyday lives (Watkins, 2015). The value of oral histories for this research is even greater as traditional woodland-related practices from the 19th century have carried on in rural areas well into the 20th century (Figure 3.18). This makes the collection of oral histories as one of the best ways to gain access to the valuable knowledge the elderly residents possess.

Figure 3.18. A woman from Split hinterland carrying firewood on her back. Traditional practices such as this one were common in rural areas of Dalmatia throughout the 19th and 20th centuries. (Source: Private archive).

In order to access the personal experience and knowledge that local people possessed, a series of semi-structured and unstructured interviews were conducted. The former enabled respondents to recall information they felt was important, to express their views and perspectives on landscape change and to explore new themes as they were brought up during the interview (Riley, 2005). The aim was to lead the interviews in the form of a two-way conversation in order to avoid imposing feelings of subordination which often arise when the interview is completely researcher-directed and professionally detached (Russell, 1999). Each interview was, however, guided through specific themes that were predetermined based on the previous archival work. They included inquiry about the interviewees' background, land use practices of their ancestors and themselves, their knowledge about local pastoralism, their interaction with local woodlands in the past and present, attitudes and knowledge about reforestation and forest fires, and general social trends of their community over their lifetime. Placing focus on other aspects of life other than woodland exploitation enabled the extraction of other valuable information which might not have been brought up if the interview was focused explicitly on woodlands. Also, placing the theme of woodland in the latter part of the interview and not starting with it allowed the respondents time to reflect on past activities before responding to questions about woodland use. This was seen as necessary after the first respondents reacted dismissively to the idea of discussing woodlands as they believed woodlands did not exist in the area or that they did not possess knowledge that could help the research.

Semi-structured interviews were held on a pre-arranged basis with villagers in the three case studies and forestry-related professionals. Initial contacts were made in the village of Grebaštica where access to people was the easiest because of existing personal contact. From there, with the help of respondents, contacts were made with new research subjects who then referred more contacts, using the 'snowball technique' of sampling (Vogt, 1999). All respondents were older than 55 with the eldest being 87. Interviewed university professors were from the Department of Forestry and Department of Biology in the University of Zagreb while

foresters were from Forestry Office Šibenik and the Institute for Adriatic Crops and Karst Reclamation.

Unstructured interviews were carried out after in-depth semi-structured ones with villagers with whom there was no pre-arranged session. These were elderly people that were approached in different villages within the research area and with whom different themes were briefly discussed in order to gain more information. In the unstructured interview, there was no predetermined list of questions, but rather respondents' narration spontaneously generated new questions by the interviewer in what can be considered an informal conversation (Zhang and Wildemuth, 2009). Each subject was approached with a topic which was specific for the location of the interview and these varied from inquiry about specific woodland or forest fires to pastoralism practices. In general, these interviews lasted from five to thirty minutes depending on the level of comfort and affability of the respondents since they were usually disrupted in their daily chores. They served as a follow-up on themes discussed in semi-structured interviews which needed more perspectives or details and were not recorded. In contrast, semi-structured interviews lasted from 45 minutes to two hours, that is, until all predetermined themes were covered or respondents had nothing more to recollect on, and they were voice-recorded when permission was given. The number of interviewees varied in each case study as it depended on the number of settlements that were within the case study catchment.

Table 3.7. The number of interviews carried out in each case study compared to the total population.

Area	Settlements	Population	Semi-structured	Unstructured
Zlarin	Zlarin	284	3	5
Grebaštica	Grebaštica, Krapanj, Konoba, Brnjača	1107	11	13
Boraja	Boraja, Podine, Vrsno	342	2	7
Forestry professionals	/	/	4	0
TOTAL			**20**	**25**

3.7. Fieldwork

Fieldwork was conducted in 2016 and 2017 in all three case study areas and Šibenik district. A field diary was kept with notes taken in every location about tree species and the overall state of woodlands. Fieldwork was also used to identify areas where pine was spreading, such as abandoned pastures, and for assessing the regeneration of woodlands that were devastated by forest fires (Figure 3.19). Woodlands that were mentioned during the interviews or in the archival records were also visited in order to find evidence of previous activities and management and to assess the changes which have happened since those activities stopped. The overall purpose of the fieldwork was to gain a deeper understanding of the processes that occurred in the woodlands of the research area in order to make informed conclusions about data uncovered throughout the research process.

Figure 3.19. Analysis of Aleppo pine spread on abandoned pastures near Grebaštica village (Photo taken by Charles Watkins in September 2016).

3.8. Conclusion

This chapter has provided an overview of the methods and sources used in the study of the environmental history of woodlands in the Šibenik area. A variety of different sources and methods was utilised and combined to provide a comprehensive understanding of the processes that shaped the area's woodlands. Forestry records from the State Archive in Šibenik and cadastral documents from the State Archive in Split represent the foundation of the research upon which other sources build. The *Forestry Journal* was utilised as the main means of studying the ideas and perceptions that influenced foresters in their development of policies for the karst area of the Austro-Hungarian Empire and Yugoslavia. Due to the continuity of practices, a collection of oral histories has provided valuable data not only for the period after the 1950s but before as well. The implementation of different methods and work with various types of sources made it possible to develop a detailed understanding of the processes that shaped the woodland landscapes of Šibenik district in the 19th and the 20th century.

4. Forest policy, karst woodlands and the idea of reforestation in Croatia and Dalmatia during the Austrian and Austro-Hungarian Empires (1815-1918)

4.1. Introduction

While chapter 5 explores woodland management in the research area from 1797 until 1918, this chapter deconstructs narratives and ideas on forest history of Dalmatia and reconstructs the development of forestry and forestry policies such as reforestation in the whole of Dalmatia. For this reason, although chronologically it is closely related to Chapter 5, it stands alone as a chapter on the historiography of Dalmatian and Croatian forestry. It focuses explicitly on published work by Austrian and Croatian foresters in the Forestry Journal as this was the principal means of communication within the Croatian forestry community. Dalmatia, which was politically separated from Croatia, was not included in this community and most of the debates about forest policies relevant to karst landscapes were developed in other karst regions of the Empire. Later these policies were applied to Dalmatia and had an enormous influence on forestry and woodland management of the late 19th and 20th century. Therefore, this chapter presents and analyses the theoretical background to woodland management in the study area 1797-1918.

The chapter begins with an overview of the development of modern forestry in Croatia and then examines the ideas that foresters had about Dalmatian woodlands and how their perceptions led to the development of specific reforestation policies.

4.2. Development of forestry in Croatia and Dalmatia under the Austrian influence

German forestry in the 18th century was established as a science and a state-controlled profession and quantitative methods measuring tree volumes and growth rates were developed to maintain or expand strategic resources through maximum sustainable yields and profit (Oosthoek, 2007; Wiersum et al., 2013). Maximum

uniformity was encouraged and there was a preference for monocultures of conifers (Lowood, 1990; Radkau, 1996). Forestry schools started appearing in other European countries, from France to Spain, Austria and Russia (Sands, 2013) and the influence of German practices, ideas and theoretical concepts spread rapidly (Lowood, 1990; Oosthoek, 2007; Sands, 2013).

Fernow (1911) argued that Austrian forestry largely developed under the influenced of German ideas and innovations This was confirmed in a monumental five-volume work from 1898, published in honour of the 50 years of the reign of Franz Joseph I, where the rise of Austrian forestry in the 19th century was attributed to timber exploitation along German lines in the forest-rich regions of Bohemia, Silesia and Moravia. In 1848 state forests were placed under the administration of professional foresters who pushed for the first comprehensive forestry law which was passed in 1852 and marked a new period in Austrian, and hence Croatian, forestry. However, the management of state forests was allocated to the Ministry of Finances in 1853 during whose administration more than 50% of state forests were sold off to private owners and industries. State ownership over forests started to recover in 1872 with the establishment of forestry management offices that were run by forestry technicians and professionals (K.K. Ackerbau -Ministerium, 1899).

Forestry continued to develop further due to the rapid increase in prices of timber and other forest products and was tightly connected with the spread of railways. The German practice of clear-cutting imposed the need for more extensive reforestation in contrast to natural regeneration which was a characteristic of the previously dominant practice of selective cutting. (K.K. Ackerbau -Ministerium, 1899).

Because Croatia was politically divided (see Chapter 3, p.59-60) the Austrian influence varied across the regions (Ivančević and Piškorić, 1986). For instance, the first forestry decree in Croatia-Slavonia was implemented in 1769. This was a forestry ordinance on preserving, protecting and managing forests which was passed by Empress Maria Theresa for the whole Habsburg Monarchy. It is regarded as the first forestry law that was translated into Croatian, and because it collected the knowledge on practices in forest management of that period, it was also regarded as

the first forestry management handbook for Croatia (Kesterčanek, 1882d). In some parts of Croatia such as Zagorje region, near the Slovenian border, villagers still followed this law at the end of the 19th century (Partaš, 1892). However, forestry as a practice developed earlier in the Croatian Military Frontier. In this mountainous, forested region three forestry offices were established already in 1765 (Kesterčanek, 1883) which marked the beginning of organised forestry in Croatia (Šumarski list, 2015).

On the other hand, Istria and Dalmatia were under Venetian rule until 1797 and did not become a part of the Austrian Empire until 1814. The regulations enacted by the Venetians and the French at the start of the 19th century were all abandoned when Dalmatia became a part of the Empire (Kesterčanek, 1882e). The first comprehensive law, the Austrian Forest Act (1852), was enacted in Croatia and Slavonia in 1857, in Dalmatia in 1858 and in the Military Frontier in 1860 (Kesterčanek, 1883). However, according to Pjerotić (1886a), neither before nor after the Austrian 1852 Forest Act did organised forestry in Dalmatia exist as such. He argued that some regulations were implemented on the local level, but there were no officials or civil servants who would enforce them, and the protection of woodlands was poorly managed.

The first forestry authorities for Dalmatia were appointed in 1872 as a part of the establishment of forestry offices across the Empire (Oraš, 1940). These officials improved the shortcomings of the 1852 Forest Act with forestry legislation that dealt with specific Dalmatian issues (Wessely, 1878a), but despite this, Dalmatia continued to fall behind other Croatian regions in terms of forestry. For example, the Law on reforestation of karst was implemented in Istria 1866 but Dalmatia had to wait until 1912 (Marčić, 1956). What is more, this Law, as well as the Law on measures for the protection of forests in Kingdom of Dalmatia from 1913, never entirely came to life due to the outbreak of the First World War (Balen, 1927).

Forestry education was dominated by Austrian influence and Croatians were usually taught at the Academy of Forestry at the Mariabrunn monastery, Vienna, founded in 1813. This was considered to be the source of scientific forestry in Croatia

as it was attended by Croatian students ever since it first opened (Kesterčanek, 1881). Forestry was also taught in the Institute and Academy of Mining and Forestry in Banská Štiavnica in Hungary, but this was less popular especially when classes began to be taught in Hungarian rather than German (Partaš, 1892). These academies were attended mostly by sons of wealthy families who could afford tuition fees, particularly those from the Croatian Military Frontier where forestry had a long tradition (Partaš, 1892). Archival records show that in Dalmatia state-funded scholarships for studying forestry at Mariabrunn were promoted for successful pupils, but knowledge of German language was a prerequisite which was problematic as in Dalmatia Italian was commonly spoken.[4]

Eventually, the Croatian forestry students from Mariabrunn sparked the development of scientific forestry in Croatia-Slavonia too. They tried to interlink their activities through the establishment of a forestry section within the Croatian-Slavonian Agricultural Society in 1842. Since its structure did not fit with their plans, in 1846 they created a new association called the Croatian-Slavonian Forestry Society which had 160 founder members in the first year (Kesterčanek, 1881). There was however an intense government crackdown on all nationalist movements in Croatia from 1852 and many members were banished from Croatia. The association was renewed in 1876 under the same name and its work carried on unhindered. Dalmatian foresters, however, were not included in the Society and were left out of this larger network of Croatian foresters (Šumarski list, 1878).

The most substantial amount of activism by the Society during the political crackdown was directed at establishing proper forestry education within Croatia (Matić, 2003). Their efforts were boosted by the fact that the Austrian 1852 Forest Act required that forestry staff had to have a proper level of education and this led to the establishment of the Royal Agriculture and Forestry College in Križevci in northeast Croatia in 1860 (Partaš, 1892). Despite this, many foresters were still forced to study in Mariabrunn to attain a university degree, and eventually, a law from 1894 prescribed that such degree was mandatory for professional foresters (Matić, 2003).

[4] HR-DASI- Šibenik 19.-20.st. Šumarstvo. 14th May 1834. N. 7763/1337

Soon after, in 1898 a Forestry Academy was established within the University of Zagreb and most of the staff from Križevci was transferred there (Anić et al., 2012). This enabled Croatian foresters to attain full forestry education within Croatia and reduced the inflow of foreign experts into Croatian forestry (Matić, 2003).

It was different for forest guards who were recruited from the ranks of ordinary villagers (Marinović, 1919), but there were no schools for their education in Croatia or Dalmatia. Instead, they had to secure positions in schools in the Austrian provinces of Tirol, Styria and Galicia and these opened only in 1881 (Fernel, 1911). Since the position of a forest guard was not well paid, they could rarely attend school in such distant provinces, so they were usually left with only basic skills such as writing and reading (Marinović, 1919).

Since the opening of the college in Križevci happened in the second half of the century, and of the academy in Zagreb only in its final years, for many years Austrian foresters were able to consolidate power within relevant institutions. For example, when the Military Frontier was dissolved and joined with the Kingdom of Croatia-Slavonia in 1881 the chief administrators in forestry remained without exception Austrian officials (Ivančević, 2003). Dalmatian foresters, despite being few, were also supervised by the state forestry officials who were appointed by the Austrian government (Malnar, 1885). Even if they educated themselves in Križevci in Croatia, the Forestry College was established by those foresters who were educated in Austria, so the new generation of Croatian foresters still adopted Austrian ideas. What is more, the college was focused on forestry in Croatia, and it did not provide proper training for working conditions in the karst environment of Dalmatia. Ettinger (1886) noticed that the teaching largely neglected the needs of local people and focused only on deriving value from timber, disregarding the fact that firewood collection and pastoralism posed an essential part of local economies. This is why Wessely (1877b) argued that it was imperative to establish a special forestry school in one of the karst areas of the Empire such as Istria or Dalmatia. However, this did not happen.

The influence of Austrian forestry in Croatia was also present in the professional forestry literature. The review of forestry literature that existed in Croatia in the 19th century compiled by Partaš (1892) shows that all experts on forestry were either Austrian or German foreigners and 'Croatian sons' who were educated in Austrian and German schools which is why the first publications and discussions on forestry issues were written in German. Forests and forestry of karst were markedly underrepresented in the overall literature. The first publication on this topic focused on karst forests of upper Croatia-Slavonia and it was published in 1857. According to Petračić (1928), it was primarily based on the previously published work on karst of Trieste hinterland. In the 1870s and 1880s, Wessely (1877a; 1877b; 1877c; 1888a; 1888b) wrote extensively about the karst of the Croatian Littoral[5] and contributed to the beginning of karst reforestation in Croatia-Slavonia. The number of publications on karst continued to increase after Croatia institutionalised forestry education and incorporated the karst forests of the Military Frontier. Dissemination of forestry knowledge, particularly from the Croatian foresters, become more prominent with the publication of the *Forestry journal* from 1877.

However, the amount of literature on Dalmatian woodlands from the same period is negligible. This is not unusual as the first recorded botanical research on Dalmatian coastal flora dates back to 1825 with the results published in three volumes in 1842, 1847 and 1852 by Visiani (Meštrović and Glavaš, 1997). Partaš (1892) listed only two publications that focused on Dalmatian woodlands, and both were written by Guttenberg (1870; 1872). Out of these, only one was translated for Croatian and Dalmatian readers. In one of his works Guttenberg (1872) also acknowledged that although there was considerable work on the management of forests, it was all written in German because German scientific forestry had advanced the most. He argued that only two comprehensive publications on management of forests were written by Croatian authors, but they were not applicable for Dalmatia because of different environmental conditions. The same issue existed with foreign

[5] Until the dissolution of the Military Frontier Croatia had access to the sea only in the vicinity of Rijeka city and the area was called the Croatian Littoral. After the Military Frontier was merged with Croatia, the coastal territory of the Frontier was also recognised as the Croatian Littoral. This is in contrast to the Austrian Littoral which corresponded with Istria, contemporary Slovenian coastal area and vicinity of Trieste.

forestry books and he argued that these all discussed 'forests of the north and central Europe where forests are made of tall trees and composed of fir, spruce, black pine, larch, beech, oak and others. But the forests of central Italy, Dalmatia, Spain and Greece … demand different management. Even if translated in the appropriate language, the existing forestry books would be unusable for southern provinces, since, for instance, of all the tree species that exist in other Austrian provinces, only two can be found in Dalmatia – oak, although of a different variety, and elm' (p.4). He believed that the weak state of Dalmatian forestry was a direct consequence of the inexistence of forestry books in the native language.

4.3. Narratives on Dalmatian forest history

One of the most critical factors that shaped the development of forestry in Dalmatia was the fact that Dalmatia as a region was characterized by karst. The term *karst* in the 19th century was not exclusively linked to geology and petrology but was also used to describe barren, rocky landscapes with a distinct lack of vegetation. Also, for the most foresters, the karst was something that was created by people. For instance, Kramer (1889) concluded that the karst 'spread' with the destruction of trees while Vučković (1904) argued that it was 'created' through erosion of thin layers of soil after trees had been removed. According to the Austrian Ministry of Agriculture, karst landscapes were those that had 'rocky surfaces which were overgrown with rare, but good grass and were therefore used as pastures' (Šumarski list, 1905a, p.271). This notion that karst is something that is not natural but rather a product of human activities was almost unanimous within the Croatian forestry community.

Since forestry in Dalmatia was not as developed as in Croatia-Slavonia, the research on karst woodlands was focused on the Croatian part of the karst where it did thrive. Because of this, for most of the 19th century, Dalmatian woodlands were approached from the insights foresters gained from this area. However, they rarely took into account that the Croatian karst was a mountainous region, with a very different climate and vegetation than Dalmatian karst. One of the most important

works on the Croatian karst was written by Wessely[6] (1877a; 1887b; 1887c; 1878a; 1878b) who focused on the coastal part of what used to be the Military Frontier. In his research he drew many parallels with the landscape of Dalmatia, and his work embodies the main paradigms that existed within the forestry community of the 19th century: 1) karst was initially covered with lush, high forests only centuries before the 19th century and those had been destroyed through deliberate cutting, 2) the lack of forests on karst was the main reason those regions were impoverished, and this had to be mitigated through reforestation. The idea that karst used to be covered with high forests was also present in the relevant bodies of the Austrian government (Wessely, 1877a; Šumarski list, 1905a; Fernel, 1911).

Among the many influential 19th century Croatian foresters who held a similar view, Kesterčanek[7] was especially important and influential. He was praised by contemporary Croatian foresters as one of the most important foresters in Croatian history because he was the first who wrote extensively about the history of the nation's forests (Petračić, 1956; Frković, 2015). Since he was a lecturer at the Royal Agriculture and Forestry College in Križevci, which was the only institution for forestry education in Croatia until the end of the century, his views were passed on to generations of young foresters.

Kesterčanek's work is characterized by the idealisation of the relationship that Croatian ancestors had with their forests: '… traditional games and customs prove how much the Croatian people valued forests since the ancient times, as they were not only a source of so much useful and needed timber but a source of their joy, games and entertainment' (Kesterčanek, 1882b, p.117). He summarized this

[6] Wessely, Josip (1814-1898) is considered as a veteran of Austrian forestry. He was educated in forestry sciences in Imperial Academy of Forestry at the Mariabrunn near Vienna where he was born. Afterwards, he worked in government service, obtained his first teaching position as a forestry professor in Aussen and in 1855 joined the service of State railroad management. Soon after he became the chief inspector of Austrian Empire's resources and from 1867 until 1870 was the headmaster of Academy of Forestry at the Mariabrunn. After Austria decided to reforest and cultivate barren karst areas, he dedicated himself to the study of littoral karst area of Military Frontier and was later recognised as having a key role in beginnings of reforestation of Croatian karst (Biškup, 2000).

[7] Kesterčanek, Fran Žaver (1856-1915) was born in Zagreb but he finished his forestry education at Imperial Academy of Forestry at the Mariabrunn. In 1878 he was appointed as an assistant of forestry profession at Royal Agriculture and Forestry College in Križevci. During his early career he was an advocate of moving the Forestry College to the University of Zagreb as a separate department. This happened in 1898 and Kesterčanek was appointed as professor of forestry (Biškup, 2000).

relationship by arguing that 'forests provided our grandfathers with so much and with a variety of goods and benefits since the ancient times and only through this we can rightfully confirm that our people forever knew how to understand and appreciate the richness of their forests' (Kesterčanek, 1882b, p.119).

However, he contrasted this view with condemnation of the Republic of Venice which had conquered Dalmatian coastal areas 'not because of our fertile lands but mainly because of our forests (Kesterčanek, 1882b, p.121). He described Venetians as 'greedy and soulless merchants, lustful only for riches and wealth' and attributed the creation of karst to the Venetian legacy: 'This is why the otherwise famous Venetian Republic, despite all of its fame, art and economy, left for the history of Croatian culture a sad monument of its barbarism which will for ages remind us about the rule of Venetian lion and that monument is our devastated and barren karst!' (Kesterčanek, 1882b, p.121). Kesterčanek (1882b; 1882d) argued that through the course of five centuries Venice had cut down millions of Dalmatian trees which were then used to build up Venetian capital which consequently transformed much of Dalmatia into a wasteland. The forestry policies that did exist in Venetian Dalmatia he attributed to a belated attempt to save the forests after they had realised the damage they had done (Kesterčanek, 1882d).

However, Kesterčanek was not proposing a new view here as Wessely (1877a) argued that books and popular belief often blamed the destruction of forests on Romans and Venetians. Pjerotić (1886a) and Kosović (1909) also confirmed that this narrative was widespread among the common people, but it was also evident in the foreign literature on the Croatian karst (Prestini, 1885). However, in the years following Kesterčanek's publications this became a common explanation of forest disappearance on the karst (Šumarski list, 1886b; Šumarski list, 1887a; Radošević, 1892) and the same narrative was the perceived opinion in forestry publications of the mid-20th century as well (Marčić, 1935; 1956; Vajda, 1954).

In contrast to Kesterčanek, some foresters did not accept that Venice was the only and the main reason for forest destruction and emphasised the role of malpractices by local people. Pjerotić (1886b) suggested that the blame on Venetians

had political origins while also argued that shifting the blame on others came naturally to Croatian foresters. He made a comparison with the mountains of the west European karst and forests of central Europe which he described as also deforested but without Venetian influence. Additionally, he argued that it was impossible to thoroughly understand the impact of Venetian government in Dalmatia because the archives of the Dalmatian national government at the time were sealed away which left many vital documents inaccessible to historians, thus creating room for a lot of speculation.

Wessely (1877a) attributed most of the 'spreading of karst' to the local population whose 'uncontrollable use of pasture' was 'the demon devastating the hillsides' and that 'the population itself has ruined its own country and the future of their grandchildren' (p.59). He emphasised their reliance on goats and sheep which had prevented the natural regeneration of trees in the Military Frontier and consequently left them in poverty and 'all the Littoral a barren rock…' (p.63) (Figure 4.1). In Dalmatia, he argued that that the people lived in the widespread poverty which in turn led to overexploitation of woodlands (Wessely, 1877a). This is why, he argued, 'wherever we look or reach in that horrible edge of our otherwise advanced Monarchy, everything is desert and bare' (Wessely, 1877c, p.244).

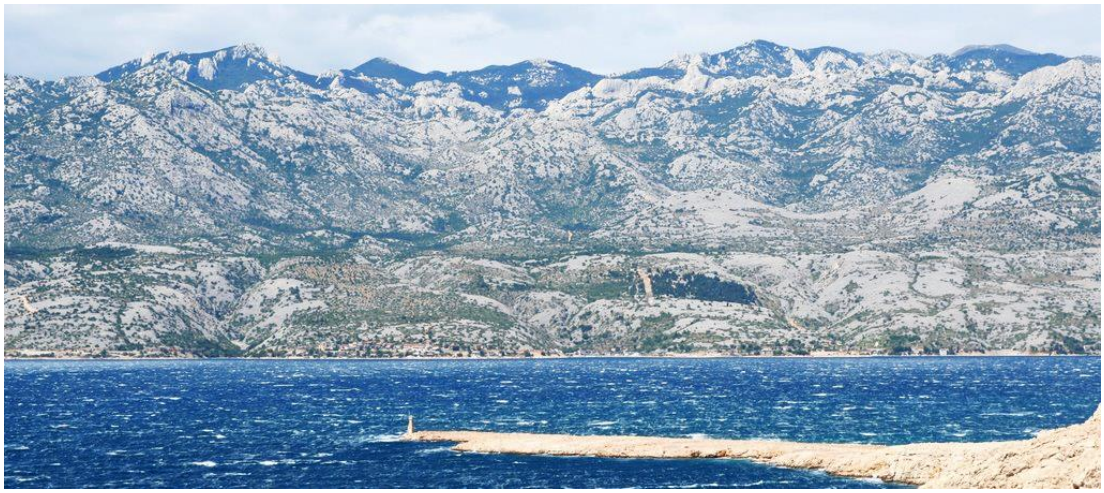


Figure 4.1. The coastal side of Velebit mountain viewed from Maslenica bridge in September 2018. The mountain range spanned across the coastal part of the Military Frontier and later of the Croatian Littoral. It represents the northern and north-western border of Dalmatia. For many foresters in the 19th century, the notable karst features of the coastal side of Velebit were seen as a proof of destruction of forests, particularly by Venetians (Photo taken by Boris Kačan).

There was also a third opinion about the history of Dalmatian forests and their disappearance which was represented by Kosović (1909).[8] He was the only forester who argued that neither Venice nor the local people were responsible for the destruction of Dalmatian forests. He observed that the karst was more widespread in the territory of the former Military Frontier which was outside of Venetian governance, than in Dalmatia where Venice ruled for more than three centuries. What is more, based on analysis of historical maps he concluded that the Croatian karst of the Venetian period was not much different from the karst of the 19th century (1914a). This is because he questioned the paradigm that the forest was a natural state of the karst (1909; 1910). In other words, Kosović placed the disappearance of forests further back in history and argued that the pastoralism and woodland exploitation only prevented regeneration of forest in some areas where it had already been long gone.

Kosović based his conclusions on archaeological findings (1909), historical documents (1914a; 1914b) and the latest findings in geology (1910). For instance, based on the analysis of surface graves of Iapydes tribes from the start of the CE, he concluded that the soil had already been washed away in that area otherwise the graves would have been buried by subsequent deposits. It was similar with the Roman graves which were carved into barren rocks on the surface, and he argued there was no geological evidence of soil deposits in the shallow waters near the coastland that would point to massive historical erosion. He analysed the 1572 map of the Military Frontier and observed that the coastal sides were depicted treeless, while the continental side was covered in forest. This was the period before the

[8]Bogoslav Kosović was born in Lika (Croatian Military Frontier) where he worked for the most of his life. He was educated in Vienna University for Soil Culture which was created in 1872 into which the Imperial Academy of Forestry in Mariabrunn was incorporated. He worked in the forestry service in various parts of Croatia and Slavonia and in 1905 he was assigned at the forestry department of the National government of Croatia. During his lifetime he was often in the conflict with his superiors, both in forestry and in politics, which is why he was forcibly retired in 1923. After a change in government he was brought out of retirement as an assistant in the Ministry of Forests and Mining but was once again he was retired only one year later because of another change in the politics. He was successful in reforestation of the heaths of Lika, made considerable contributions to forest regulations and management in different parts of Croatia and during his career wrote many important articles and publications. From 1912 until 1916 he was the chief editor of the *Forestry Journal*.

massive immigration of the Morlach population, so his conclusion was that the general condition and distribution of woodlands had changed little over 300 years.

Despite Kosović's well-established position and reputation, he was alone in the forestry community in his views. There was no other forester in the late-19th or the early 20th century who supported the idea that high forest was not a natural state of the karst and that forest cover had been intentionally destroyed by people in the recent history.

4.4. Common land and pastoralism as causes of karst

There was a lot of debate among foresters about how exactly people destroyed forests and what could be done to mitigate this. They examined especially the influence of land use and land ownership.The French administration in the first years of the 19th century identified the lack of private property as the main problem for woodland management and protection. The administration argued that the idea of progress and development was strictly related to private ownership and contrasted this to the devastation in municipal (communal) woodlands because they were used by people who only considered their immediate needs and did not think about the consequence of devastation.[9]

In the late 19th century, a team of scientist sponsored by the Austrian Ministry of Agriculture also argued that the principal cause of the disappearance of forest cover on karst was linked with the ownership of the land. They emphasised that preserved patches of forests in the karst regions were all state or privately owned, while those that were in municipal ownership and used as common land were devastated and degraded (Austria K.K. Ackerbau -Ministerium, 1899). Wessely (1877a) also observed that 'Barren wastelands were unregulated municipal property' and contrasted these to private properties which he described as 'lush oases' amid karst (p.59). The reason for this destruction of forests on municipal land, according to Wessely (1877a; 1877c) was that people were greedy, cared only about their immediate needs and acted upon the presumption that whatever they did not use

[9] HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c*. 1809-1812. *Circolare ai Capitani circolari ed alle Preture*. N. 11641-359.

would be used by somebody else. He noted that that local people did not treat their private properties in the same way and concluded they were fully aware of the negative consequences of overexploitation.

However, the foresters believed that the devastation in municipal lands was not caused by illegal cutting, rather they blamed the browsing of goats and, to a lesser extent, of sheep (Wessely, 1877a; 1877c; 1879; Guttenberg, 1881). Wessely (1877c) explained that even though more than 50% of the karst were pastures and infertile areas, the condition of those pastures was such that they could not support large numbers of animals. Because they provided grass of meagre quality, it was necessary to release goats and sheep into woodland where they browsed trees stopping their regrowth. The surveys on pastoralism across the Empire, which Wessely used to support his arguments, showed that karst areas of the Empire indeed had more than double the number of goats compared to the non-karst areas. As a result, Wessely argued that the remaining vegetation in Dalmatian karst would disappear within the next 60 years if the trend was not reversed.

As a solution, Wessely (1877c) proposed that 'existing municipal pasture lands and forests should be transformed into an untaxable private property as soon as possible' and that any areas 'reasonably left as municipal land should be subjected to proper and strict management which would create a well-managed municipal property from what used to be nobody's land' (p.251). These ideas were accepted by the Austrian Ministry of Agriculture and used as a justification for implementing the Law on the partition of municipal goods. The Law was based primarily on the German model of land division and was implemented in Dalmatia in 1876 (Preyer, 1878). In practice, the Law had little effect because its implementation depended on the will of municipal authorities who were often controlled by those who owned large numbers of animals who had the most interest in keeping large areas of common land (Guttenberg, 1881; Petrović, 1910). Guttenberg (1881) strongly advocated that the Law on the partition of municipal lands should be obligatory, but according to Petrović (1910) the issue of unsustainable use of common lands remained unresolved.

Foresters also promoted laws to restrict the number of goats. In 1764 the Austrian government implemented laws in the Military Frontier to reduce the number of goats, but the local population ignored them and the number of goats continued to grow (Wessely, 1877a; Petrović, 1910). Wessely (1877a) argued that a ban on goats was essential and that goats were 'a genuine evil, a real Satan that created all those horrible wastelands' (p.78). He explained that browsing transformed trees into shrub-like, shrivelled vegetation and prevented regeneration. He also argued that this was well known among local people who consequently did not allow their animals to browse on their own private property but sent them to municipal woodlands (Wessely, 1879). Goats were often left in woodlands without supervision or with children so the goats would roam even in the protected areas of woodlands. The adverse effect of goats was made worse by the limestone bedrock (Wessely, 1877a) and the mild winters in Dalmatia which allowed browsing throughout the year (Vučković, 1904).

In 1873 a law was passed which gave municipal authorities the right to ban goats from woodlands and consequently browsing, and grazing was banned on 455,000 ha of karst (Šumarski list, 1905a). However, Zikmundovsky (1885b) reported that as with the Law on the division of municipal goods, municipal forestry staff had problems with implementing the ban on browsing because the municipal authorities opposed it. Also, in many cases when the Law was successfully implemented, it had to be repealed after individual complaints since the regulations were not well founded in the Forestry Act itself (Wessely, 1878a). The regulations were also opposed by the poorest people since sheep and goats were the essential elements of the peasant economy providing profits unobtainable from the cultivation of crops (Ettinger, 1886). According to Siddle (2009, p.524) 'for the poorest in the rural populations of the Mediterranean region, the goat held the same position on the subsistence economy as the cow held in northern and Western Europe' as it represented not only a source of meat and milk but a wide range of other use derived from its skin and horns.

Wessely (1877a; 1877c) believed that the regulations failed because no money was invested in improving people's livelihoods and as a result, he argued,

people lived in medieval conditions. Consequently, it was almost impossible to implement proper education or steer the economy in a direction other than agriculture and pastoralism. Due to these conditions, Wessely (1877a) argued that 'only state government with energetic, regular measures' could improve the situation but that these needed to 'be adapted to the needs of the people in order to succeed' (p.64).

4.5. Reforestation

4.5.1. The beginnings of reforestation

There is evidence that reforestation of previously destroyed or devastated woodlands in Dalmatia was implemented under Venetian rule in the 17th and the 18th century. These were government-led initiatives which mandated obligatory planting of oak seedlings in every privately-owned woodland parcel in an effort to secure a supply of shipbuilding timber (Jedlowski, 1975). However, it is not clear whether these schemes were successful.

In the short period of French administration in Dalmatia (1805-1814) reforestation was again implemented to mitigate what the French perceived as firewood and timber shortage (see Chapter 5). The short period of French rule did not allow significant reforestation, but this did not stop Kesterčanek (1882c) from praising the French attempts as revolutionary in terms of Dalmatian forestry.

The first organised attempts of reforestation of karst in the Austrian Empire began in 1842 on the hills behind Trieste (Figure 3.15, p.60). This attempt failed but was redone in 1857 and again in 1859 when good results were achieved (Tomašević, 1979). Wessely (1877c) stated that the term 'karst' originated in the hilly hinterland of Trieste and was later used for landscapes with similar characteristics. After reforestation in Trieste similar attempts begun to spread in other karst regions of the Empire including Istria and Croatian Military Frontier. The first notable reforestations there were carried out in 1865, both in coastal and mountainous areas (Oraš, 1940; Vajda, 1955). In the same year, the assembly of the Austrian Forestry Society held in Trieste had a focus on the future of karst forestry, and foresters discussed the

techniques of karst reforestation, selection of species and obstacles for achieving reforestation goals (Petračić, 1928). Tomašević (1979) argued that this period marked marks a shift when the topic of karst forestry specifically started to centre on the theme of reforestation. My analysis of articles published in the *Forestry Journal* confirms this as Croatian foresters almost never approached karst woodlands from the perspective of traditional management for firewood collection. Ever since it was published in 1877, the topics of karst forestry in the *Forestry Journal* were equated with reforestation.

The rapid expansion of reforestation quickly led to its institutionalisation. This happened with the creation of the Royal Inspectorate for the Reforestation of Karst in the Military Frontier (*Kraljevsko nadzorništvo za pošumljenje krasa krajiškog područja*) in Senj in 1878. The Inspectorate for Reforestation represented the first special karst forestry organisation in Croatia-Slavonia. The impetus for its creation was given by the Austrian commander of the Croatian Military Frontier Antun Mollinary and chief of Frontier's forestry Milan Dürst. After considering several different scenarios for revitalising the economy of the Frontier, they accepted that reforestation would bring the most significant social and economic prosperity to the population of the coastal area of the Military Frontier. Several tree nurseries were established and soon the extensive reforestation of the coastal Military Frontier was underway (Ivančević, 2003).

There are no records of reforestation in Dalmatia until the 1870s. According to Wessely (1878a), the first forestry officials appointed in Dalmatia in 1872 focused on the preservation of municipal woodlands for firewood and did little reforestation. However, this changed after the establishment of the Inspectorate for Reforestation. In 1880 Zikmundovsky (1880) reported that the seeds from nurseries had been acquired by the Dalmatian governorship and were distributed to municipalities and agrarian societies in order to proceed with the reforestation. Also, the amount of funding for Dalmatian forestry by the Austrian and the Dalmatian government started to increase steadily, along with the number of forestry staff. The seeds that were acquired from outside Dalmatia, mainly Croatia-Slavonia and the Inspectorate for Reforestation, were also used to establish new nurseries in Dalmatia the most

important of which were the Imperial and Royal nursery of Kotor (in contemporary Montenegro) established in 1881 (Šumarski list, 1882c; Šumarski list, 1885) and the one near Zadar (Zikmundovsky, 1885a). The closest to Šibenik was at Tisno which opened in 1884 (Šumarski list, 1885).

An important impetus for the development of reforestation in Dalmatia was the management of torrents and gullies which began in 1882 and 1883 (Šumarski list, 1882d). The works had been induced by unusual flood damage in Tirol and Carinthia provinces in Austria in 1882 (Fernel, 1911) and Dalmatia was the first territory of the Empire where hazard mitigation was carried out not only with walls and digging of canals but through reforestation according to the French model (Šumarski list, 1883b; Hauesie, 1928). The whole basis of the legislation for flood reduction was developed through the translated work of the French forester Demontzey while a Law for the regulation of torrents was enacted in 1884 (Fernel, 1911). A special department for management of torrents and streams in Dalmatia was established at Zadar in 1888 under the administration of Imperial and Royal forestry inspector for Dalmatia (Šumarski list, 1887b; 1888b). The Law on the management of torrents was implemented in the Kingdom of Croatia-Slavonia a decade later, in 1895 (Hauesie, 1928).

This further increased the importance of reforestation in Dalmatia as well as the amount of funds allocated for the forestry activities in the region. The amount of forints[10] designated for Dalmatian forestry by both Austrian and Dalmatian governments steadily increased from 10,175 forints in 1879 (Šumarski list, 1882d) to 16,531 forints in 1882 (Šumarski list, 1883c). This was also followed with an increase in funds for seeds and plant nurseries which increased from 1,465 forints in 1877 to 3,128 forints in 1881 (Šumarski list, 1882d). By the end of the decade, the Ministry of Agriculture dedicated 22,700 forints for Dalmatian forestry, out of which 4,500 forints were allocated for nurseries and 5,000 specifically for reforestation activities (Šumarski list, 1888c).

[10] The Gulden or forint was the currency in the lands of Habsburg Monarchy from 1754 to 1892 when it was replaced with Krone.

4.5.2. Reasons for reforestation and selection of tree species

Afforestation was the dominant forestry policy of foresters in the 19th century in karst areas although it was usually termed 'reforestation' as this accorded with the idea of returning them to woodland after a period of devastation. Foresters argued that forests were beneficial for the overall progress of society which could not be achieved without them. Dudan (1892) noted that 'Reforestation of coastal karst is indeed a vital issue of our unfortunate fatherland, as the prosperity of this area was destroyed together with the forest, only by the planting of forest could it be brought to life again' (p.341). The importance of forests for the prosperity of the country was indicated by Pleša (1907) who argued that 'The most accurate indicator of one country's economic progress is its forests' (p.420).

It was not uncommon for foresters to link the collapses of prosperous civilisations such as Carthaginian, Mexican, Mesopotamian, North African and Greek with the disappearance of forests (Šumarski list, 1886c; Kauders, 1904). Forestry supervisor Rybak (Šumarski list, 1886c) wrote that all these civilisations had faced a collapse once their people overexploited forests because this had caused climate change: 'In countries with scarce forests one can encounter destructive summer heat, dry soil, rare but fierce and dangerous rainstorms as well as extreme winter cold with gales; on the other hand forested countries have less extreme summers with frequent warm rains, while the forested sides of mountains protect them from gales and winter cold' (p.361). Pleša (1907) argued that where less than 35-40% of the land was wooded 'poverty prevails because abrupt weather changes devastate other branches of the economy' (p.420).

This interconnection of forests and climate was often emphasised by foresters as the argument for reforestation. Guttenberg (1881) explained that forests collected and stored moisture from the air and thus prevented droughts, while Vac (1905)

thought forests had a crucial role in the formation of precipitation. Wessely (1877a) argued that forest loss increased the severity of droughts in Croatian karst areas. A report published in *Forestry Journal* (Šumarski list, 1888a) justified reforestation by noting that Egypt experienced 5 to 6 rainy days before forests were planted and 64 days after forests expanded. Forests were also praised for the mitigation of strong winds (Vac, 1905), particularly the harsh bora wind which blows in coastal Dalmatia (Guttenberg, 1881; Pleša, 1907). According to Wessely (1887a), the bora increased in strength following the disappearance of trees on the coastal side of Velebit mountain. Forests were also considered essential for maintaining the flow of rivers, and smaller streams and floods from Sicily, Greece, Mesopotamia, and Lika were given as examples of adverse effects of forest clearance (Šumarski list, 1886c; Dudan, 1892; Kauders, 1904; Vac 1905).

However, the interconnectedness of climate, floods and forests was not an idea that was promoted only in the Austrian period. Already at the start of the 19th century, the French administration in Dalmatia tried to emphasise the environmental importance of woodlands by referencing the popular beliefs of their time. Namely, they claimed that forests exerted influence on climate, regulated the movement of air masses from seas, protected from winds, sunshine and floods and mitigated extreme temperatures.[11] It is exactly at this time that the debate on the influence of forest cover on climate and water flows had started to develop in France and proponents of these ideas spread them in conquered regions (Andréassian, 2004). While in the Austrian period these ideas were disseminated through articles and discussions in the *Forestry Journal,* in the French period the central Dalmatian government headed by the French governor sent circulars to municipality authorities to justify and bolster the reforestation as will be evident in chapter 5.

A letter from the Dalmatian National government in 1902 reveals that mitigation of torrents and protection from winds was still of concern a century later. The National government stressed the fact that barren karst magnified damage from sudden downpours of rain and torrents and that the fertility of such areas was

[11] HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c.* 1809-1812. *Circolare ai Capitani circolari ed alle Preture*. N. 11641-359.

continuously decreasing so it was imperative to reverse the trend. They also urged the Ministry of Agriculture to focus reforestation not only on devastated woodlands and barren areas with frequent torrents but also on areas along public pathways that needed protection from the harsh bora wind.[12]

Reforestation was also seen as a way to improve local economies with the creation of the exploitable resource. According to Kosović (1914a) already in the 18th century, the Austrian government promoted the planting of oaks in the Croatian Littoral for the use in the shipbuilding industry. Nanicini (1881) argued that reforestation of karst was directly tied to the financial progress of Croatian people and Laksara (1880) and Nanicini (1880) discussed specific financial gains that could be obtained from planting different tree species. In different reports (Šumarski list, 1877; Čelija, 1879; Nanicini, 1882; Šumarski list; Ettinger, 1884; Stiasny, 1886; Šumarski list, 1882b; 1889b; 1906) many foresters discussed how the choice of species could promote local economies. However, the creation of forest cover with exploitable timber was often seen as an ideal solution.

Wessely (1877a) argued that 'reforestation should primarily promote the planting of forests because… [they] can create a layer of black soil[13] in such quantities that are needed for a compact vegetation cover.' He also thought that 'since the remaining soil on karst is not suitable for agriculture, forest brings the best benefits because of the value of timber and the proximity of the coast which is why all karst is naturally predisposed to be overgrown with forest…' (p.69). Vac (1905) also believed that karst soil had no other purpose but to support high forest due to its low fertility. This was supported by Guttenberg (1881) who also promoted extensive forest cover because only large patches of forests could be subjected to systematic management for economic purposes.

Wessely (1877c) was convinced that reforestation would mitigate the negative economic effects brought through deforestation. He believed that 'Because of deforestation the Austro-Hungarian karst lost half of its productivity, which would

[12] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 6th December 1902. N. 34330.
[13] Black soil on limestone is called Calcomelanosol.

be same as if the Monarchy lost 290 square miles of land and a quarter of a million of souls, that is, one small kingdom' (p.242). According to many foresters in the late 19th century, the disappearance of forest cover led to soil exhaustion, low agricultural productivity and poverty. Forest cover was then seen not only as a source of timber but a way of replenishing soil cover which would then restore the productivity of the region (Kramer, 1889; Fuksa, 1902; Šumarski list, 1904; Petrović, 1910). For example, Čelija (1878) explained that the reforestation of Grobnik polje in the hinterland of the Croatian Littoral was influenced by the idea that it would lead to soil improvement. Various reports that looked into the selection of tree species for reforestation explicitly focused on their ability to improve the soil (Zikmundovsky, 1880; Fuksa, 1902; Šumarski list, 1904; Petrović, 1910). Other foresters noted that once the newly created forests had improved the soil and habitat conditions, the species could be replaced with more desirable ones (Fuksa, 1902; Šumarski list, 1904; Petrović, 1910).

By the end of the Austrian period, reforestation policy had started to mainly focus on the replenishment of soil which would then bring about the economic prosperity through the cultivation of newly created productive areas. As Kosović (1914a) summarised it 'the Austrian foresters have set the main goal of reforestation of karst: through the growth of tall trees to create, no matter how barren the land may have been, woodlands, pastures and the thick layer of humus which had allegedly existed before it was made barren'. (p.13). Indeed, foresters often wrote how reforestation would restore the ruined landscapes to their once pristine state and to 'make Dalmatia green again as it was before the Venetians came' (Šumarski list, 1877a, p.178).

However, for a few foresters reforestation was also seen as a way to increase the appeal of the landscape. This perception of karst landscape as something horrible in opposition to forest cover as something visually pleasing was first made explicit by Dudan (1892) who argued that reforestation 'among other various benefits also beautified the surroundings' (p.345). Hirc (1900) emphasised the benefits of holm oak for 'covering up the horror of the karst' (p.7.). These aesthetic values of afforestation were to become more important as tourism developed in the 20th century.

The careful selection of tree species for karst reforestation was crucial for its success. In assessing the benefits of particular species, foresters would consider their speed of growth, suitability for poor soil conditions, the ameliorative effect on the soil, costs and methods of planting and the economic benefits. Many of the species discussed never became important. For instance, Cork oak (*Quercus suber)* was suggested as a very profitable species because of its use in railway building, as evidenced by experience in other European countries (Šumarski list, 1877). Nanicini (1882) strongly recommended *Eucalyptus amygdalina* for Croatia-Slavonia and Dalmatia noting that it was recommended by the French foresters because of its ability to grow on degraded soil and its timber. Stiasny (1886) recommended *Eucalyptus globulus* because it grew particularly fast, its timber could have been used for local shipbuilding and leaves for the production of dyes. Some other species were considered because of the value of their by-products in a desire to find species which would improve the local economy and make tree planting popular with local people. For instance, the fruit of the carob tree (*Ceratonia siliqua*), which grew in the wild in the south of Dalmatia, was seen as a possible source of income for local people (Šumarski list, 1906), while the mastic tree (*Pistacia lentiscus*) was suggested for the profitable production of mastic (Šumarski list, 1889b). There were other examples such as *Tamarix gallica var. mannifera* which was used in the production of manna, nectar of high value, and the smoke tree (*Rhus cotinus)* which was considered well adapted for karst environment and potentially useful for economic exploitation by local people (Šumarski list, 1889b). However, none of these species were commonly planted.

The selection of tree species for reforestation were strongly influenced by the first reforestation attempts in the hinterland of Trieste. In the first attempt deciduous oaks, ash and hornbeam were planted, but because of a severe drought, the seedlings died. In subsequent attempts, only some conifers survived in the areas which were protected from the bora wind. Among them the Austrian or black pine[14] (*Pinus nigra austriaca*) proved to be the most successful and further successful plantations that

[14] *Pinus nigra var. Austriaca*, should be differentiated from *Pinus nigra subsp.Dalmatica* which grows only on the most elevated parts of Brač island in the south Dalmatia and is considered a relict (Farjon, 2013).

resulted in stands of tall trees were made with this species (Šumarski list, 1905a). Guidelines for reforestation were developed from the Trieste reforestation scheme for other karts areas (Wessely 1877c, p.252). These proposed that reforestation through the planting of seedlings was faster and cheaper than sowing of seeds and that the deforested areas with poor soil quality should be planted with the Austrian pine while those with better soil should be planted with a mixture of native broadleaved species and the Austrian pine (Petračić, 1928).

How these guidelines were adhered to was evident a decade later when in 1878 the Royal Inspectorate for the Afforestation of Karst in Senj was established. Its nursery Sveti Mihovil was established in 1879 and more followed in 1886, 1894 and 1926. Between 1878 and 1942 reforestation was dominantly carried out with the black pine (85%) and the same species was also used for 78% cases of beating up.[15] An average of 1.3 million seedlings was created annually with 93% of them being conifers and only 7% broadleaves. Approximately 60% of the seedlings were distributed to nurseries, private owners and municipalities across the whole country and 98% of such seedlings were conifers. The remaining 40% were used for reforestation of the Croatian Littoral (Ivančević, 2003). In the Austrian Littoral, up to 1899, more than 60 million seedlings were used for reforestation, out of which 91% were the black pine, 7.4% were other conifers while 1.6% were broadleaves (Erny, 1900).

In Dalmatia, until the 1880s the scope of reforestation was much smaller than in the Croatian and the Austrian Littoral and, at first, was not dominated by the conifers. The seeds Zikmundovsky (1880) reported were obtained in 1880 by the Dalmatian government for planned nurseries and reforestation included a variety of species, mostly broadleaves with conifers represented with Aleppo pine and black pine. However, the ones that were disseminated the most were ailanthus and English oak (Table 4.1). Along with seeds, at least 18,500 seedlings were freely given out to municipalities.

[15] Beating up is a term used in forestry for the replacing of unsuccessful or dead young trees with new nursery stock (Hibberd, 1991).

But it did not take long for the reforestation with conifers to spread. At the Tisno nursery near Šibenik, most of the trees grown were pines, but the black pines did not thrive in this coastal nursery. Here the seedlings of maritime pine (*Pinus pinaster*), Aleppo pine (*Pinus halepensis*) and stone pine (*Pinus pinea*) succeeded (Šumarski list, 1885) being well suited to the Mediterranean climate of the south Dalmatia (Trinajstić, 1998).

Table 4.1. Tree species used in first reforestations in Dalmatia (Source: Zikmundovsky, 1880).

Tree species	**Latin name**	**Amount of seeds**
Ailanthus	*Ailanthus glandulosa*	411kg
Sycamore	*Acer pseudoplatanus*	110kg
Aleppo pine	*Pinus halepensis*	57kg
Black pine	*Pinus austriaca*	55kg
Field elm	*Ulmus campestris*	40kg
Manna ash	*Fraxinus ornus*	32kg
Honey locust	*Gleditsia triacanthos*	20kg
Nettle tree	*Celtis australis*	20kg
False acacia	*Robinia pseudoacacia*	20kg
White/black mulberry	*Morus alba/nigra*	15kg
Tasmanian bluegum	*Eucalyptus globulus*	3kg
English oak	*Quercus pedunculata*	100hl
Sessile oak	*Quercus petraea*	12hl
Turkey oak	*Quercus cerris*	10hl

Since the continental pines did not succeed well enough in Dalmatia, reforestation had to rely on newly established nurseries throughout Dalmatia. Among these, the nurseries at Makarska and Kotor in southern Dalmatia and at Zadar in north Dalmatia provided most seedlings (Zikmundovsky, 1885a; 1885b). In 1888 approximately 64,000 pine trees were grown yearly in the nurseries across Dalmatia and the government's plan was to increase that number to at least 100,000 in 1889 (Šumarski list, 1888a). This trend increased rapidly and in 1903 across 39 nurseries

across Dalmatia over nine million pine trees were grown in contrast to only 1.3 million broadleaved trees (Šumarski list, 1905b).

The evidence provided by the nursery statistics shows that pines were already the most commonly used species for reforestation in the 1880s. However, there is a notable lack of debate on the planting of pines within the Croatian forestry community and in the publications in the *Forestry Journal*. This is most likely because the use of pines had already become a standardised practice in the 1860s and Dalmatian forestry staff had no other choice but to accept the already standardised practice of reforestation that had been developed in the karst of continental Croatia over the preceding two decades.

In discussions on reforestation, the perceived ability of pines to improve soil was usually brought up as an argument for their planting. For instance, Čelija (1887) noted that in the case of the hinterland of Rijeka city the black pine was suggested for reforestation because it rapidly improved the soil while Fuksa (1902) argued that pines were suitable for planting only in areas where soil improvement is needed otherwise oaks or beech presented a better choice. Petrović (1910) explained that fallen pine needles improved the physical and chemical properties of soil as they created humus. Fuksa (1902), however, noted that decomposition of needles was very slow because of the high volume of resin and the effect was less productive than the decomposition of broadleaved leaves which is why he suggested planting of pines only where other trees could not succeed. Because the purpose of pines was to replenish the soil, most authors accepted the view that pine stands were only a temporary measure in the restoration of karst landscapes. As Fuksa (1902) stated 'pine should not be cultivated because of itself but because of habitat' (p.551) and as soon as the soil was improved a new, more valuable or needed species was supposed to be introduced with pines slowly removed from the stand (Fuksa, 1902; Petrović, 1910). Petrović (1910) concluded that the reforestation of karst was not finished until the next generation of trees had grown and eventually replaced the pine stand under whose protection it grew.

As for the other commonly planted trees in Dalmatia, resistance to environmental conditions and replenishment of soil was again the most important reason for their selection. Ailanthus was promoted by Zikmundovsky (1880) because it was resistant to environmental conditions and goat browsing, bound the soil and created considerable amounts of humus. Eucalyptus, on the other hand, was planted in swampy areas in order to drain the soil and improve living conditions in such areas (Marčić, 1956). Juniper was praised in a 1904 report published in *Forestry Journal* because it grew on even the most degraded karst, it bound the soil and over time improved its quality and could be used as a shelter for growing other more valuable species. Although considered a weed in other areas, the article promoted the view that this was not the case in karst areas.

However, some species, although widespread in Dalmatia, were barely discussed or were not well known to Croatian foresters, further indicating the lack of understanding of Dalmatian environmental conditions. For instance, holm oak, which is the most common oak species of coastal Dalmatia, was merely mentioned as a possible reforestation species in Istria (Crnković, 1882). The first lengthy work on this species was published by Hirc (1900) at the start of the 20th century, and even then, it considered the holm oak only in the Croatian Littoral. The fact that Croatian foresters were not acquainted with this species is evident from Hirc's statement that he could not identify the species at first and had to consult the botanical books for more information. Additionally, there was only one mention of the maquis in the *Forestry Journal* when Hirc (1900) referred to it using the French term 'maquie', despite the fact it constituted the most widespread form of vegetation in coastal Dalmatia. The first comprehensive research on Dalmatian vegetation distribution and characteristics was published by Adamović (1911) and only then was maquis defined as 'low-growth form of ancient high forests' (p.4) with accompanying plant species listed.

There was also some confusion regarding Dalmatian oaks in the hinterland. According to Visiani (1852), pubescent oak (*Quercus pubescens*) was the most common tree species in the hinterland Dalmatia, which is supported by recent works in forestry (Trinajstić, 2011; Matić et al., 2011). However, in the late 19th century

pubescent oak was discussed in the *Forestry Journal* only in the context of the Croatian Littoral, without considering Dalmatia (Wessely, 1877b; Ettinger, 1884). What is more, in the botanical research of Dalmatian species, Adamović (1911) does not mention *Quercus pubescens* at all but singles out *Quercus lanuginosa* as the most important species. According to IUCN (Gorener, 2018) *Quercus lanuginosa* is the synonym from the 19th century for Turkey oak (*Quercus cerris*) which does grow in Dalmatia, but less extensively than pubescent oak. To add to the confusion, Adamović labels *Quercus lanuginosa* as *maljavi hrast*, whereas *maljavi hrast* or *medunac* is a Croatian term for *Quercus pubescens.*

When considering the archival records from the 19th century written by Austrian or Dalmatian government officials in Italian, or even travel accounts, it is impossible to distinguish which species of oaks is implied in forestry-related reports. While holm oak (*Quercus ilex*) is usually singled out from other oaks because of its evergreen characteristics and is referred to as *elice* (Hanelt, 2001, p.319), deciduous oaks are referred to as *quercie* or *rovere*. Today in Italian *rovere* usually signifies sessile oak (*Quercus petraea*), but according to Berenger (1865), the Venetians used the term *rovere* for 'other deciduous species of oak' (p.290). Since the reports were related to Dalmatian hinterland, they could signify pubescent oak or even a less known variety known as *Quercus virgiliana*. In his papers about the distinction between the two, Trinajstić (1998; 2007) refers to them as different species that are, however, very hard to differentiate. According to the European Forest Genetic Resource Programme (EUFROGEN, 2018) these two species often crossbreed while Schirone and Spada (2001) conclude that *Q. virgiliana* is a semi-evergreen oak that probably represents a developmental state of *Q. pubescens* and a 'site- and nutrient-dependent morphism with an unpredictable potential for recombination of characters and with no reliable taxonomic stability' (p.25). However, they also note that a true morphologically distinct species may develop where genetic drift has been long lasting and especially in the geographical fringes of environmentally distinct regions, which Dalmatian hinterland certainly is.

Lovrić (1981; 2001) wrote about *Q. virgiliana* in more detail, calling it *drmun*, which is a name used by local people in Istria and the Croatian Littoral, although it

grows in Dalmatia as well. His conclusion is that *drmun* represents an ancestral developmental variety of pubescent and holm oak, as it grows in the borderland between the Mediterranean and the sub-Mediterranean zone. It developed as an adaptation to dry and hot Mediterranean climate and poor, karst soils, prospering in conditions too hot and dry for pubescent oak, but also too cold for holm oak. Q. virgiliana is, however, also mentioned by Berenger (1865) in his monumental work on Italian woodlands from the 19th century, although it is not clear whether he distinguished it as a separate species or a subspecies. Whatever the case is, neither the government officials nor the foresters in the *Forestry journal* distinguished between the two or even mention the existence of *Q. virgiliana*.

There was also a lot of confusion surrounding the pine species in Dalmatia. In the first-ever botanical research of Dalmatia, Visiani (1852, p.199-200) differentiated *Pinus pinaster*, *Pinus halepensis*, *Pinus sylvestris*, *Pinus austriaca, Pinus pinea* and *Pinus pumilio.* While the latter three are clear as they represent black pine, stone pine and Mountain pine, the former three posed a lot of confusion for foresters. For instance, Visiani labelled *Pinus pinaster,* nowadays known as maritime pine, with a Croatian name *Czerni bor*, which is an old Croatian word for black pine (*crni bor*). In contrast, *Pinus halepensis* he labelled as White pine (*bili bor*) which is nowadays used for Scots pine (*Pinus sylvestris)*. The synonymous name for both varieties, however, he wrote as *Pinus maritima*. On the other hand, the late 19th century foresters (Wessely, 1877b; Crnković, 1882; Ettinger, 1884) called Pinus halepensis as *morski bor* which would literally translate as *sea pine (morski* means pertaining to or belonging to sea). Zikmundovsky (1880) referred to it as *primorski bor* which means coastal pine. All cases, however, can be regarded as varieties of a term 'maritime'. However, a report on tree species planted in Tisno nursery near Šibenik (Šumarski list, 1885) lists *morski bor* as *Pinus maritima* but *Pinus halepensis* separately, indicating that they were two different species. Marčić (1918a) distinguished *Pinus halepensis, Pinus maritima* and *Pinus pinaster* and in another case (1918b) described hill Marjan in Split, which was known for Aleppo pine stands, as reforested with *Pinus maritima.* What is more, Adamović (1911) recognised only *Pinus halepensis* (Figure 4.2) along with *Pinus pinea* and *Pinus nigra* and did not mention *Pinus pinaster* at all.

Only after the 1950s did *Pinus pinaster* or its synonym *Pinus maritima* become recognised as maritime pine (Marčić, 1955) which is unusual as Šibenik district records show foresters and city officials differentiated Aleppo pine and maritime pine as early as 1900.

Ambiguity with pine names also makes it difficult to determine the areas in which pines used to grow. The natural distribution of Aleppo pine and maritime pine is confined to south Dalmatia according to modern botanists and foresters (Kajba et al., 2011; Prpić et al., 2011; Trinajstić, 2011). More specifically, Aleppo pine, as the most used pine for reforestation in Dalmatia, is considered natural or autochthonous only on islands south of Krapanj and on the mainland south of Split (Figure 4.3), which is nowadays used as a counter-argument for reforestation with Aleppo pine outside its natural habitat. This distribution was defined already by Adamović (1911) but many modern foresters based this conclusion on observations of Visiani (1852) who noted the northern-most located *Pinus halepensis* stand was on Krapanj island. However, a closer examination of Visiani's work reveals that he wrote how the habitat of *Pinus halepensis* was, among others, '*in maritimis in insularum Crappano*' (p.200). Since Krapanj island is located only 300 m away from the shore (Figure 4.4), *in maritimis Crappano* or 'Krapanj coastland' could also indicate Aleppo pine's distribution in the coastal mainland area of Krapanj, as in the mid-18th century Krapanj was the largest settlement between Šibenik and Primošten to the south and a seat of Krapanj commune. This would put Aleppo pine's natural distribution area further north of Split. Additionally, Krapanj's proximity to the shore raises doubts that pines, whose pollen is easily distributed by wind, would have remained confined only to the island, especially if it was naturally occurring.

Figure 4.2. *Pinus halepensis* woodland near Dubrovnik in south Dalmatia (Source: Adamović, 1911).

Figure 4.3. Location of Split and Krapanj in Dalmatia, as the northern-most points of Aleppo pine distribution on the mainland and on islands.

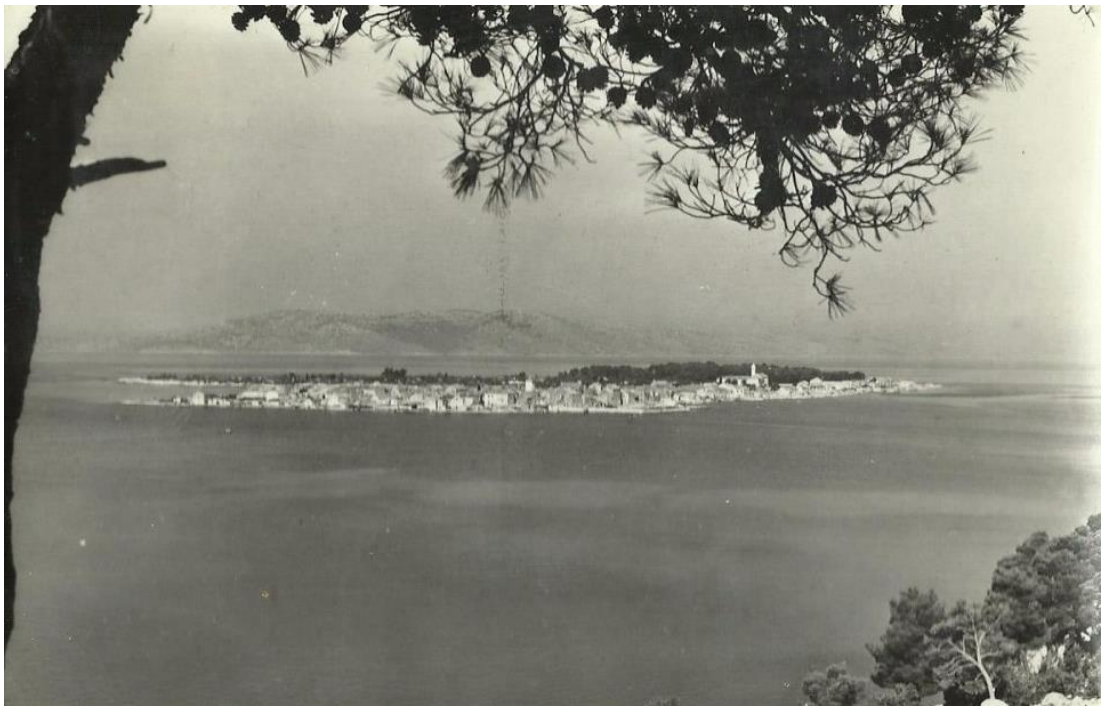


Figure 4.4. View on Krapanj island and settlement from Prigrada area on the mainland in 1966. The pine woodland of Krapanj can be seen behind the settlement (Source: Private archives).

However, it should be noted that Visiani (1852) also recorded another pine species on Krapanj island, which he identified as *Pinus sylvestris* or *bor divii* on Croatian (p.199), which translates as wild pine. Nowhere else in Dalmatia did Visiani record this pine but he did mention that it grew on Velebit mountain. Since *Pinus sylvestris* in modern taxonomy signifies Scots pine, which does not grow in Dalmatia, but does grow in Velebit and continental Croatia, it is possible that Visiani witnessed some pines that were planted on the church grounds in Krapanj for decorative purposes or that he misidentified the species. Unusually, the archival records from the early Austrian period also mention the existence of *Pino selvatico* which also translates as wild pine. Its location was in Prigrada area, which is on the mainland right across from Krapanj.[16] These pines were used as firewood by the local people and were described as thriving in the area. Since Visiani recorded that Aleppo pine was present on the island and possibly in the coastal area, it is likely that the Austrian report on *Pinus selvatico* confirmed the existence of Aleppo pine on the mainland and was not related to *Pinus sylvestris* which was coincidentally locally also known as

[16] HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c.* 1820. *Prospetto de' Boschi Sacri eretti al Circondario Comunale di Zlarin*. N. unknown.

'wild'. If anything, the confusion with the terminology of pine names only emphasises how the name of a species in the 19th century cannot be taken for granted even if it was written by a forester.

While most of the foresters focused on the environmental benefits of reforestation with pines and their potential rejuvenation of soil, Wessely (1877b) put an emphasis on potential uses various tree species could have had for local people and their livelihood focused around pastoralism. He argued that since 'in other states these pastures would be categorised as unfertile lands' (1877c, p.241), browsing in woodlands was crucial for the survival of pastoralism and 'Every child there [in the Croatian Littoral] knows that domestic animals survive more on browsing of bushes than from municipal pastures where they graze scarce grass which withers during summer when it is the most needed' (1877a, p.85). For instance, he described Aleppo pine as unsuitable for reforestation of the Littoral karst not only because it was expensive for planting, but because it did not provide good fodder and was not good for browsing. He argued that because local people relied on pastoralism, they would oppose reforestation that did not prove beneficial for their animals and without their support he believed reforestation would not be successful (Wessely, 1877a). This is why he stated that 'forestry should be managed in a way that will be best for the economy, especially pastoralism' (p.69-70).

Since these comments came after his harsh criticism of pastoralism and its destructive impact on woodlands, they also show that, despite his attitude, Wessely (1877b) was well aware of the prevailing social conditions in the areas where reforestation was taking place. His solution for reforestation and the cessation of woodland devastation dismissed the idea that all karst should be forested and proposed what he called 'the nurturing of woodlands for browsing', that is, professionally managed areas overgrown with broadleaved trees where fodder for livestock would be obtained from. The tree species he proposed included ash (*Fraxinus*), hornbeam (*Carpinus*), varieties of oak, beech, mulberry tree and cherry (Wessely, 1879). He believed that woodlands for browsing would have significantly improved pastoralism, reduced the pressure on scarce meadows and other woodland areas allowing their recovery and through taxation would bring money for forestry

including the management of woodland for browsing. In contrast, he argued that establishment of high forests of conifers would be opposed by local people because they would not be able to use them for pastoralism and would be financially unviable until trees were fully developed. (Wessely, 1877b).

Wessely (1877c; 1878a; 1879) criticised foresters, agriculturalists and the Austrian government officials for neglecting the importance of browsing and disregarding it in investment plans. He argued that foresters condemned browsing because they viewed forests only as a source of timber. He observed that when given the opportunity, the local people never solely nurtured forest on their property. Instead, they would combine the establishment of small fields with patches of grassland covered with bushes and patches of woodland with trees suitable for browsing and firewood collection. He argued that the government and professionals should have followed this example and he also used it to justify his calls for the division of municipal properties in which the land was unmanaged and solely used as a pasture. Finally, Wessely (1877c) claimed that the establishment of woodlands for browsing was 'a condition sine qua non, without which the unfortunate coastal karst cannot be reforested' (p.235).

Despite being an influential forester, Wessely's views were largely ignored by the broader forestry community. However, he was supported by Kosović (1914a, p.13-14) who proposed that 'where we can grow only stunted trees we should rather nurture woodlands for browsing and abandon dreams of high forests and green grasslands. With the nurturing of woodlands for browsing, we would solve the problem of food for animals during summer and winter'. He disagreed with the 'Austrian foresters' who wished to create high forests which might 'be enjoyed by people in 200 and 300 years from now' and argued that 'the goal should be the rational exploitation of soil productivity that exists on the karst now' as this 'would grow woodlands for browsing which would serve the contemporary generation.'

Despite being described by Kosović (1909) as unsystematic and without proper legislative basis, reforestation before the First World War yielded substantial results. The policies of reforestation developed in the Austrian and the Croatian

Littoral had been quickly accepted throughout the Empire, and by 1900 the Austrian Ministry of Agriculture stated that the problem of the reforestation of karst was considered as solved (Šumarski list, 1905a). The same conclusion was presented at the Paris World Exhibition by foresters of the Austrian Littoral (Erny, 1900). However, Petrović (1910) argued that the problem of karst reforestation could have been considered solved only from the technical perspective. There remained problems and barriers to the reforestation of karst as it was viewed by local people as an attack on their livelihoods. The result was precisely what Wessely had foreseen – opposition in the form of deliberate cutting and browsing in the reforested areas. Examples of these activities are laid out in chapter 5. However, foresters failed to address this problem in their discussions, and beside Wessely and Kosović, continued to focus on the establishment of high forests at the expense of pastures and local economies.

4.6. Conclusion

The development of forestry in Croatia occurred mainly under the Austrian influence, as education, published literature and institutions related to forestry were all tied to the Austrian foresters. The same was true with the development of forestry on karst. Led by the idea that forested landscapes are a natural state of karst regions and that loss of those forests led to economic decline, the Austrian foresters developed a reforestation scheme in the karst hinterland of Trieste. Their trials here in the 1850s refined a scheme of planting conifers, particularly black pine. In a matter of a decade, planting of pines for the purpose of replenishing soil had spread across the karst of the Croatian Littoral by the Croatian foresters. This led to the first institutionalisation of reforestation in 1878. By the start of the 20th century, the scheme developed by the Austrians had yielded such results that the problem of karst reforestation was proclaimed as solved by the Austrian government.

By the time Dalmatia received its first forestry officials in 1872, reforestation had already been established in the neighbouring karst areas of Croatia-Slavonia. Because of the similarity in the form of karst landscape, reforestation schemes were quickly adopted in Dalmatia although black pine was replaced with its Mediterranean counterparts in the coastal areas, Aleppo pine and maritime pine. However, there

was a considerable disregard for environmental conditions in Dalmatia by the Croatian foresters, and even the most widespread types of vegetation such as species found in maquis were barely discussed in forestry publications. The situation was made worse because there were no forestry organisations in Dalmatia, no forestry schools and little forestry literature.

The traditional management of Dalmatian woodlands, which revolved around firewood collection and pastoralism, was completely neglected in the literature. In the following chapter, the work of foresters and government officials concerning both reforestation and municipal woodlands will be explored to address this gap in knowledge and to contrast theoretical discussions and ideas with what really happened on the ground.

5. Woodlands, woodland management and reforestation *c.* 1790 to 1918

5.1. Introduction

This chapter will explore the woodland landscapes in both Dalmatia and Šibenik area from 1797, almost four centuries of Venetian rule ended, until the start of the Yugoslav period in 1918. With the advent of the short French administration in 1805 and a century-long Austrian one in 1815, the foundations of modern woodland management in Dalmatia were implemented. This included management of existing patches of woodland as well as the establishment of new ones through protective regulations and reforestation. The implementation of these regulations will be explored in the context of two different foreign administrations in Dalmatia, the French and the Austrian. Through analysis of the first detailed land surveys supplemented with archival research, woodland parcels will be identified together with changes in their structure and composition. Finally, the implementation of reforestation schemes that were developed in the Austrian and Croatian karst in the second half of the 19th century will be analysed. Landscape analysis and woodland management will be assessed at both the level of Šibenik district and at a more local level in three detailed case studies.

5.2. Woodlands in Dalmatia and Šibenik district in the 18th century

The area of Šibenik was described as barren and rocky as early as 1600, according to the description of sea routes reviewed by Pavić (2003). These features are clear on a drawing which depicts an Ottoman attack on the town in the mid-17th century (Figure 5.1) where the hills surrounding Šibenik appeared to be completely barren. Since agricultural areas are drawn at the foothills, it is likely that any larger patch of woodland would also have been depicted if it existed. However, it is not known when the landscape in the vicinity of Šibenik became largely treeless or if it was like that even when the town was established in the 11th century. It is known however that a dominant factor affecting landscape change in this period was the

conflict with the Ottomans that continued for almost three centuries from the start of the 15th century.

Figure 5.1. A drawing showing the Ottoman attack on Šibenik in 1647 and the landscape surrounding the town (Source: Blaeu, 1704).

While there were reports of deliberate burning of woodlands around Šibenik to prevent hideouts (Novak, 1976), the most profound consequences were probably caused by the gradual movement of the border between the two warring states towards to coastland. Fuerst-Bjeliš (2018) argued that historical sources of this period mostly depict the borderland area as a place of devastation. For instance, Pavao Ritter Vitezović on his 1699 map of Croatian Kingdom (*Mappa generalis regni Croatiae totius*) labelled the area of hinterland Dalmatia which was then liberated from the Ottomans as *Terra desserta* or a wasteland. Beside devastation, the movement of the border also caused a massive movement of the people from the hinterland into the remaining settlements of the district and especially onto islands. This caused a rapid increase of population in the territory of Šibenik district which in the 17th century had only 12 settlements, a drop from 120 before the wars started. This led to increased pressure on the small remaining territory of the district that stretched along the coast.

The pressure decreased after the 1649 plague in which Šibenik lost almost 80% of its population which dropped to only 1,500 people. Many more also died in rural areas (Novak, 1976). The abrupt loss of population was alleviated through immigration and settlement of the semi-Nomadic pastoralists known as Morlachs

from the hinterland. For instance, in 1692 on the persuasion of the Venetian governor, 5,000 Morlachs from the hinterland were settled in the surroundings of Šibenik to compensate for the losses during the previous wars (Soldo, 1991). Their different way of life, inexperience with coastal agriculture and even different language and religion made a profound mark on the future development of the landscape in the region. Although they also lived in the area before the wars with the Ottomans, the plague that devastated coastal towns led to their overall dominance in the population structure (Novak, 1976; Mayhew, 2008).

Hostilities with the Ottomans finally stopped after the 1699 treaty of Karlowitz through which Venice seized control over much of modern-day Dalmatia. The border was pushed back deep into the hinterland, thus enabling economic renewal and expansion of population without external threats throughout the whole 18th century. However, the increase of population led to a significant intensification of land use which subsequently led to further pressure on the remaining woodlands (Fuerst-Bjeliš et al., 2011). According to Matas (1993), this was mainly due to the heavy reliance of people on pastoralism, particularly in the hinterland areas.

Despite the hundred years of peace, the region remained underdeveloped, and Dalmatia entered the 19th century in a state of impoverishment (Berengo, 1952; Novak, 1976; Čoralić, 1992). Travel accounts from the second half of the 18th century portrayed Dalmatia as a poor region that was based entirely on traditional agriculture. The hinterland was dominated by the cultivation of cereals, while in coastal areas people focused on vines, olives and fishing. Agricultural production was strictly regulated by the Venetian administration and most of the surpluses had to be shipped off to Venice where they were sold by the Venetian merchants under their own prices (Anonymous, 1775-1776, according to Novak, 1959; 1966). While the regulations eased up by the mid- 18th century economic progress was very slow (Anonymous, 1775-1776, according to Novak, 1962). It was also burdened by unsolved land ownership rights, exceptionally fragmented properties and the lack of innovative techniques in agriculture (Fortis, 1778; Anonymous, 1775-1776, according to Novak, 1962). The situation was aggravated by stark differences between the Morlachs and the native citizens as Morlachs had to adapt to settled, village life and

farming. There was much hunger throughout the 18th century while archival research by Markovina (2010) revealed that the years between 1772 and 1783 were marked by starvation. Craft industries were barely developed and confined to major cities (Anonymous, 1775-1776, according to Novak, 1959; Božić-Bužančić, 2014).

Pastoralism was particularly important for the livelihood of Dalmatians. The region's hilly terrain had been used for pastures for thousands of years and the reliance of Morlachs on domestic animals significantly increased during the Ottoman conquests. Animals were a mobile asset that were easy to move in the event of a conflict, while reliance on agriculture presented a risky livelihood (Mayhew, 2008). Travel accounts note that the Dalmatian dry, hilly and rocky landscape was not suitable for large animals. Oxen for ploughing were imported from the Ottomans, small numbers of cows were kept for milk, while horses were replaced by mules (Anonymous, 1775-1776, according to Novak, 1960; 1962).

Šupe and Radinović (1993) concluded that the sheep was the most important animal in Dalmatia as no other species managed to exploit karst pastures so well. Jedlowski (1975) argued that the goat also had a major role as it was the most versatile and resilient of all domesticated animals. According to Siddle (2009), goats in Mediterranean countries bring 30% more income to poor families than sheep. Despite transhumance being the main feature of Dalmatian pastoralism, in coastal areas a lot of animals, especially goats never moved away from settlements (Chapman et al., 1996). Because of the poor quality of pastures, the woodlands were crucial for the survival of these animals as leaves, buds and small branches offered supplementary food during harsh periods which is why pastoralism is closely associated with traditional woodland management and woodland loss. Siddle (2009) considered that the goat was viewed as particularly destructive because of its ability to reach and devastate areas especially prone to erosion.

The anonymous Austrian official sent to Dalmatia by the Austrian government (1775-1776, according to Novak, 1960; 1966) carefully described woodlands and their value as a resource. He noted the lack of properly developed trees with thick trunks throughout Dalmatia except some remote mountaintops in the hinterland and near

the Norin and Cetina rivers in central Dalmatia. Most 'woodland' was 'scrubland rather than woodland, bushes rather than trees'[17] (Novak, 1960, p.486), scattered in patches across the landscape. Another exception were the pine woodlands of Korčula and Hvar islands which were 'preserved and abundant'. Jedlowski (1975) also emphasised the importance of the strict Venetian management policies for the production of shipbuilding timber for the survival of the pine woodlands of Korčula.

While many foresters in the 19th century blamed the devastation of Dalmatian woodlands on the Venetian administration and exploitation of timber for shipbuilding, travel accounts emphasise the destructive influence of the local population. In the mid-17th century, Venice proclaimed large tracts of Dalmatian land as municipal or common land, effectively giving people the right to use them freely for firewood collection and as pastures for animals. Marčić (1935) and Vajda (1954) believed that this was the crucial period when the destructive influence of people and animals on the woodlands began. Indeed, the anonymous Austrian official (according to Novak, 1960) also reported in 1775 and 1776 how Morlachs regularly cut the young trees without any surveillance and damaged the trees by cutting the branches in an unsystematic way. The bundles of wood they collected were used exclusively for heating and cooking and some were sold at coastal towns which were described as constantly suffering from firewood shortages. The lack of wood often led to the uprooting of trunks or debarking. Fortis (1778) took a particularly negative view of the traditional way of life of the Morlach population. In contrast, the Austrian official admired their way of life, but when it came to woodlands, he agreed that the 'Morlach has a character so inclined to the destruction of trees that if he sees a good stand on someone's field he barely manages not to cut it on the first night' (Novak, 1960, p.487).[18] Lovrić (1786) also shared the view that his countrymen 'are the main enemies of the trees' (p.25).[19]

While Kesterčanek (1882b) argued that the Venetians implemented regulations for woodland protection only after they had realised that they

[17] *Il restante sono piuttosto Boscaglie, che Boschi, cespuglj anziche alberi.*
[18] *Il Morlacco ha un' indole tanto proclive a distruggerei, che se vede nel campo altrui una ben intera piantagione, a pena si conviene di non tagliarla alla prima note.*
[19] *(I Morlachi) sono capitali nemici degli Alberi stessi.*

overexploited them, the fact is that until the 18th century most of Dalmatia, other than the narrow coastal strip, was under Ottoman rule. After Venice acquired the whole of Dalmatia at the start of the 18th century they implemented a series of regulations to stop woodland degradation (Jedlowski, 1975). Since many people cut wood and uprooted trees because it was a lucrative business to sell it on foreign markets, the Venetian government banned wood export to foreign countries in 1760. Conversion of woodland to pastures was prohibited, and they also tried to mitigate the effect of goats by prohibiting them. In 1760 it was declared that people had to kill off their goats within three months , but this measure was met with protests and opposition and had to be rescinded (Markovina, 2010).

While it was probably easier to implement regulations on spatialy limited areas such as Korčula island, where a strong tradition of woodland protection also already existed, the newly liberated hinterland presented a different problem. The anonymous Austrian official described these areas in 1775/6 as very rarely visited by any government officials, while those few that did so, often collaborated with local people in order to secure some scarce wood for themselves (Novak, 1960). Although the laws mandated a financial penalty for each illegally cut tree, the area in the hinterland was so vast and scarcely populated it was impossible to find and fine the culprits who regularly roamed the hills with their flocks, while villagers never reported each other for malpractices.

The coastal area near Šibenik, however, was much more densely populated and had a very different history than the hinterland. By the end of the 18th century, Šibenik still had not regained the wealth and power it had before the 1649 plague. Its population of 4,333 in 1788, down from 7,500 from the century earlier, was mostly comprised of peasants and pastoralists (Novak, 1974; Šupuk, 1986). Travel accounts from the 1770s described how every available piece of land in Šibenik district was cultivated (Anonymous, 1775-1776, Novak, 1962) while Fortis (1774, p.169) praised the 'delicious appeal'[20] of the landscape of Prvić island because of the prevalence of vineyards and olive groves. However, he also noted that 'the appearance of the other

[20] *L'aspetto di quest'isola è delizioso anche di lontano.*

surrounding [islands] disgusts the eye with the display of hills that are too high, too stony and naked'[21] (p.169). For instance, Tijat island was described as 'desolated by the shepherds'[22] (p.170). This was supported by the Austrian official in 1775/6 (Novak, 1962) who reported that people often kept sheep on the Šibenik islands and visited them for firewood collection as soon as something managed to grow on them. Fortis (1774) described the landscape at Zlosela (modern Pirovac) on the coast 25km north of Šibenik as 'horrid because of the nakedness of the mountains which were stripped by the inconsiderate brutality of the inhabitants'[23] (p.159). He also described some privately-owned groves near Šibenik. Such was the manna ash (*Fraxinus ornus*) woodland owned by Count Girolamo Draganich Veranzio from Zlosela, which was planted and managed for manna production. The production of mastic from mastic trees (*Pistacia lentiscus*) was also noted (Fortis, 1774; Anonymous, 1775/6, Novak, 1960). Fortis (1774) also described some smaller islands in the strait of Murter as wooded.

More importantly, ship records from Krapanj, Kaprije and Zlosela researched by Peričić (1975) reveal that inhabitants of these villages exported firewood to Venice on many occasions throughout the 18th century. This firewood was collected locally and sold directly from these small coastal villages and not through the port of Šibenik. Šibenik port served as the central hub for export of products from the hinterland, but firewood is absent from ship records of products that were exported to Venice, which would imply that Šibenik, as the largest settlement and the consumer of firewood in the area, also imported firewood (Peričić, 1975). Therefore, the firewood that smaller settlements shipped to Venice had to come from their local woodlands, most likely those in municipal ownership, and apparently, there was enough for both local consumption and export.

[21] *L'aspetto dell' altre vicine (isole) disgusta l'occhio colla mostra di troppo alti colli e troppo sassosi ed ignudi.*
[22] *Tihat desolata da' pastori.*
[23] *L'esterno aspetto della plaga è orrido per la nudezza de' monti, spogliati dalla brutalità inconsiderata degli abitanti.*

5.3. The landscape and woodlands of Šibenik district in the first Austrian (1797-1805) and the French (1805-1813) periods

The travel accounts that depict the Dalmatian landscape in the 18th century as a predominantly treeless landscape dotted with cultivated valleys nestled between the barren hills are supported by the statistical data on the land use. These became more precise and frequent after Austria took over Dalmatia in 1797. Foretić (1963) compared several publications of statistical data from this period and concluded that there were only minor differences between each but credited the table published by Baron Francesco Maria di Carnea Steffaneo, a Court councillor of the Austrian Emperor Francis II, as the most exhaustive and plausible. His table *Tabella Enciclopedica* consisted of 19 tables of data that covered each of the 19 administrative areas of Dalmatia which he studied during his 15-month-long journey that started in 1797. The part of his *Tabella Enciclopedica* relevant for this research, i.e. data on the economy and land cover, was finalised in 1798 and Foretić (1963) published it in its original form and language as an appendix in his paper. For each province, Steffaneo calculated data separately for the area that was part of *Vecchio acquisto* and *Nuovo acquisto.*[24]

The whole Šibenik district counted 56 populated places with a total population of 23,038, which is a density of only 31 people per km². Stefanneo's data on land use (Table 5.1) shows that areas labelled as 'arable and with vineyards' (*arativo e vignato*) covered only a small proportion of the land or 11.6%. Olive trees were probably grown within the vineyards. The remaining 88.4% of the land was labelled as uncultivated (*incolto*).

[24] *Vecchio acquisto* (old acquisition) was the term for Venetian territory in Dalmatia which they acquired prior to 1420 and the Ottoman conquests while *Nuovo acquisto* (new acquisition) was a term for territory they gained from the Ottomans after the peace treaty at Karlowitz in 1699. *Vecchio acquisto* was a very narrow coastal area and islands, and while the town of Šibenik was a part of it, the area of Skradin only 10 km distant was entirely a part of *Acquisto nuovo*.

Table 5.1. The area of specific land use categories in Šibenik district in 1798 according to Steffaneo (Foretić, 1963).

	Vecchio Acquisto				*Nuovo Aquisto*	
	Islands		Mainland		Mainland	
Cultivated	10.4 km²	11.6%	34.6 km²	12.4%	41.8 km²	11.3%
Uncultivated	76.5 km²	88.4%	243.8 km²	87.6%	327.1 km²	88.7%

The uncultivated lands included 'woodlands' (*boschi*), 'bushes' (*cespugli*) and 'rocky pastures' (*pascoli sassosi*) thus making it impossible to distinguish the precise extent of woodland or what exactly was regarded as a woodland. Although not present in the territory of Šibenik, Steffaneo singled out another category within the uncultivated one which he labelled as 'woodland used as gaj'.[25] Garagnin (1806, according to Foretić, 1963), however, uses a different term and labels it as 'woodland for pasture of oxen'.[26]

The statistical data on the economy also confirms that the basis of livelihoods was in agriculture and pastoralism, as exports were dominated by wine, olive oil, figs, fish, sheep, some wool and cheese. The export of firewood or any other wood related product was absent in the records for this year, indicating a rising local consumption. Most of the wood came from the hinterland as a letter from 1804 written by the traveller Concina (1809) described how roads that arrived from Knin were convenient for timber transport. The same road also connected Šibenik with the territory of Bosnia and presented the main trade route for the town. Beside this road, there was only one more and that one connected Šibenik with Zadar. Markovina (2010) argues that both were built by Venice only in 1780 as Venice avoided roadbuilding in earlier periods because they feared the Ottoman army would benefit from them, thus leaving much of the vast hinterland inaccessible other than on foot or donkeys.

[25] *Bosco ad uso di Gajo. Gaj* is an old Croatian word which signifies woodland where people collected firewood and brought animals for pasture. Further explanation of the term will follow later in the chapter.
[26] *Boschi per pascoli dei bovi.*

The French occupied Dalmatia shortly after the Austrians, and administratively it was included in the French Kingdom of Italy in 1805. With further territorial gains by Napoleon in 1809 it was incorporated in the Illyrian Provinces along with the rest of Croatian territory. Napoleon regarded Dalmatia as the gateway to the Balkan peninsula, but it was under constant threat from the Austrian Empire, as well as the Russian and the English fleets, and bolstering its defences was crucial (Prpić, 1964). This is why the French implemented a sweeping reorganisation of the Dalmatian administration. Agriculture was boosted with the introduction of new crops, the first modern roads in rural areas were built, and schools were opened. The French administration has been credited by some historians as accomplishing more for Dalmatia in less than a decade than Venice did in four centuries (Čulinović, 1974; Pederin, 2003; Piplović, 2013).

One of the critical issues in the economy that was addressed by the newly formed administration was also woodland management. There has not been any comprehensive research on the forestry of the French administration in Dalmatia. The modern works on Croatian woodland history cite forester Kesterčanek (1882c) who described the French period as a short-lived one, but worthy of praise for the way woodlands were managed. However, according to Dimitz (1886), administrative documents of forestry institutions established by the French military commander for Dalmatia Auguste de Marmont were all lost after the Austrian military reconquered Croatia and Dalmatia in 1815. Therefore, the only source of information about woodland management of this period can be obtained from documents and letters exchanged between government officials at various political levels along with reports from foresters and forest guards that were kept by district and municipality departments.

According to one of the circulars from the French administration in Dalmatia issued to all delegates and captains of all districts, the French considered woodland management to be one of the most important economic activities of rural areas.[27] However, the woodlands across the region were described as devastated because of

[27] HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c.* 1809-1812. *Circolare ai Capitani circolari ed alle Preture*. N. 11641-359.

the constant unmanaged cutting by the local people who met their firewood needs in these woodlands without caring for the consequences. The administration believed that the devastation was of somewhat recent origin. They argued that only a century before the vast wooded areas of Dalmatia were reduced to small patches of degraded vegetation throughout Dalmatia. According to a referenced circular from 1808, Dalmatia still had 7,770 km² of a wooded area in the 18th century.[28] During that period, the region was described as prosperous and great, but it all changed once the fertile areas were transformed into a barren landscape. The figures provided by the French administration, however, do not add up unless all uncultivated areas including rocky pastures, as laid out in the land use statistics table from Steffaneo, were counted towards the area of woodland since the whole Dalmatian territory had only 13,000 km².

In order to mitigate the effects of devastation and to restore the prosperity of the region, the French administration issued repeated calls for a more vigorous fight against woodland violations and expressed the need to reinforce woodland regulations and prosecute woodland malpractices strictly.[29] These efforts reflected the ongoing debate over the consequences of forest cover disappearance in France that occurred after the diminished state influence after the French Revolution led to severe devastation of French forests (Andréassian, 2004).

According to letters reviewed by Marčić (1935), the Dalmatian provincial governor Dandolo wrote to Napoleon and described the state of Dalmatian woodlands as pathetic. He attributed their destruction to unmanaged cutting by the local people and the forest fires started by the shepherds in order to improve pastures. Because of the gravity of the situation, Dandolo started to work on the improvement of woodland management immediately after his appointment, and he also focused on reforestation. The first nursery was established near Zadar, and more than 100,000 different seedlings were ordered from Italy. Several regulations

[28] HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c.* 1809-1812. *Circolare ai Capitani circolari ed alle Preture*. N. 11641-359.
[29] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1808. *L'Ingegnere de Seconda Classe al Sig. Commisso*. *Straordino di Governo in Seben.* N. unknown; HR-DASI-Hortikultura: Šibenski perivoj/šumarstvo. 21st March 1810. *L'uditore nel consiglio di stato*. N. unknown.

concerning the prohibition of cutting young trees, wood export and burning of fires in woodlands were also enacted. Goat keeping was still perceived as a big problem and was tackled with steadily increased pasture tax in the hope of discouraging people from keeping them.

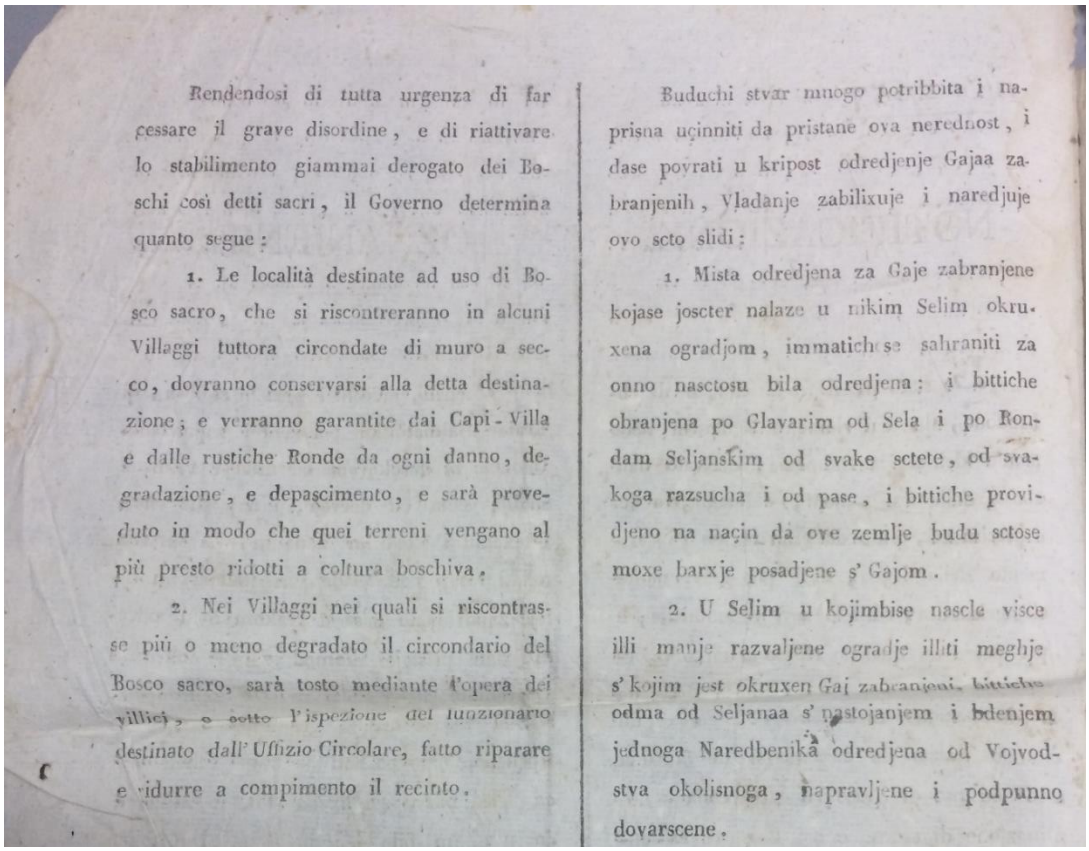
Kesterčanek (1882a) and Marčić (1935) particularly praise Dandolo for the establishment of *Sacri boschi*. The records on *Sacri boschi* originating from the French period could not be found, but a circular published during the Austrian Empire in 1821 provides valuable information.[30] According to this document, the government of the Kingdom of Italy was worried about the adverse effects that continuous woodland damage which included digging of stumps, cutting of young trees, debarking and excessive pasture had on the agriculture and overall economy of Dalmatia. Therefore, they passed a regulation which mandated that 'each village designates an area to be enclosed with a dry-stone wall for the purpose of establishing a woodland denominated as *sacro*'.[31] The Austrian regulations concerning these *Sacri boschi* strictly prohibited cutting of any trees and shoots, digging of stumps, damage to the enclosing wall and any type of pasture and it is likely the same regulations existed in the French period (Racolta delle leggi ed odrinanze…, 1834).

In the Italian language, this woodland was denominated as *Bosco sacro,* which translates into English as 'sacred' or 'holy forest/woodland'. Kesterčanek (1882a) translated it in Croatian as *sveti gaj* which translates as 'sacred' or 'holy grove', as the word *gaj* (grove) was often used synonymously for a small patch of woodland. This was then accepted by other Croatian foresters who published in the 20th century. However, the original proclamation from 1821 was written in both Italian and old Croatian (called by the Austrians Illyric) and used two words to translate *sacro*. In two instances it translates it as 'sahranjen (gaj)' which translates in English as 'buried (grove)'. However, this could be a mistake in transcription as in later instances the term '*sacro'* is translated as '*zabranjen (gaj)*' which translates in English as 'forbidden (grove)' (Figure 5.2). A mistake between '*sahranjen*' and '*zabranjen*' in two very similar

[30] HR-DASI- Šumarstvo 19.-20.st. 23rd January 1821. *Notifizione/Oznanjenje*. N. 1657-302.

[31] *La Reggenza Italica decretata la destinazione in cadaun Villaggio di un spazio da circondarsi di muro a secco ad uso di Bosco riservato colla denominazione di sacro.*

letters (s-z and h-b) is a probable occurrence with a language that was not official and spoken among the illiterate rural population. Also, the word 'forbidden' reflects the character of the regulations concerning these woodlands which is why this term will be used in the text from now on.



Rendendosi di tutta urgenza di far cessare il grave disordine, e di riattivare lo stabilimento giammai derogato dei Boschi così detti sacri, il Governo determina quanto segue:

1. Le località destinate ad uso di Bosco sacro, che si riscontreranno in alcuni Villaggi tuttora circondate di muro a secco, dovranno conservarsi alla detta destinazione; e verranno garantite dai Capi-Villa e dalle rustiche Ronde da ogni danno, degradazione, e depascimento, e sarà provveduto in modo che quei terreni vengano al più presto ridotti a coltura boschiva.

2. Nei Villaggi nei quali si riscontrasse più o meno degradato il circondario del Bosco sacro, sarà tosto mediante l'opera dei villici, e sotto l'ispezione del funzionario destinato dall' Uffizio Circolare, fatto riparare e ridurre a compimento il recinto.

Buduchi stvar mnogo potribbita i naprisna ucinniti da pristane ova nerednost, i dase povrati u kripost odredjenje Gajaa zabranjenih, Vladanje zabilixuje i naredjuje ovo scto slidi:

1. Mista odredjena za Gaje zabranjene kojase joscter nalaze u nikim Selim okruxena ogradjom, immatichse sahraniti za onno nasctosu bila odredjena: i bittiche obranjena po Glavarim od Sela i po Rondam Seljanskim od svake sctete, od svakoga razsucha i od pase, i bittiche providjeno na naçin da ove zemlje budu sctose moxe barxje posadjene s' Gajom.

2. U Selim u kojimbise nascle visce illi manje razvaljene ogradje illiti meghje s' kojim jest okruxen Gaj zabranjeni, bittiche odma od Seljanaa s' pastojanjem i bdenjem jednoga Naredbenika odredjena od Vojvodstva okolisnoga, napravljene i podpunno dovarscene.

Figure 5.2. A part of the original proclamation on forbidden groves with text in Italian on the right and the translated 'Illyric' on the left (Source: HR-DASI- Šumarstvo 19.-20.st. 23rd January 1821. *Notifizione/Oznanjenje*. N. 1657-302).

According to the *Giornale Della Società* (1809, p.338), Dandolo's idea about forbidden groves was implemented in 1807 and already by the following year 360 Dalmatian villages designated an area for the new woodland. A delegate letter from 1809 reveals that in the vicinity of Šibenik (although well beyond the research area border) the communes of Rupe (*Ruppe*), Dubravica (*Dubraviza)*, Bratiškovci (*Bratiscovzi*), Smrdelje (*Smerdeglie*), Piramatovci (*Piramatovzi*), Čista (*Cista*) and Sonković (*Sonkovich*) established their forbidden groves over an area of ten Italian paces[32] or more, while Bribir municipality could not stretch it over an area of more

[32] *Passi.*

than five paces. Forbidden groves existed in the coastal areas of Tisno, Mandalina, Oštrica and Pigrada as well.[33] In the case of Oštrica and Prigrada, they covered 20 *campi*[34] and 200 *campi* respectively, which translates to 5.5 ha and 55 ha. Marčić (1935) argued that these woodlands had to cover an area of 3.5 to 7 ha, but in reality, their extent varied considerably.

The forbidden groves consisted of the 'natural' vegetation of the area and their main purpose was the provision of firewood. In the case of the eight hinterland villages mentioned the trees and shrubs were oaks, manna ash, hornbeam, holm oak, mastic and terebinth trees, olive, wild cherry, juniper and thorny scrubland (*spine*). The forbidden grove in coastal Oštrica provided wood from oaks, juniper and unspecified woodland in general, probably a mixture of species commonly found in maquis. At Prigrada firewood was derived only from oak, juniper and *Pino selvatico*.[35]

Reforestation in these groves was a crucial part of their management.[36] For instance, in forbidden groves in the hinterland, both seeds and seedlings were planted among rocks in an effort to promote the growth of high-quality wood which would have been used for all kinds of construction. Seeds were also distributed among senior Captains in the communes, and instructions provided on proper ways of managing the soil and irrigation in the case of drought. The tree species included lime (*Tilia europea*), cypress (*Cupressus pendula*), catalpa (*Catalpa bignonioides*), tulip tree (*Liriodendron tulipifera*), sycamore (*Platanus occidentalis)* and false acacia (*Robinia pseudoacacia*). Out of these, only cypress and lime grew in the area naturally while three were from North America which emphasised the French affinity for the

[33] HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c.* the 1820s. *Prospetto de' Boschi Sacri eretti al Circondario Comunale di Zlarin.* N. unknown; HR-DASI- Šumarstvo 19.-20.st. 13th April 1809. *Il Delegato di Governo al Delegato Distretuale di Governo in Sebenico*. N.302.
[34] *Campo* is an area unit used in Venetian Lombardy and corresponds to 0.6881 acre or 0.27ha (Clarke, 1891, p.80).
[35] HR-DASI- Šumarstvo 19.-20.st. 13th April 1809. *Il Delegato di Governo al Delegato Distretuale di Governo in Sebenico*. N.302; HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c.* the 1820s. *Prospetto de' Boschi Sacri eretti al Circondario Comunale di Zlarin.* N. unknown.
[36] *Ibid*.

planting of exotic species. The work itself was carried out by village volunteers but required a knowledgeable professional to supervise the work.[37]

The French administration also implemented regulations on the exploitation of woodlands, especially cutting firewood. For instance, if mayors, council members or supervisors of public works wanted to cut firewood, construction material or any other purpose, they first had to file an official request to the forest inspector through local foresters or delegates. The request consisted of a form with detailed information about the woodland and the planned activities.[38] If approved, it had to be supervised by forest guards or the Inspector for woodlands. They had to ensure that the cut did not extend beyond the 25th part of the woodland, while trees whose shape fitted the needs of shipbuilding or construction works had to be left alone. The regulations also stipulated that cutting had to be done before March when trees started to come into leaf. The penalty for people caught cutting in other periods was confiscation of their animals and tools.[39]

The sustainable use of woodland was supposed to be achieved by sowing seeds of appropriate trees immediately after an area was cut. Because of the threat to the young trees, pasture was forbidden after the cutting for the following year or until the trees reached a height of at least seven feet. In the case of derelict woodlands, a quarter always had to be free from pasture until trees reached a height of seven feet. In addition, 'pasture of small animals and browsing of goats was rigorously forbidden not only in the woodlands but near their borders'.[40] The new regulations limited the traditional custom of keeping animals used for labour, such as oxen, in woodlands during winter to only three-quarters of the woodland while all animals had to be kept out of the final quarter throughout the year.[41] This supports the statistical data from Garagnin (1806, according to Foretić, 1963) in which he

[37] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1808. *L'Ingegnere de Seconda Classe al Sig. Commisso*. *Straordino di Governo in Seben.* N. unknown; HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c.* the 1820s. *Prospetto de' Boschi Sacri eretti al Circondario Comunale di Zlarin.* N. unknown.
[38] HR-DASI- Šumarstvo 19.-20.st., 30th June 1812. *Bisogni in legna*. N. 24.
[39] HR-DASI-Šibenik 19.-20.st. Šumarstvo, 14th June 1812. *Ispezione d'ogne foreste*. N. unknown.
[40] *Ibid.; Pascolo degli animali minuti e legnatamente delle Capre è rigorosamente vietato non solo entro i boschi, ma pefino in prossimisà ai confine loro.*
[41] HR-DASI- Šumarstvo 19.-20.st., 30th June 1812. *Bisogni in legna*. N. 24.

specifically singled out 'woodland for pasture of oxen' and it is possible such woodlands had a different management scheme. A forest guard explained that keeping a quarter of the woodland safe from pasture was the most important regulation of the woodland management and also 'the only way to resurrect the ancient Dalmatian forests'.[42] The woodland regulations, however, did not extend to the wooded areas people referred to as *gaj* but were instead limited to municipal woodlands.[43]

Regulations also stipulated that each commune (village) had to have a forest guard who was obliged to do work dutifully; otherwise, he was removed from his position. His responsibilities included more than just guarding the woodland and were more focused on its management. The forest guard was elected from the local population by the representatives of the municipality, and in later periods this type of election process was often taken as a cause for numerous unsanctioned woodland felonies because of corruption.[44] The prevention of woodland damage was also under the jurisdiction of territorial forces and village guards who had also existed during the Venetian period (Oršolić, 2007). However, the French administration also introduced country police who were tasked with the prevention of damages to both woodlands and cultivated areas.

Despite many new regulations, illegal pasture and unsupervised cutting in the woodlands continued which is evident from the administration's repeated calls for the stricter upholding of the woodland regulations.[45] The majority of people, especially in rural areas, still lived in widespread poverty and the French administration was not in power long enough to change the traditional pastoral practices. Although praised by some for their attempt to alleviate poverty, the French introduced at least 13 taxes in order to support the needs of newly established administration (Prpić, 1964; Ćosić, 2000). The hunger years of 1809 and 1811 aggravated by conscription and compulsory labour in public projects as well as the

[42] *Questo (è) il solo mezzo di far risorgere le antiche foreste della Dalmazia.*
[43] HR-DASI-Šibenik 19.-20.st. Šumarstvo, 14th June 1812. *Ispezione d'ogne foreste*. N. unknown.
[44] *Ibid.*
[45] HR-DASI-Hortikultura: Šibenski perivoj/šumarstvo. 21st March 1810. *L'uditore nel consiglio di stato*. N. unknown.

maritime blockade by the English and the Russians made the life of people extremely difficult (Šupuk, 1974; Peričić, 2016). It is therefore unlikely that the new administration managed to implement so many strict regulations in just a decade. Many of the management plans required professional foresters, especially in reforestation activities, as the regulations stressed the need to choose species according to the environmental conditions of the area, but these did not exist.[46] Indeed it is doubtful whether the French had any significant impact on the woodlands of Dalmatia; this was immediately apparent at the start of the Austrian Empire when all of the forbidden groves were found to be in a devastated condition.

5.4. Traditional woodland management during the Austrian Empire and the Austro- Hungarian Monarchy

5.4.1. Woodlands in Dalmatia and Šibenik district from 1814 until the second military survey of the Empire (1851-1854)

Although the Austrian occupation of the French Illyrian Provinces began already in 1813, it took several years to resolve the status of Dalmatia within the Austrian Empire. This finally happened on 10th July 1816 when Emperor Franz I issued a patent declaring Dalmatia a separate kingdom within the Empire. The management of Dalmatian woodlands in this period was carried out by the Austrian administration, as administratively the Kingdom of Dalmatia was under direct rule of Vienna and civil and military control was entrusted to Austrian high-ranking military officers. Only in 1902 did the civil and military administrations became separated. The Austrian military officers served as governors of the Kingdom's National Government, or regents when the National Government was replaced with the Regency from 1852 and were directly subordinate to Austrian ministries. At a more local level, the woodlands were managed by the county, district and municipality authorities but this administrative division changed several times throughout the century. For Šibenik

[46] HR-DASI-Šibenik 19.-20.st. Šumarstvo, 14th June 1812. *Ispezione d'ogne foreste*. N. unknown.

district notable changes were made only in 1868 when the political power shifted from Zadar to Šibenik itself (Table 3.2, p.41) (Ivković, 1992; Ćosić, 1997).

Until 1865 the political power over Šibenik's affairs was located within the county authorities based in Zadar. Municipalities, clustered into districts, represented basic political-territorial units and each municipality consisted of settlements or communes. Those settlements with more than 25 families were represented by the village head who was elected by the county authorities. However, municipalities did not have real autonomy in their work and directives mostly came from the Austrian officials (Ivković, 1992; Ćosić, 1997).

The Austrian administration started to manage woodlands already in 1814. In this transitional period Inspector for Water and Forests delivered rules on woodland management and pasture to the municipalities. The aim was to avoid firewood shortages which is why the cutting in woodlands was limited to a tenth of the area at a time while pasture was banned for the first year after cutting. The cutting area had to be designated by a professional forester and approved by the Inspector himself, while there had to be forest guards who would supervise the cutting.[47] The necessity for professional foresters meant that, since there were no forestry schools in Dalmatia, nor Croatia, until 1860 and most of the schools were established only recently by the French, these foresters were exclusively from Austria. However, from 1834 the Austrian government did provide funding for talented Dalmatian pupils proficient in German to study in Vienna.[48]

These woodlands regulations were very similar to the ones existing in the French period and since they were issued even before the status of Dalmatia within the Empire was resolved, it is safe to assume that the transitional period was not disruptive regarding the regulations. In fact, almost immediately further regulations concerning woodland protection were implemented which contrasts forester Kesterčanek's (1882c) claims that once Austrians took control 'all French regulations

[47] HR-DASI- Šumarstvo 19.-20.st., 28th December 1814. *Reg. Sig. Podestà della Comune di Sebenico.* N. 2208 and N.11411.
[48] HR-DASI- Sibenik 19.-20.st. Šumarstvo. 14th May 1834.

and laws, even those benefiting our people, were abolished' (p.324).[49] Kesterčanek's view was later adopted by foresters from the Yugoslav period (Marčić, 1935).

The regulations which followed after the inclusion of Dalmatia in the Austrian Empire in 1815 again represented a repetition of those which existed in both the French and the Venetian period before it. They included implementation of the ban on digging of roots and stumps, debarking of pines, cutting of young shoots, clearing woodlands with fire and their conversion to arable land (Raccolta delle leggi…, 1830). If a person was found selling wood, shoots, roots or bark, their products had to be immediately confiscated and the person fined or sent to prison. Cutting in *gaj* without supervision 'in the winter period as well' was also prohibited, which implies that previously some free cutting was allowed during the winter when the trees were dormant. Similarly, pasturing of cattle, horses and sheep was excluded from *gaj* outside of times determined by the custom, which was also likely to be in winter (Raccolta delle leggi…, 1831). Regulations concerning goats were stricter as they were again seen as the biggest threat to woodlands, so their release in *gaj* or any woodland area was strictly forbidden. The same applied to pigs, although they were not usually kept in the Dalmatian villages (Raccolta delle leggi ed ordinanze…, 1828). Finally, the establishment of lime kilns was strictly regulated already from 1815. For instance, if someone wanted to establish a lime kiln, they had to petition the government through a local office and prove they had their fuel which they would use for burning (Raccolta delle leggi…, 1830).

The French administration was often praised by foresters from the late 19th and 20th century specifically for their effort in establishing the forbidden groves. However, the Austrian administration continued this practice as well. In 1821 they issued a proclamation on forbidden groves ordering renewal of all previously established forbidden groves along with the same regulations that existed in the French period. This means specific areas had to be encircled with dry-stone wall and exploitation completely prohibited so that woodland could be established.[50] The fact

[49] *Jedva što je god 1814. Ilirija opet Austriji vraćena, ukinute su sve, ma i koli koristonosne po narod naš francezke uredbe i zakoni.*
[50] HR-DASI- Šumarstvo 19.-20.st. 23rd January 1821. *Notifizione/Oznanjenje*. N. 1657-302.

that the regulation came into power is evident from the archival records which describe the establishment of forbidden groves in Prigrada and Oštrica in the early 1820s, but their establishment continued later as well, as in 1848 new ones were planned on Prvić and Žirje islands.[51]

The regulations on forbidden groves serve as the best example of continuity of woodland regulations from the French period into the Austrian one and coupled with other mentioned regulations show that the Austrians immediately tried to tackle issues of woodland preservation. While forest guards were traditionally responsible for the protection of woodlands, the Austrians also retained territorial guards, who were responsible for preventing various types of criminal activities and felonies including those in rural areas, as well as village patrols and rural police for the prevention of agricultural and woodland damage (Oršolić, 2007). As for forbidden groves, their protection was specifically entrusted to village heads and village patrols.[52] Despite all of this, by 1821 most of those groves established by the French were utterly devastated and in 1835, because of excessive damage occurring to the properties, including woodlands, the government again instructed the municipalities to employ territorial guards for the protection of woodlands (Raccolta delle leggi…, 1845).[53]

The cadastral survey of the Empire, which was carried out in Dalmatia between 1823 and 1838 and in Šibenik district in 1825, brings detailed and precise information about the woodlands in this period. Examining Dalmatia as a whole (Figure 5.3), most of the areas classified as a woodland (grey) were located in the hinterland of the region and on the islands of southern Dalmatia. Korčula and Hvar islands stood out as having the most substantial proportion of territory under woodlands, and this confirms Jedlowski's (1975) research on the importance of these pine woods for shipbuilding. On the mainland, the largest sections of woodland areas were in the less populated hilly and semi-mountainous areas in the hinterland. The

[51] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1821. *All' Imp.Reg. Pretura in Sebenico.* N. 735; HR-DASI-Šibenik 19.-20.st. 4th June 1848. Šumarstvo. *Prospetto degli spazi poco produttivi, produttivi ed improduttivi…del Sindacato di Zlarin.* N. 1394.
[52] HR-DASI- Šumarstvo 19.-20.st. 23rd Gennajo 1821. *Notifizione/Oznanjenje*. N. 1657-302.
[53] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1821. *All' Imp.Reg. Pretura in Sebenico.* N. 735.

pronounced lack of woodlands in the coastal communities reflected the increased pressure on landscapes that occurred because of the movement of people from the hinterland towards the coast. The influence of coastal communities on the hinterland was also limited by geomorphology as is clearly evident in the coastal area south of Split (Figure 5.4). Here, the coastal slopes of Mosor and Biokovo used as vineyards and pastures, restricted access to the hinterland where most of the land remained as woodland (Figure 5.5).

Figure 5.3. Cadastral map (1824-1837) of Dalmatia depicting categories of land use type (Source: MAPIRE.eu).

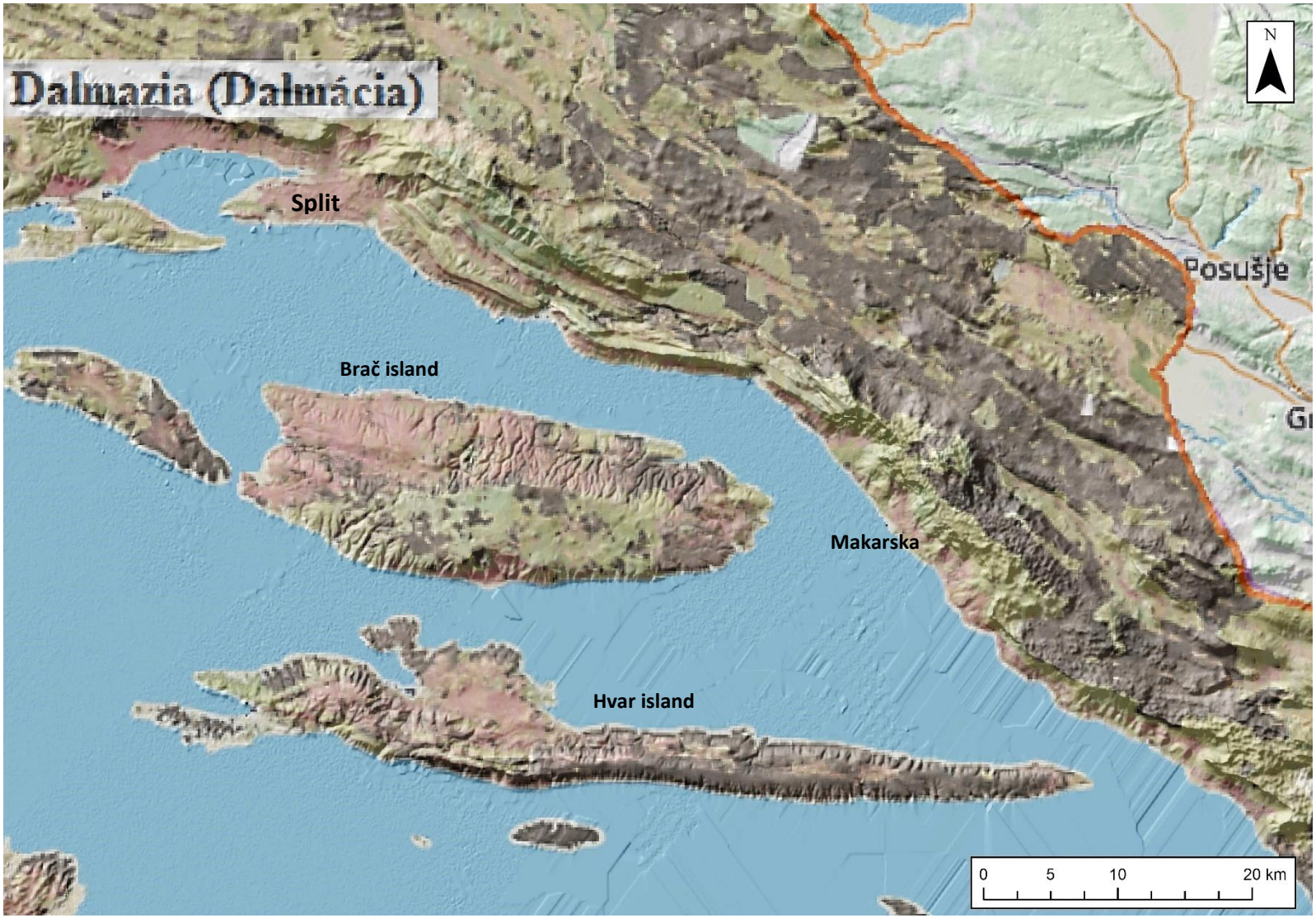


Figure 5.4. Cadastral map of southern Dalmatia from 1833-1835 which the author superimposed on shaded relief map in ArcGIS (Source: MAPIRE.eu).

Figure 5.5. View on Makarska town and coastal slopes of Biokovo Mountain which presented a barrier for transportation routes to hinterland (Photo taken by Boris Kačan, 2015).

According to the 1825 plans, the municipality of Šibenik was characterized by an almost complete lack of woodlands (Figure 5.6). The agricultural areas dominantly planted with vineyards covered relatively small, fertile sections in narrow, NW-SE elongated valleys that stretched between parallel ranges of hills. These hills were used as municipal pastures. The pastures were distributed also in hinterland plains where agriculture was not possible because of the karst bedrock. Only a few larger patches of coppiced woodland existed. This was confirmed in 1835 when the Austrian forestry official sent to inspect Dalmatian woodlands and propose management plans concluded that 'it would be wasteful to spend any money on Dalmatian woodlands because they could not provide any gain' (Pjerotić, 1886a, p.315).[54]

[54] *…bila bi grehota trošiti novaca za naše šume, jer nebi iz njih nigda ništa i nikakve koristi.*

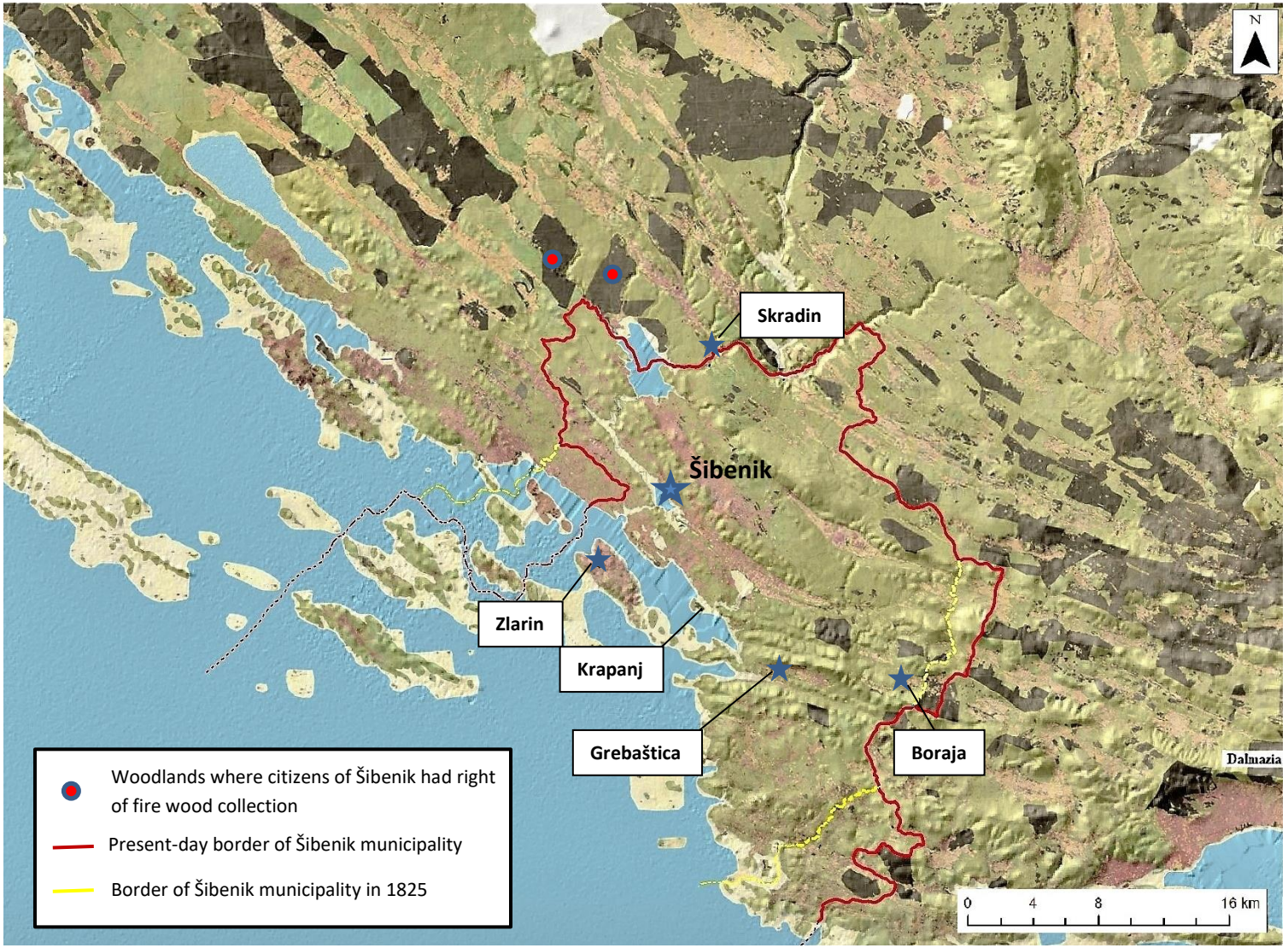


Figure 5.6 Land use map of Šibenik municipality and surroundings from 1824 to 1829 which the author superimposed on shaded relief map in ArcGIS (Source: MAPIRE.eu).

Further details about the condition of the areas classified as woodland were evident in the written records that accompanied the cadastral plans. According to these, woodlands were divided into three classes according to their produce and value of standing wood. The first-class woodlands were those of '*roveri cerri'* and were located within two miles from the sea, while the second-class woodlands were identical except they were located further than two miles from the sea. The woodlands of third-class were made up of hornbeam, ash, buxus, and other species of 'white wood' (*legna biance*). The specification of '*roveri cerri'* is confusing as it would indicate Turkey oak (*Quercus cerris*). However, this oak did not constitute the dominant tree in many parts of Dalmatia. Since *rovere* was used at the time as a word for oaks in general, it is more sensible to conclude that it signified different varieties of oak. The other explanation would be that the Austrians did not differentiate Turkey oak from the pubescent oak which was prevalent in Dalmatia. In any case, oak wood was valued more than those of other trees. The instructions further reveal that all three classes of woodlands were managed as coppice woodland while pasture was their added product (Raccolta delle leggi ed ordinanze…, 1847).

Further information is also provided through the descriptive category of 'Money value' in the Register of land parcels (Methodology chapter, p.53-54). Despite their 'Land use type' being depicted as woodland (as evident in grey colour on the plans), there was not a single woodland parcel in Šibenik municipality where the 'Money value' was expressed as 'woodland' (*bosco)*. Rather, for most of them, the 'Money value' was expressed as 'wooded pasture' (*pascolo boscato)*. This means that these woodlands did not have a value in timber but were used mainly as places for pasture and firewood collection. According to the cadastral records, while woodlands had three different classes, wooded pastures were categorized in one single class which was called 'unique', as they did not show significant differences between them. They included parcels characterized by scattered oak, and hornbeam bushes which were used for firewood collection and the Austrian government recognized them as a very important source of firewood specifically in the coastal areas (Raccolta delle leggi ed ordinanze…, 1847). Therefore, the woodland parcels in the municipality were

made of more or less densely scattered bush-like trees which were managed as coppice for firewood collection along with pasture.

The structure of these woodlands can be further understood from the fact that parcels where the 'Land use type' was designated as 'pasture' also showed 'Money value' in 'wooded pasture'. This means that both woodland parcels and parcels for pasture could have shown similar if not identical characteristics in the sense of vegetation structure. However, because they were differentiated by the 'Land use type', the woodland regulations applied on parcels designated as woodland. On the other hand, pastures with 'Money value' of a wooded pasture represented areas were people had the right, according to the custom, to use them freely for firewood collection and pasture - *ius pascendi et lignandi* (Vučković, 1904). Many foresters of the 19th century referred to these areas as remnants of past woodlands which were crucial for local people's livelihoods and were in desperate need of protection as woodland regulations did not apply there.

Finally, the difference between pastures that showed 'Money value' of a wooded pasture and those with the 'Money value' of simply 'pasture' was that the latter did not consist of bushes but only grass which grew among rocks and boulders (Raccolta delle leggi ed ordinanze…, 1847). This means that cadastral surveyors differentiated landscape based on the type of vegetation and according to the types of exploitation.

It is likely that the previously mentioned term *gaj* was used precisely for these pastures that showed 'Money value' of wooded pasture. A forest guard from the French period defined 'the so-called *Gaij*' as areas that were 'reserved for pasture of working animals as well as small animals'.[55] They were also mentioned as wooded areas but where woodland regulations did not apply as people had the right to exploit freely.[56] The term also appeared in the Austrian legislation where again the 'so-called *gaj*' was defined as 'wooded tracts reserved for pasture and shelter of animals'.[57] Since the only wooded tracts that existed at the time beside proper woodland parcels

[55] *Così detti Gaij riservati per pascolo degli animali da lavoro quanto quelli per gli animali minuti.*
[56] HR-DASI-Šibenik 19.-20.st. Šumarstvo, 14th June 1812. *Ispezione d'ogne foreste*. N. unknown.
[57] *Cosidetti gaj…tratti boschivi riservati pel pascolo e ricovero degli animali.*

were pastures with the 'Money value' of a wooded pasture, it is likely that they were referred to as *gaj*. However, the confusion is created by the fact that many areas categorized as woodlands were also called *Gaj,* such as Vrpolje gaj, Stari gaj, Ravni gaj, etc.

According to several Croatian dictionaries (Jugoslavenska akademija znanosti i umjetnosti, 1891; Anić, 2003) *gaj* in Croatian means a small wood, or grove. Šugar (2008) in his research on the old Croatian terminology on woodlands concluded that *gaj* was only one of the several terms used for woodlands by the local population across all of Croatia and that it signified economic woodlands where pasture and cutting of firewood were allowed. Therefore, the possible explanation is that local people used the term *gaj* for all areas they perceived as wooded, whether they were defined as woodlands or pastures, and this is how they became noted as toponyms, while the foresters differentiated between the two for legislative purposes.

Every larger patch of woodland in the Šibenik municipality was, however, in municipal ownership. Vajda (1954) claimed that these were remnants of forbidden groves established by the French. Since their borders did not follow any distinctive environmental features, and often sharp transitions occurred between woodland parcels and those without any types of vegetation, it is evident that borders were agreed on and woodland area preserved only because of a different management regime. Ivšić (1942), however, argued that they were of Venetian origin when in the 18th century the Venetians handed over control of state woodlands to the settlements or *communes* in order to procure more taxes, which is why they were also referred to as communal woodlands. Kesterčanek (1882b) also mentioned the existence of these municipal woodlands in 1756 and explained that animals were taken there for pasture. It is therefore likely that these woodlands had been passed down from the Venetian times.

Unlike the municipal woodlands, the privately-owned woodland parcels were generally tiny and located on the edge of settlements and fields. Their use, however, was the same as in the case of municipal woodlands, that is, for pasture and firewood collection. Guttenberg (1872) documented that in Dalmatia firewood was collected

from all species of trees and bushes. Hardwood, that of deciduous oaks, holm oak and Turkey oak, was sold for twice the price of other wood. The prices were standardised, and collected wood was tied together forming specified measures. Chopped wood (*legna spaccate*) was derived from thicker trees and was at least six thumbs thick. *Legna rotonde*, locally called *svrževina*, was derived from thinner coppiced wood or branches from tall trees. Pieces of wood that were too small or too thin and could not be sold on markets were used for burning in lime kilns. Another type of wood was called *zappino*, also known as *užežine* or *luč* and was derived only from either black pine or coastal pines from south Dalmatia were they were abundant. This wood was used by fishermen to provide light in nocturnal fishing. Lorini (1903) explained that fishermen would burn juniper or pine wood in braziers to attract sardines which were then caught with nets. Juniper and pine wood was used because of the high amount of resin and was stored on the ship for the duration of fishing.[58]

The archival records depicting disputes between specific settlements over the right of exploitation of certain municipal woodlands show that each settlement had jurisdiction over woodlands in their territory. The exception was Šibenik, the largest settlement in the district. The people of Šibenik '*had a benefit they enjoyed from distant times'* in exploiting '*wooded areas'*[59] of Guduča, Glava, Čista and Babić (Figure 5.6) in Skradin municipality. Once the Austrian government took over Dalmatia, the people of Šibenik were afraid they would lose that benefit, but immediately in 1814, the Austrian Inspector for Water and Forests allowed them to retain it. [60] In the cadastral survey these areas were simply named *Gaj,* despite them being designated as municipal woodlands, but the 'Money value' was again of wooded pasture.

[58] This practice continued until the early 20th century.
[59] *Benefito che hanno goduto da lontani tempi…località boschive.*
[60] HR-DASI- Šumarstvo 19.-20.st., 28th December 1814. *Reg. Sig. Podestà della Comune di Sebenico.* N. 2208 and N.11411.

5.4.2. Woodlands of Šibenik district from the mid-19th century until the dissolution of Austro-Hungarian Monarchy in 1918

The topographical maps of Dalmatia produced between 1851 and 1854 as a part of the Franciscan military survey show very little change in terms of woodland parcels. In the surveyed area of Šibenik, none of the woodland parcels depicted earlier on cadastral plans experienced any changes in their borders on the topographical maps (Figure 5.7). They do, however, note some new elements in the landscape such as railways and roads, so it is likely that woodland parcels did not change because there were few relevant political and legislative changes between the 1820s and the 1850s.

The condition and structure of woodlands in this period was reported by the Office for Military subsistence in Šibenik in 1858. The Office concluded that woodlands in Šibenik area were simply general village woodlands which consisted of bushes while the thickest tree trunks found were only two to three thumbs thick at most with their roots intermixed.[61]

The topographical maps of the 1850s were created at the start of dramatic economic and land use changes that occurred in Dalmatia in the second part of the 19th. Šibenik district was traditionally reliant on the production of wine and olive oil, along with pastoralism. In the 1830s Šibenik district was the largest producer of both wine and olive oil in Dalmatia. In 1838 it produced 28,000 bariles[62] of olive out of 35,000 produced in the whole Dalmatia and had the largest number of fruit-bearing olive trees in Dalmatia (Narodni list, 1884). In 1834 the district also produced 76,672 bariles of wine, out of which 48,394 bariles were used locally which left plenty of wine for export (Peričić, 2016). However, low yields meant that in order to reach affordable production, large areas of agricultural land had to be planted with vineyards, leaving very little area for other crops. Already by 1841, some settlements in the districts such as Dubrava, Vrulje, Mandalina and Zaton had approximately 90%

[61] HR-DASI- Šumarstvo 19.-20.st, 9th November 1858. *Ufficio alle Sussistenze militari all'Onorevole Amministrazione Comunale di Sebenico.* N.147.
[62] 1 Venetian barile equalled to 64.387 litres (Pryor, 1988, p.80).

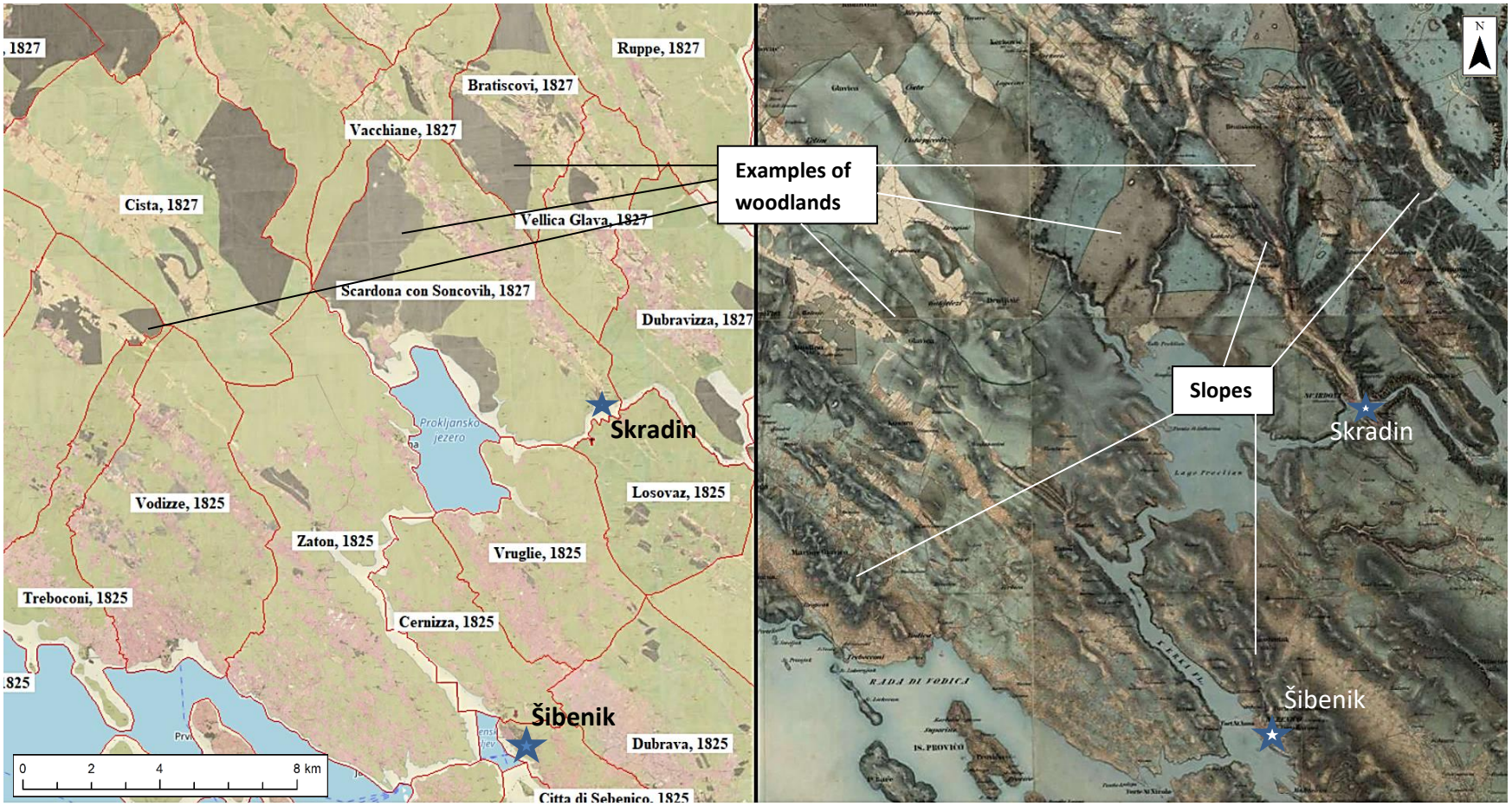


Figure 5.7. Location of woodland parcels of northern Šibenik and Skradin hinterland area on the cadastral map from the 1820s and the topographical map from 1850s. The woodland parcels depicted in grey on the cadastral map are visible in the same borders on the topographical map in grey as well. They should not be confused with slopes that are depicted with method of hatching (Source: MAPIRE.eu).

of their total agricultural area covered in vineyards. In the whole district, 54% of all agricultural areas were planted with vineyards, and from the 1850s their area started to increase even more rapidly (Tambača, 1998).

The rapid expansion of vineyards was propelled by the increase of wine price in Dalmatia from between 1.4 and 3 forints per barile in the 1840s to 3.5 forints in 1848 and then rapidly peaking to an average of 38 forints per barile in 1860 (Figure 5.8) (Ožanić, 1923). This increase started when vineyards in France and Italy were hit by powdery mildew (oidium) and downy mildew (Peronospora) diseases from the early 1850s which caused a steady increase in demand of the Dalmatian wines in the rest of Europe (Ožanić, 1923; Nakova et al., 2017). As a result, the Dalmatian vineyards underwent a massive expansion which was not stopped even by the outbreak of the mildew in Dalmatia from 1857 until 1867 (Čuka et al., 2017). In Šibenik district the area under vineyards almost doubled, from 5,592 ha in 1841 to 10,421 ha in 1857 (Tambača, 1998). As phylloxera started to ravage vineyards of France, Spain and Italy from the 1870s, Dalmatian vineyards quickly recovered bringing a period of prosperity especially to the rural areas (Ožanić, 1923; Kraljević, 1994). As a consequence, the pressure on woodlands increased not only because of the need for more land but because people needed wood for poles in vineyards (Figure 5.9). However, this changed towards the end of the century. The first blow to the wine industry was given by the so-called Wine Clause negotiated between Italy and Austria-Hungary in 1892 that lasted until 1903. It led to substantial duty cuts in the import of Italian wines which devastated the local production (Stulli, 1982). In the same decade phylloxera appeared in north Dalmatia and in 1898 it spread across the Šibenik district devastating the livelihood of many people (Peričić, 2016). The disease ravaged the Dalmatian viticulture-focused economy and caused a wave of emigration after 1900.

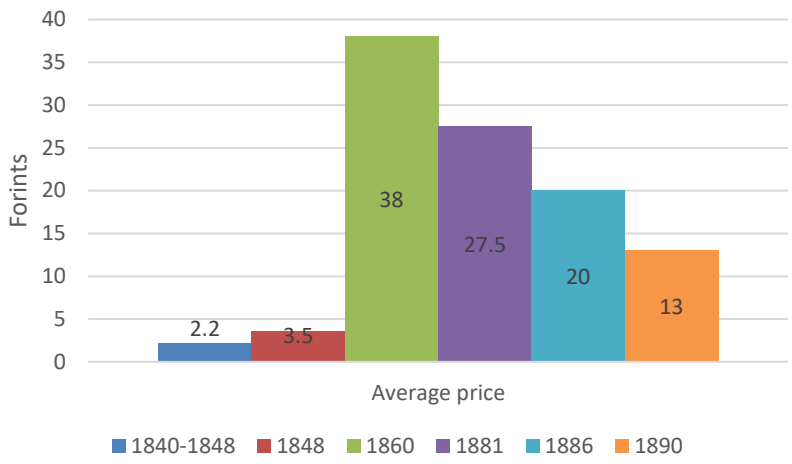


Figure 5.8 The average price of barile of wine in Dalmatia (Source: Ožanić, 1923).

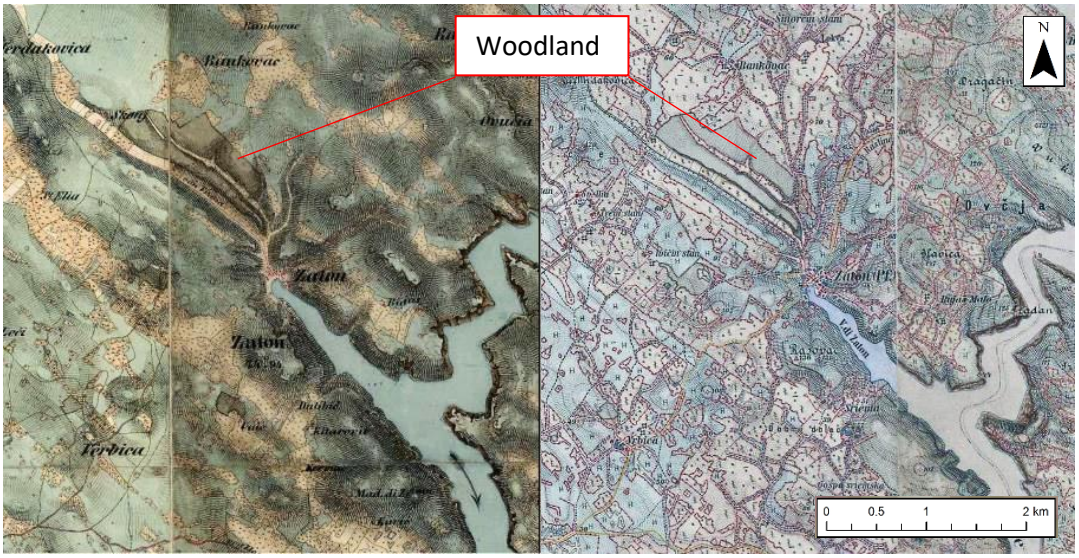


Figure 5.9. The landscape of Zaton area northeast of Šibenik on second military survey topographic map (1851-1854) and third military survey topographic map (1869-1887) depicting the spread of vineyards. The agricultural areas, dominantly planted with vineyards are marked in yellow, while pastures are green (Source: MAPIRE.eu).

With only 9.5% of its territory covered with fertile plains, compared to an average of 23% in other karst regions of the Empire, Dalmatia was naturally predisposed for pastoralism. In 1851 pastures covered 66% of the land, compared to an average of 18% in the rest of the Empire. However, the poor condition of Dalmatian pastures and the type of terrain on which they were distributed was clearly reflected in the composition of domestic animals (Figure 5.10).

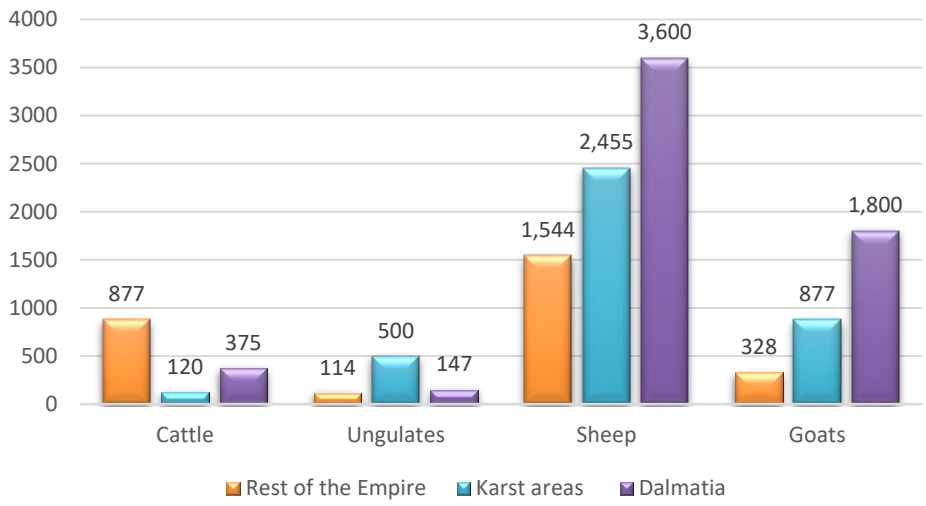


Figure 5.10. Average number of domestic animals per mile in different parts of the Austrian Empire in 1851 (Source: Wessely, 1877c).

Pastoralism in Dalmatia was dominantly based on sheep and goats with a ratio of two sheep per one goat. The reliance on more agile goats that could handle the terrain easier than other animals was such that in some areas, such as Obrovac north of Zadar, there were as much as 3,250 goats per mile in 1851 (Wessely, 1877c).

A large number of sheep and goats was not reflected in the economic gain from pastoralism. Basing his conclusions on texts from the 19th century, Vipauc (2006) argues that people put more effort into increasing the number of animals, rather than creating better breeds. There was no particular breed of sheep in the region at the time and efforts to breed merino sheep, carried out by the French and the Austrians mostly failed. Therefore, the sheep yielded wool of poor quality and little meat, except on some islands and coastal areas where conditions were milder while collaboration in cheese production, which could have mitigated this, was absent. The goats, however, were described as 'pretty, strong and yielding a lot of milk', while their meat was especially valuable in rural households. Peričić (2016) explained that they also provided people with hide for belts and *mijeh,* a flayed skin sown into a sack for carrying liquids, especially wines.

In karst areas, pasture was traditionally done by sending flocks of sheep, and especially goats, into municipal woodlands and especially *gaj*. The poor-quality grass was not enough for providing food, so animals relied on bushes and buds on tree

branches. While most of the flocks of sheep were taken to mountain pastures in the hinterland during dry summer, the lack of snow allowed pasture for the remaining animals, mainly goats, throughout the year (Wessely, 1878a). This led to intense pressure on local woodlands, which is why foresters were particularly concerned about goat keeping.

The data on domestic animals for Šibenik district from 1827 until 1847 show that the ratio of sheep to goats was approximately five to six sheep to one goat (Figure 5.11) which was much less than the average for Dalmatia as goats were particularly abundant in the hinterland areas and less so in the coastal ones. This is evident in the statistical data from the 1850s which showed the number of animals from the Skradin district in the hinterland and the Šibenik district together, and the ratio changed to three sheep per goat (Figure 5.12). Malnutrition, overpopulation and poor breeds were often the cause of devastating epidemics, and several of those that happened in 1829, 1830 and 1833 were clearly evident in the numbers from 1833, when the total number of animals dropped to its lowest. The numbers recovered by 1847 but the disease, and possibly rapid spread of vineyards, again caused a drop in 1857. Despite the fact that some severe epidemics were reported in the 1880s, the number of sheep remained approximately stable until the end of the century, but the number of goats continued to drop rapidly (Peričić, 2016).

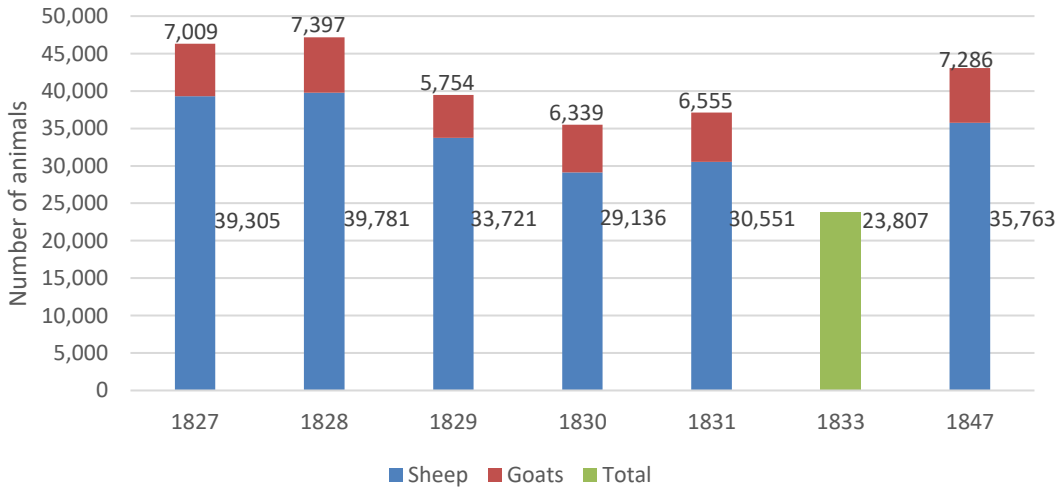


Figure 5.11. The number of sheep and goats in the Šibenik district from 1827 to 1847. Data for 1833 only included a total number of animals (Source: Peričić, 2016).

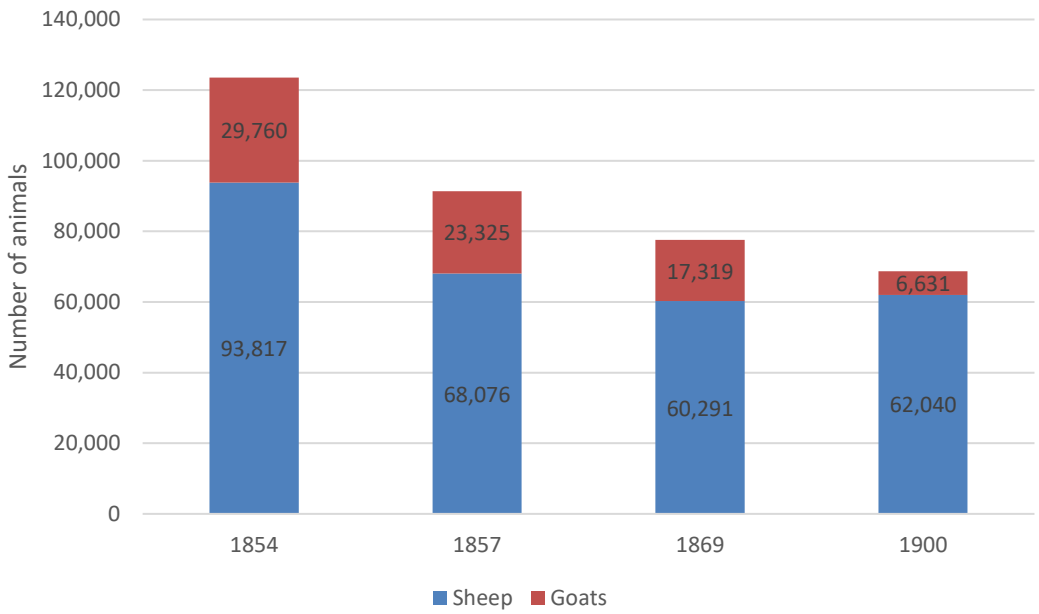


Figure 5.12. The number of sheep and goats in the Šibenik district from 1854 to 1900. Because of administrative changes the data include hinterland municipality of Skradin which used to be an independent district (Source: Peričić, 2016).

The decline of goats in the second half of the century was caused by some significant changes in the legislation and the administration of the region. In 1865 counties and county authorities were abolished, and their powers were divided between the district authorities and the Regency. Municipalities then became autonomous administrative units within the districts and the municipality councils, elected by the local population, were the ones that appointed heads of municipalities as well as village heads. The authority over woodlands had then shifted from a regional to a more local level (Ivković, 1992; Ćosić, 1997).

The first body of professional foresters in Dalmatia consisting of a national forestry supervisor and five commissioners was established in 1872. They were all placed in specific districts where they worked alongside municipal authorities. The Forest Act in enacted the Austrian Empire in 1852, but implemented in Dalmatia in 1858, did not address the specific issued related to Dalmatia. Therefore, in Dalmatia, this Act was amended with further regulations in 1873 and included the prohibition of digging and selling of stumps and roots and debarking which represented a repetition of the Austrian regulation from the earlier period. However, the new legislation also granted the district authorities the jurisdiction to ban goats in specific

areas which they immediately began to enforce (Wessely, 1878a; Šumarski list, 1905; Petrović, 1910).

Despite the newly acquired power, records show that the banning of goats was actually in the hands of the village councils as in Skradin municipality each village implemented this regulation differently. For instance, in Smrdelj the village council declared the ban would serve no purpose as there was enough land where browsing could be done, although they decided to ban the goats from entering Volunj woodland.[63] In another case, in the village of Bratiškovci, the council found that there was no suitable place for goats and since they also caused damage to agriculture, they had to be entirely removed from its territory.[64] In most of the villages, however, the ban was implemented on specific areas of the village territory only, mostly in the woodlands.

In 1888 the provincial regent wrote to the Dalmatian national government about the results of the implementation of the ban.[65] He explained that some municipalities postponed the implementation of the ban for nearly a decade as people opposed killing their goats, while others sent a request to renew the keeping of goats. Despite hinting those requests would be approved in the areas where there was no danger to woodlands, he pointed out that the free-roaming of goats that existed before 1873 was over for good. The fact that a lot of pressure was coming from people is also evident from the new regulation in 1888 which allowed the keeping of goats with a permit which would be revoked if goats were found in prohibited areas.

Another major factor which contributed to the decrease of goats, but also to major land use changes, was the Law on the division of municipal lands which the Austrian government enacted in 1876 in an effort to tackle what they perceived was the destructive influence of municipal ownership. This Law stipulated that municipal lands that were suitable for cultivation had to be divided between the people living in the municipality, while the remaining land would remain as it used to be. Foresters

[63] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 12th August 1875. *Zapisnik seoskog zbora Smrdelja.*
[64] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 22nd August 1875. *Zapisnik seoskog zbora u Bratiškovcu.*
[65] HR-DASI-Šibenik 19.-20.st. Šumarstvo. unknown. *Dopis.* N.6663.

had to establish 'proper' woodland in those parcels that were designated in the cadastral survey with a value of wooded pasture. The establishment of woodland was supposed to be carried out through natural regeneration and if necessary, reforestation. To achieve this, pasture and other types of exploitation had to be prohibited, at least until the stand had developed enough to resist the damage from animals, and the area had to be enclosed (Wessely, 1878a; Šumarski list, 1905; Petrović, 1910). These new regulations are similar, if not identical, to the regulations concerning the establishment of forbidden groves from the earlier period and can easily be understood as their continuation. The term which was used for the areas where woodland was supposed to be established was *branjevina* or protected woodland.[66]

The Law on the division of municipal lands also allowed that previously barren areas could also be designated as a woodland if its establishment was considered to be of public interest. This opened up vast areas for conversion into woodland through reforestation (Wessely, 1878a). Although the management of newly created woodlands was entrusted to the district authorities, as the state was supposed to relinquish its jurisdiction, the real power of dividing the municipal lands was in the hands of the municipality. The division plan was assembled by the municipal authorities, but it had to be confirmed by the local division council which consisted of the district head, two envoys from the municipality representatives, two citizens and, in a case of woodland division, a state forestry official. After their confirmation, the plan was passed on to the national committee, set up within the Regency[67], which considered complaints from citizens and gave the final approval (Wessely, 1878a).

Since the whole process had to be initiated by the municipal authorities, Guttenberg (1881) described it as slow, because the wealthiest people held positions in the municipal councils. These people had the largest flocks of animals, hence their dependence on municipal pastures, which is why they were reluctant to give up the land on which they depended. Nevertheless, the process was set in motion, and large

[66] *Branjevina* is a noun which is derived from the verb *braniti* which translates as *protect*.
[67] Regency or I*mperial Regia Luogotenenza della Dalmazia* represented the central government body in Dalmatia and was headed by a regent which was selected by the Emperor.

areas previously designated as wooded pastures and pastures were then administratively changed to woodlands.

This is confirmed by the topographical map produced in the third military survey which was carried out in Dalmatia between 1869 and 1887. Since the municipality of Šibenik was characterised by a lack of woodland, the changes were most clearly visible in the neighbouring municipality of Skradin, which was also a part of the Šibenik district (Figure 5.13). This was the area where Šibenik citizens had the right of firewood collection in several municipal woodlands. The woodland parcels that were shown on the cadastral plans from the 1820s and the topographical map from the 1850s are marked in red on Figure 5.13. The woodland areas that were noted during the third military survey (1869-1887) are marked in grey and show a considerable increase in area. They included karst plains and hills that were on the cadastral plans from the 1820s categorised as pastures. This does not mean that the vegetation cover underwent any changes, instead only the label and the corresponding regulations were applied to areas that the district authorities designated would be used as woodland or for which plans of a woodland establishment were made. Consequently, the category of woodland now spanned over areas where woody vegetation cover was minimal. After all, the term forest/woodland was never explicitly defined in the Austrian legislation, not even in the 1852 Forest Act, which means that even an area completely devoid of trees could have been considered a woodland if it was proclaimed so by the authorities (Vac, 1902).

This map also explains how the woodland area in Dalmatia statistically increased by 39.5%, or from 192,417 ha before 1876 to 268,468 ha after the Law on land division was implemented. The total average increase for the whole Empire was only 6% (Sternegg, 1885). Despite this, Dalmatia was still the least wooded region of the Empire with just 17% of its area designated as woodlands compared to an average of 35% in the rest of the Monarchy. The newly established woodlands were dominantly in the municipal ownership, a characteristic which became more and more explicitly related to Dalmatia. While the rest of the Monarchy had an average

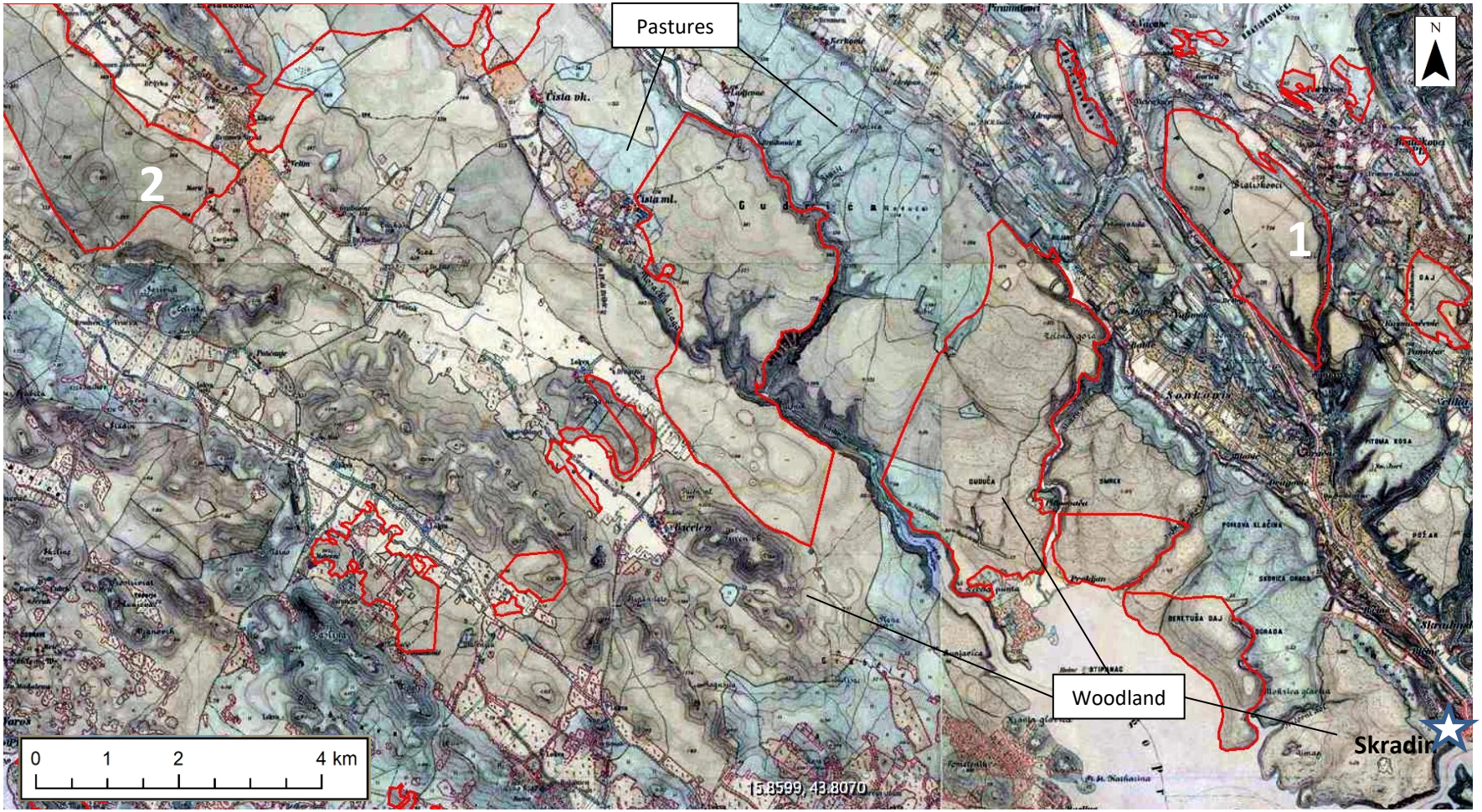


Figure 5.13. Topographical map of Skradin hinterland (1869-1887) with woodland areas depicted in grey. For the purpose of comparison, the borders of woodland parcels from the 1820s cadastral plans are drawn in red by the author (Source: MAPIRE.eu).

of 8% of woodlands in municipal ownership, in Dalmatia 55% of woodlands were so held (Šumarski list, 1884).

Closer examination of woodland parcels on the topographical map from the third military survey (1869-1887) reveals that there were two shades of grey used to depict woodlands and delineation lines were drawn across some of these parcels. Differences between these delineated areas are evident on the topographical map from the third military survey but produced in the scale of 1:75,000 as it showed more details on the vegetation cover than the one in the scale of 1:25,000. In Podi woodland (number 1 in Figure 5.13) the line stretching across the middle of woodland distinguishes an area depicted as covered with single trees from a more wooded area with groups of trees (Figure 5.14). On the other hand, in the woodland near Sonković village (number 2 in Figure 5.13) the line delineates areas which had the same vegetation structure which was depicted as scattered single trees (Figure 5.15). It is not clear how the line on the maps was represented in the landscape, but records from the late 19th century mention demarcation stones were used in some cases.

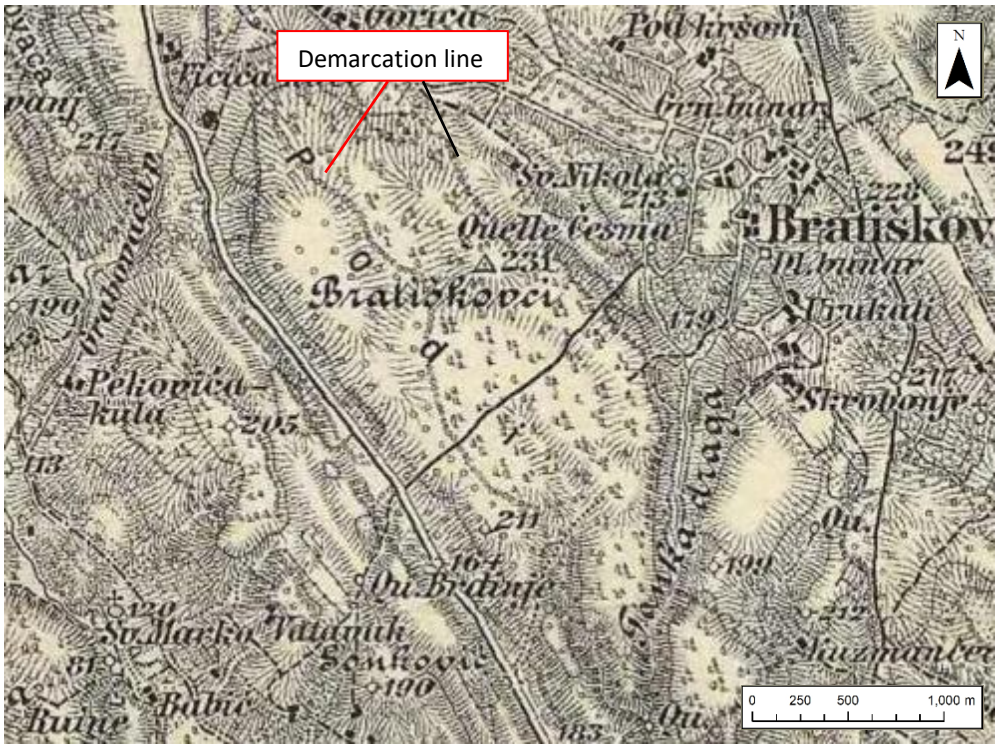


Figure 5.14. Podi woodland is shown in the third military survey (1869-1887) topographical map on a scale of 1:75,000. A demarcation line in the middle of the woodland parcel (in red) delineates a more wooded part from the less wooded one and other demarcation lines (in black) mark the woodland borders in relation to the rest of landscape (Source: MAPIRE.eu).

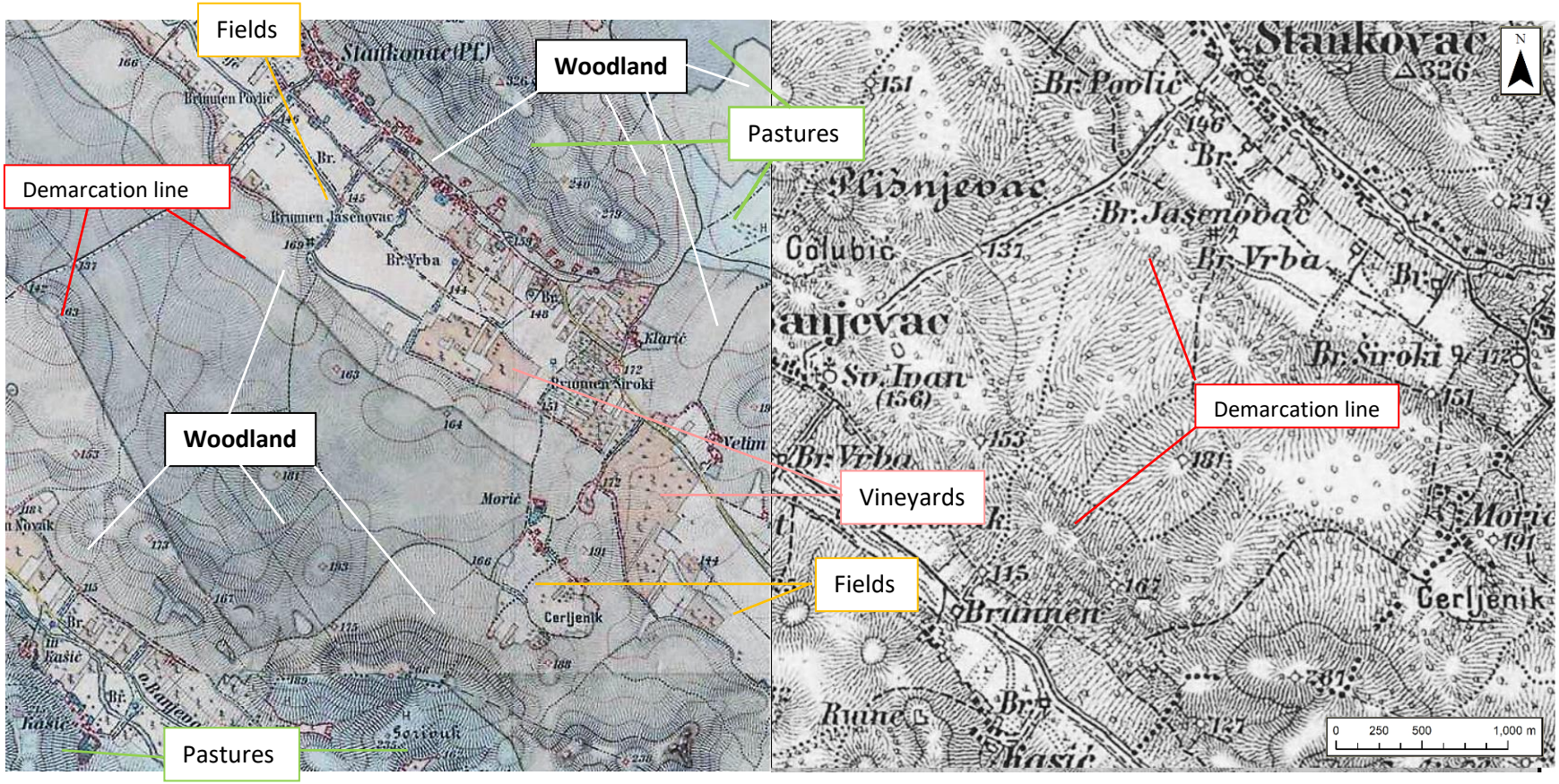


Figure 5.15.Woodland near Stankovci on third military survey (1869-1887) topographical maps in scale of 1:25,000 (left) and 1:75,000 (right). The woodland area on the map to the left is shown in a lighter and darker shade of grey, while the map to the right shows demarcation line existed between the two areas. However, there was no difference in the structure of vegetation between two shades of grey which implies that the areas had different management schemes (Source: MAPIRE.eu).

It is likely then that the demarcation lines on the map in a scale of 1:75,000 and different shades of grey shown on the map in a scale of 1:25,000 were not delineating more wooded parts of woodlands, but rather sections that were put under stricter protection from exploitation, that is *branjevine* or protected areas. A report from 1882 reveals that throughout Dalmatia 692 protected areas were established with the aim of renewing or establishing a woodland (Šumarski list, 1882a). By 1905 it was reported that an area of 155,000ha was put under protection, while pasture of goats was banned on 455,000 ha (Šumarski list, 1905). It was also mandatory by law that a fifth of the woodland area in each settlement was supposed to be under protection from exploitation. Despite this, it was not always the case and on Žirje island it was reported in 1908 that none of the woodland areas enjoyed protection because people refused to stop using them as pastures.[68]

The increase of woodland area in Šibenik municipality after the implementation of the Law on the division of municipal lands was not as significant as in neighbouring Skradin. Excluding the southern part of the municipality, which will be discussed later, only two larger patches of woodland were established – Trtar and Ravni gaj (Figure 5.16). Archival records confirm that Ravni gaj was an area classified as a municipal pasture in 1843 and was used by local people in this way for as long as anybody could remember.[69] After the area was designated as a woodland, villagers of nearby Danilo Biranj had the right to continue using only part of the woodland for pasture while cutting for firewood was forbidden entirely.[70] The only cutting that was allowed was supervised by foresters for the purposes of rejuvenation, thinning and cleaning.[71] This example also shows how the term *gaj* was transferred from a municipal pasture to a woodland along with the land category change.

[68] HR-DASI- Šibenik 19.-20.st. Šumarstvo. 27th December 1908. *Oglas zabrane paše u odlomku Žirju*. N. 25090.
[69] HR-DASI- Šumarstvo 19.-20.st. 10th June 1843. *Circolo Imp.Reg. Governo.* N.14504/1160.
[70] HR-DASI- Šumarstvo 19.-20.st. 13th June 1893. *Dopis.* N. 9057.
[71] HR-DASI- Šumarstvo 19.-20.st. 5th July 1893. *Program naumljenog službenog putovanja općinskog šumara kroz mjesec lipanj 1893*. N. 173.

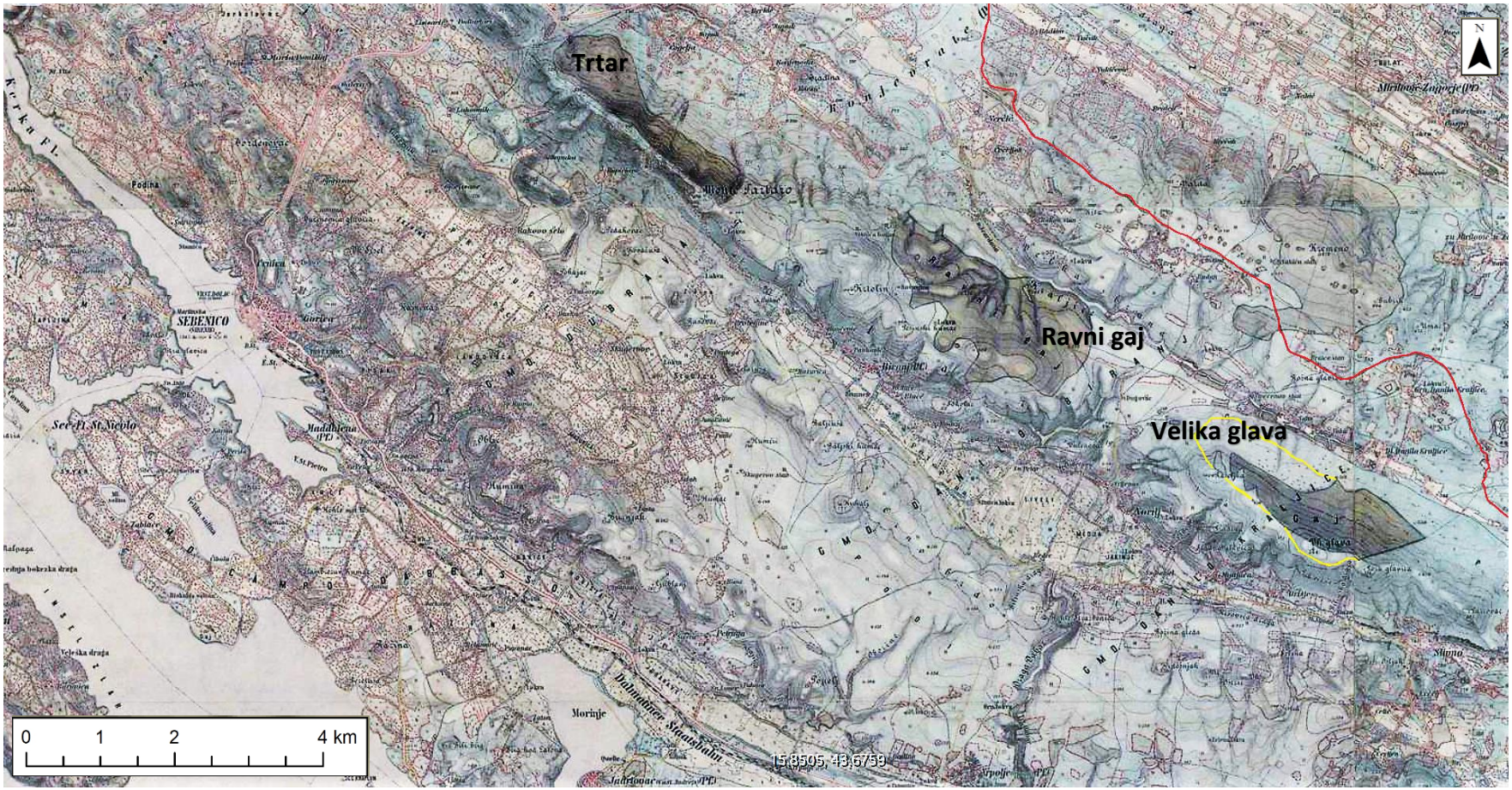


Figure 5.16. The central part of Šibenik municipality on the third military survey topographical map (1869-1887). The borders of Trtar, Ravni gaj and Velika glava municipal woodlands are marked in dark grey (darkened with Photoshop CC 2015 by the author in order to make them more distinct on the map) while the border of Velika glava woodland from 1825 cadastral survey is drawn in yellow by the author to emphasise conversion of woodland to a pasture (Source: MAPIRE.eu).

In the case of Velika glava woodland, its existence was noted already during the cadastral survey of 1825. However, the borders of the woodland had later changed. The yellow line in Figure 5.16 shows the border of the woodland from the 1825 survey in relation to the third military survey (1869-1887) which means that a part of the woodland had been transformed to a pasture. This was in direct opposition to the main stipulation of the 1852 Forest Act which stated that it was not possible to convert woodland to another land use category. However, in 1867 the Dalmatian regency informed municipal authorities across Dalmatia that such practices had been happening too frequently and had led to further devastation of woodlands.[72]

The most extensive municipal woodland was located at least until the second half of the 19th century in Vrpolje section. Comparison of borders from 1825 cadastral plans and the topographic map from the third military survey (1869-1887) shows how its borders were changed in a way that they matched the ravines, possibly in an effort to limit the woodland category to steeper terrain less convenient for pasture or more prone to erosion (Figure 5.17). The rest of the former woodland area had been designated as a pasture, which opened it up for more intense exploitation. The only report about the woodland came from 1893 and confirmed that the woodland was in good condition and was not damaged by illegal cutting.[73]

Only three years later, the municipal forester reported that out of all municipal woodlands in Šibenik district, only Trtar woodland was in moderate condition. All other woodlands were severely damaged because of illegal cutting, and excessive pasture and the officials feared about their complete disappearance. However, since many pastures contained roots of oak trees, they believed that prohibition of pasture and browsing in such areas and implementation of protective

[72] HR-DASI- Šibenik 19.-20.st. Šumarstvo. 24th August 1867. *Circolare dell' I.R. Luogotenenza della Dalmazia.* N. 10280-3267.
[73] HR-DASI- Šumarstvo 19.-20.st. 1st August 1893. N. 189.

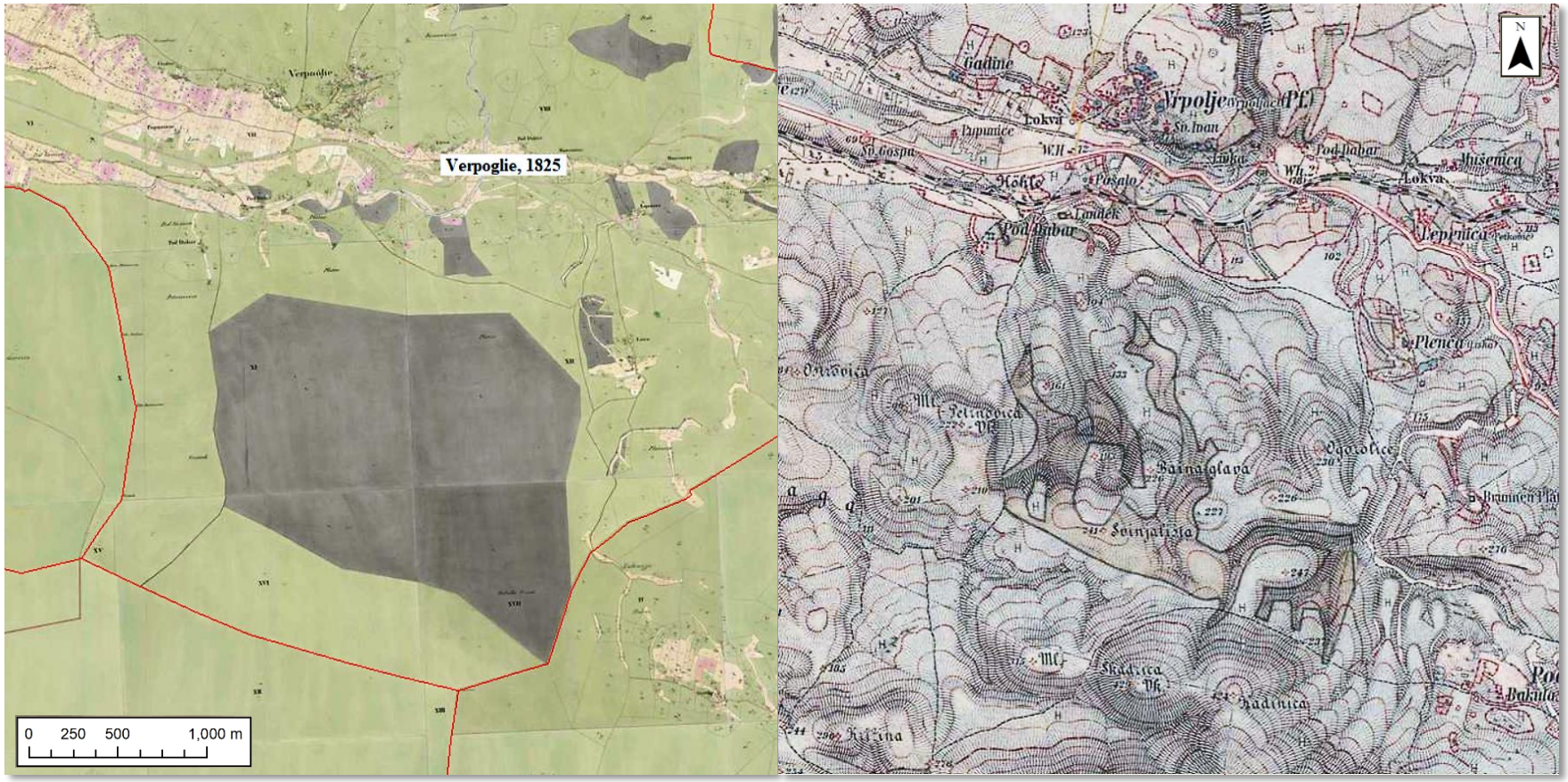


Figure 5.17. Vrpolje gaj municipal woodland in Vrpolje section on 1825 cadastral plans (left) and the third military survey (1869-1887) topographic map (right) (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmacij, KO. 719 Vrpolje (Verpoglie). Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine; MAPIRE.eu).

regulations could bring renewal. This is probably the reason new woodland areas were proclaimed on areas that were previously used as pastures.[74]

Establishment of new woodland parcels occurred on islands of the municipality as well. In the case of Kaprije island a more wooded part of the municipal pasture was separated as a woodland after 1876 (Figure 5.18). The maps also show a significant expansion of vineyards which in this period became the dominant economy on islands of the district.

Finally, the third military survey (1869-1887) also produced general maps of the Monarchy in the scale of 1:200,000. Published in the early 1890s, they depicted all woodland areas in green. The comparison of woodland areas in the municipality of Šibenik from the 1820s and 1890s does show an increase of woodland areas, particularly in the south part of the municipality (Figure 5.19). However, with only 8% of the area covered in woodland in 1889, Šibenik was the least wooded municipality in the whole of Dalmatia. Most of the woodlands here were municipal with smaller patches privately owned, but there were no state-owned woodlands, like in Zadar district where 60% of woodlands were state-owned (Chavanne, 1889).

[74] HR-DASI- Šumarstvo 19.-20.st. 20th July 1896. *Razjašnjenja k. Šumskom katastru o šumam stojećim pod javnom upravom i pod osobitim javnim nadzorom odlomka Konjevrate političke općine Šibenske na temelju poduzetih šumsko tehničkih izvidia.* N. unknown.

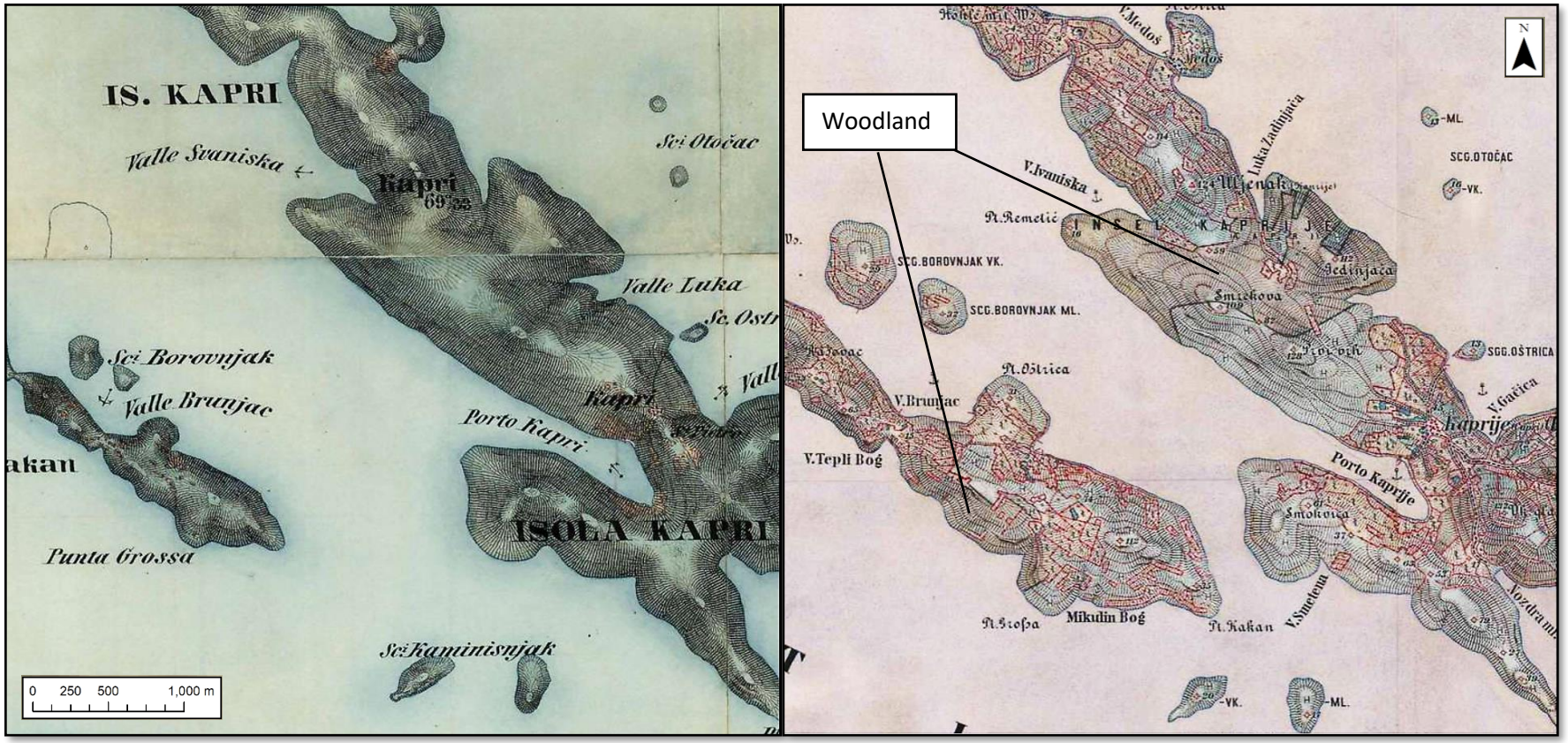


Figure 5.18. Kaprije and Kakan islands on second military survey topographical map (1851-1854) on the left and third military survey topographical map (1869-1887) to the right. Significant changes in land use occurred on the islands because of the expansion of vineyards, while pastures in the central part of Kaprije were designated as a woodland (Source: MAPIRE.eu).

Figure 5.19. Šibenik municipality (without Kaprije and Žirje islands) on third military survey (1869-1887) general map in a scale of 1:200,000 with woodlands parcels depicted in green. The extent of woodland parcels from the 1820s cadastral survey is marked in red (Source: Lazarus.elte.hu, sheets Zara, 33-44 and Spalato, 34-44).

Just as in the Venetian and French periods, the primary concern of the Austrian foresters was the protection of Dalmatian woodlands from overexploitation by the local population. The system of woodland protection included territorial guards, village patrols and forest guards, which were all adopted from the French period. However, Wessely (1878a) wrote that rapid devastation of woodlands occurred particularly until 1868 because there was nobody who would supervise the woodlands. This was supported by the Dalmatian government circular from 1867 in which the lack of staff was pointed out as the main reason why existing regulations could not be implemented.[75]

The lack of staff can be explained by the fact that even though regulations stipulated that professional foresters supervise woodland management the first forestry official was not employed until 1872. Before that forestry issues were dealt by county authorities, which for Šibenik district was Zadar, and these were too distant from local woodlands and likely included few high-ranking Austrian foresters. Only with the administrative reorganisation and the increase of forester's jurisdictions in 1868 could modern forestry management start developing.

The number of foresters in Dalmatia quickly increased as the Dalmatian government secured more funds and the area of woodlands increased after 1876 (Table 5.2). The first document which confirms that a municipal forester was employed in Šibenik municipality comes from 1888, while by 1894 one forest guard was present in each settlement of the municipality. This also means that only one person had to supervise an area of tens of square kilometres.[76] The same number of forest guards was reported in 1904 as well, with the exception of Boraja section where one forest guard was present in Mravnica and one in Boraja settlement.[77]

[75] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 24th August 1867. *Circolare dell' I.R. Luogotenenza della Dalmazia*, N. 10280-3267.
[76] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1884. *O stanju općinskog šumarskog osoblja, njegovoj djelatnosti i o stanju šumarskih naknada dosudjenih i utjeranih u … općine.*
[77] HR-DASI- Šumarstvo 19.-20.st. 22nd March 1904. *Iskaz o stanju općinskog šumarskog osoblja I njegovoj djelatnosti i o stanju šumarsih naknada dosudjenih i utjeranih na korsit općine u godini 1903.*

Table 5.2. Number of forest guards and foresters in Dalmatia from 1877 to 1886 that were funded by Dalmatian government (does not include those funded by municipalities) (Source: Šumarski list, 1882d; 1883c; 1886d; 1887c).

Year	Forest guards	Foresters	State funds (in forints)
1877	70	1	3,706
1878	85	1	3,759
1879	101	2	5,796
1880	151	6	8,332
1881[78]	184	7	9,507
1882	311	7	16,531
1884	377	12	/
1885	462	12	/
1886	/	/	47,948

Forest guards were recruited from the local population which often led to problems as they had to supervise people from their own village (Marinović, 1919). The only special schools for their education were in Tirol, Styria and Galicia from 1881, but Dalmatians could not afford to attend these schools and so they only possessed basic skills in writing and reading. (Fernel, 1911; Marinović, 1919). Municipal foresters, on the other hand, had to be educated in forestry science which was confirmed through a state exam. Their task was to draft woodland management plans, supervise cutting, thinning, cleaning and reforestation in woodlands, implement bans on exploitation and enforce penalties for woodland crimes as well as supervise the work of forest guards (Malnar, 1885).

The service of municipal foresters was a hard one and records reveal there were often struggles for power between them and different levels of authority. Although they reported to district authorities, they were based in municipalities and had to coordinate their work with them. This often caused problems in their service as interests of municipality diverged from those of the district. In such situations, the municipality would merely stop enforcing government woodland regulations which made foresters unable to carry out their work. If they complained to the district authorities, the government would punish the municipality by withdrawing financial

[78] Two more foresters and 64 forest guards were funded by municipalities.

support they received for woodland management which the municipality then used as a pretext for cutting the funds for foresters, leaving the foresters with no option but to resign (Malnar, 1885).

These struggles, which also included the disputes with village councils, became apparent in most of the duties the foresters carried out. Among these, the provision of firewood from municipal woodlands was the one that was the most important. This was done through the cyclic clear-cutting of vegetation in specific sections of woodland determined by the forester. Although regulations from 1814 mandated that cutting had to be avoided in the spring, it was only in 1873 that the period of cutting was determined by the Law. It became limited to a period from 1st September to 31st March, thus enabling its more efficient supervision (Wessely, 1878a; Šumarski list, 1905). The municipality authorities, as well as village councils, often petitioned district authorities to allow cutting in specific areas, but these were often rejected by the district authorities.[79] For instance, when such a request was made for Zaton and Raslina woodlands, the district rejected it on the basis that clear-cutting would expose the soil to heat and wind and at least some trees were needed to support natural regeneration.[80] There were also some traditional customs limited to the territory of specific settlements which were legally recognized. For example, in Primošten it was stipulated that exploitation was prohibited in their woodland from 1st March until 1st August and it had been so since time immemorial.[81]

Because woodlands were managed through clear-cutting, strict control of pasture was necessary so that regenerating plants did not get damaged. According to the regulations, the cut areas were open for lambs already in the first year from 1st of August until damage to the plants was observed. The sheep were introduced under the same conditions in the 2nd year while in the 3rd year pasture was carried out without restrictions. Cattle and goats were allowed only when the trees had grown enough to resist the damage.[82]

[79] HR-DASI- Šumarstvo 19.-20.st. 1892. *Dopis.* N.4603.
[80] HR-DASI- Šumarstvo 19.-20.st. 18th November 1892. *Dopis.* N.13550.
[81] HR-DASI- Šumarstvo 19.-20.st. 2nd June 1890. *Uglednom Obćinskom Upraviteljstvu*. N. 4803.
[82] HR-DASI-Šibenik 19.-20.st. Šumarstvo. unknown. *Dopis.* N.6663.

However, in the case of implementing a ban on pasture the authority of the district and the forester were challenged by the village councils. For instance, in 1908 a forester suggested a ban on pasture in Podi and Kita woodlands where 'poor and stunted woodland' was to be cut near the ground for rejuvenation purposes. However, the village council declared that those woodlands could not be banned from pasture in any way as 'animals are the main products on which we survive, and if pasture was banned we would have to sell everything and die from starvation'. One of the solutions the forester proposed was that after the cutting, he would open a part of protected woodland of Trtar for goats as compensation, which in turn violated regulation on the prohibition of goats in woodlands.[83] The minutes from the council meetings in Skradin reveal that it was customary that as the new areas were put under protection so previously protected ones were opened for pasture again.[84]

It was crucial for the forester to adhere to the wishes of the local population because opposition from the people meant more woodland crimes. For instance, in 1896 a forest guard was stopped from demarcating protected woodlands of nearby Danilo Biranj and Danilo Kraljice villages by a hundred of armed villagers from both villages. He had to request an armed escort in order to continue the demarcation.[85] However, even though demarcation stones were eventually placed in Ravni gaj, the woodland was reportedly regularly illegally cut, and animals were brought to pasture in the following years.[86]

The establishment of protected woodlands and increase of woodland area in general reduced the overall area of pastures by 22% in the 1880s (Sternneg, 1885). It does not come as a surprise, therefore, that the number of reported woodland crimes rose from 1,921 in 1883 to 6,702 in 1887 (Šumarski list, 1883c; 1887). The real numbers were probably higher as the Dalmatian government repeatedly warned municipalities about their reluctance to report and enforce punishments for crimes.

[83] *Blago namin je glavni proizvod od koga živemo te kad bi nam se paša zabranila morali bi sve prodati i mi od gladi skapali.* HR-DASI-Šibenik 19.-20.st. Šumarstvo. 29th September 1908. N.6199.
[84] HR-DASI- Šumarstvo 19.-20.st. 31st July 1908. *Skradinska općina.* N.561.
[85] HR-DASI- Šumarstvo 19.-20.st. 25th March 1896. N. 41.
[86] HR-DASI- Šumarstvo 19.-20.st. 31st October 1896. N. 5110.

Because of continued damage to woodlands, the government implemented a system which evaluated the success of forest guard's service by the condition of the woodland he was responsible for rather than the number of crimes reported.[87] However, with the expansion of vineyards and the population which more than doubled since 1815 (Figure 5.20), along with shrinking pastures, the pressure on woodlands only kept increasing.

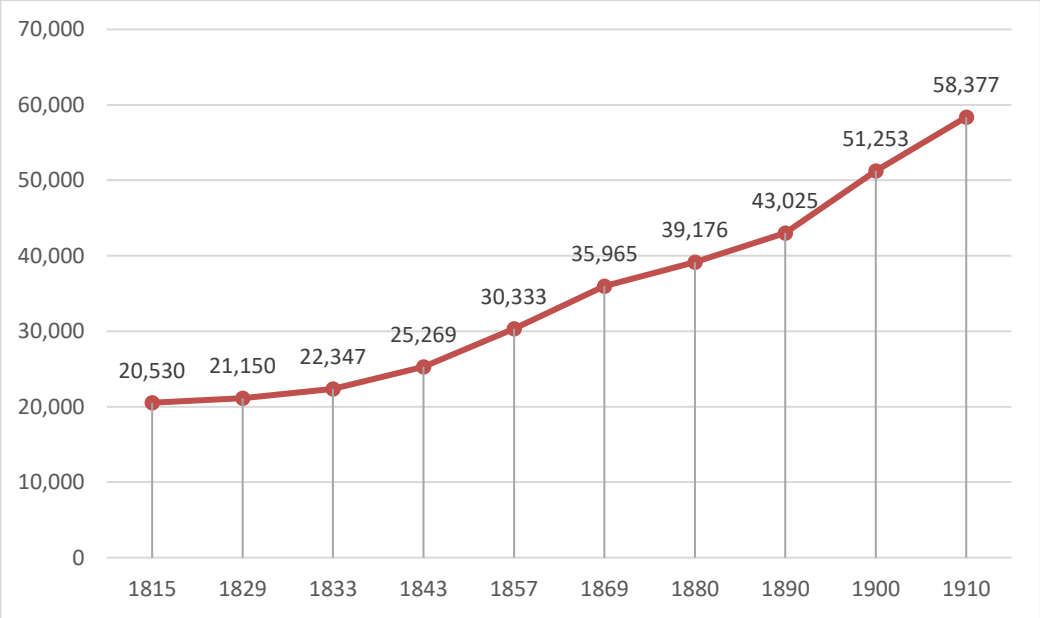


Figure 5.20. Population change in Šibenik municipality from 1815 until 1910 (Source: Peričić, 2016).

The pressure was evident mostly in the illegal pasture of sheep and goats, extraction of tree stumps and cutting in protected areas without supervision.[88] Illegal cutting was particularly problematic because the use of inappropriate tools led to permanent damage to trees, especially when people wanted to obtain poles for vineyards or cut the stumps too high from the ground. According to Vučković (1904), even the short rotation period specified by foresters was damaging because it did not allow proper regeneration. In addition, foresters allowed collection of grass and litter in woodlands which led to the removal of beneficial nutrients. Pastoralism, on the other hand, was harmful mainly because of the excessive number of animals in

[87] HR-DASI- Šumarstvo 19.-20.st. 10th March 1880. N. 883; HR-DASI-Šibenik 19.-20.st. Šumarstvo. 15th December 1884. *Okružnica uglednim občinskim upraviteljstvima. N.*4765; HR-DASI-Šibenik 19.-20.st. Šumarstvo. 31st December 1893. *Dopis svim kotarskim poglavarstvima u pokrajini*, N. 31877.
[88] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 17th May 1887. *C.K. Kotarsko poglavar stvo,* N. 4944.

woodlands in the period when trees were beginning to regrow. These animals were often entrusted to child shepherds which frequently meant the flocks spread into protected woodland (Vučković, 1904).

There were also reports of conflicts over rights of use of particular woodland between two villages which, in the case of Primošten and Rogoznica led only to complaints and a request for the employment of a forest guard but in the case of Ravni gaj woodland led to an armed conflict and severe woodland damage.[89]

However, there is no evidence that woodland crimes and opposition to woodland protection were caused by resentment towards the Austro-Hungarian government (Goldstein, 1999). As was explained earlier, regulations at the local level did not differ from the ones that were implemented during previous administrations, and even from those in Yugoslav period, as will be discussed in chapter 6. Also, woodland protection was entrusted to local people while prosecutions were handled by the municipality, which means that Austro-Hungarian imperial elements were absent at this lowest level of management. The woodland crimes can be mostly attributed to the demands of the local people for firewood and the shortage of firewood brought about by browsing goats.

That being said, archival records from the 1830s to the 1880s are very scarce and it cannot be excluded that imperial rule caused particular forms of opposition among local people. The rich records from after the 1880s show little evidence of such dissent but this does not come as a surprise as from 1871 Croatian nationalists won the local elections and took over the most important positions in the local administration (Obad, 1976). Local opposition to forestry matters was, therefore, mostly directed toward reforestation as this was a new activity introduced by the Austro-Hungarian administration and it directly interfered with peoples' livelihoods.

[89] HR-DASI- Šumarstvo 19.-20.st. 26th June 1893. N. 8300.; HR-DASI- Šumarstvo 19.-20.st. 14th April 1894. N.1429.

5.5. Reforestation in Šibenik district in the Austrian period (1815-1918)

The first reforestation in Šibenik district in the Austrian period can be traced to the 1820s. As a part of the renewal of some devastated forbidden groves from the French period, villages were ordered that 'these areas must be as soon as possible planted with woodland'.[90] In another example, records show that the vegetation in Oštrica and Prigrada forbidden groves was divided between that which was already planted (*è piantato*) and that which will be planted (*è da piantarti*). The planted species included unspecified oaks, juniper and woodland in general and since it represented the common vegetation of the area, the term *è piantato* could also be understood as the vegetation that is already growing there. There is, however, no record of which specific species were considered for the new planting since the Oštrica woodland was already considered dense enough and for Prigrada it was stated only that species that provided firewood were needed.[91]

Archival records also show that pines were considered for reforestation during the assessment of the terrain of Žirje island in 1848: it was concluded that the island offered a lot of land for 'spreading of pines'.[92] Those pines would have supplied inhabitants of the island with wood in general and that of a specific shape which was needed for constructing fishing boats in the whole Šibenik district.[93]

After the reforestation of Trieste municipality showed successful results in the 1850s the practice of establishing new woodlands was institutionalized in 1878 with the establishment of the Royal Inspectorate for the Afforestation of Karst in the Croatian Military Frontier in Senj (Oraš, 1940; Vajda, 1955). Dalmatia was the last region where reforestation attempts started. While other karst regions of the Monarchy implemented the Law on reforestation in the 1880s, this did not happen

[90] '*… ove zemlje budu sctose moxe brxje posadjene s'Gajom'*; HR-DASI- Šumarstvo 19.-20.st. 23rd January 1821. *Notifizione/Oznanjenje*. N. 1657-302.
[91] HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c.* the 1820s. *Prospetto de' Boschi Sacri eretti al Circondario Comunale di Zlarin.* N. unknown.
[92] '*In questo comune potrebbero generalizzarsi i Pini'.*
[93] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 4th June 1848. Šumarstvo. Prospetto degli spazi poco produttivi, produttivi ed improduttivi…del Sindacato di Zlarin. N. 1394.

in Dalmatia until 1912. This means that regulations governing reforestation in Dalmatia were based on the Law on the division of municipal lands from the 27th May 1876 which stated that wooded pastures had to be transformed into proper woodlands. As already discussed, this was usually achieved through simple protection and reduction in grazing, browsing and felling. However, the Law also allowed the establishment of woodland on previously barren areas and such woodland could not be established without planting or sowing trees (Wessely, 1878a; Petrović, 1904).

The first record of the reforestation in Šibenik area is in 1882 when the forestry supervisor Zikmundovsky announced reforestation to 'cover up barren landscapes around the city' (Šumarski list, 1883a). Although records indicated the existence of earlier small-scale eucalyptus stands in Vrpolje and Perković settlements, this was the first large scale reforestation initiative (Zikmundovsky, 1882). The areas he designated for reforestation included Paklena in Donje Polje, cape Mandalina, the parcel 'behind' fort St. Ivan in Crnica, St. Martin and Sedlo in Zaton and Glumča in Boraja (Figure 5.21) and in his proposal for reforestation he expressed a desire to 'cover up barren areas with woodland'. These areas were all in municipal ownership and used as pastures, and, except Glumča, located on visually prominent locations around the Šibenik channel. The selected parcels were supposed to be planted with acorns and ailanthus seedlings and designated as protected woodlands which meant that exploitation was banned.

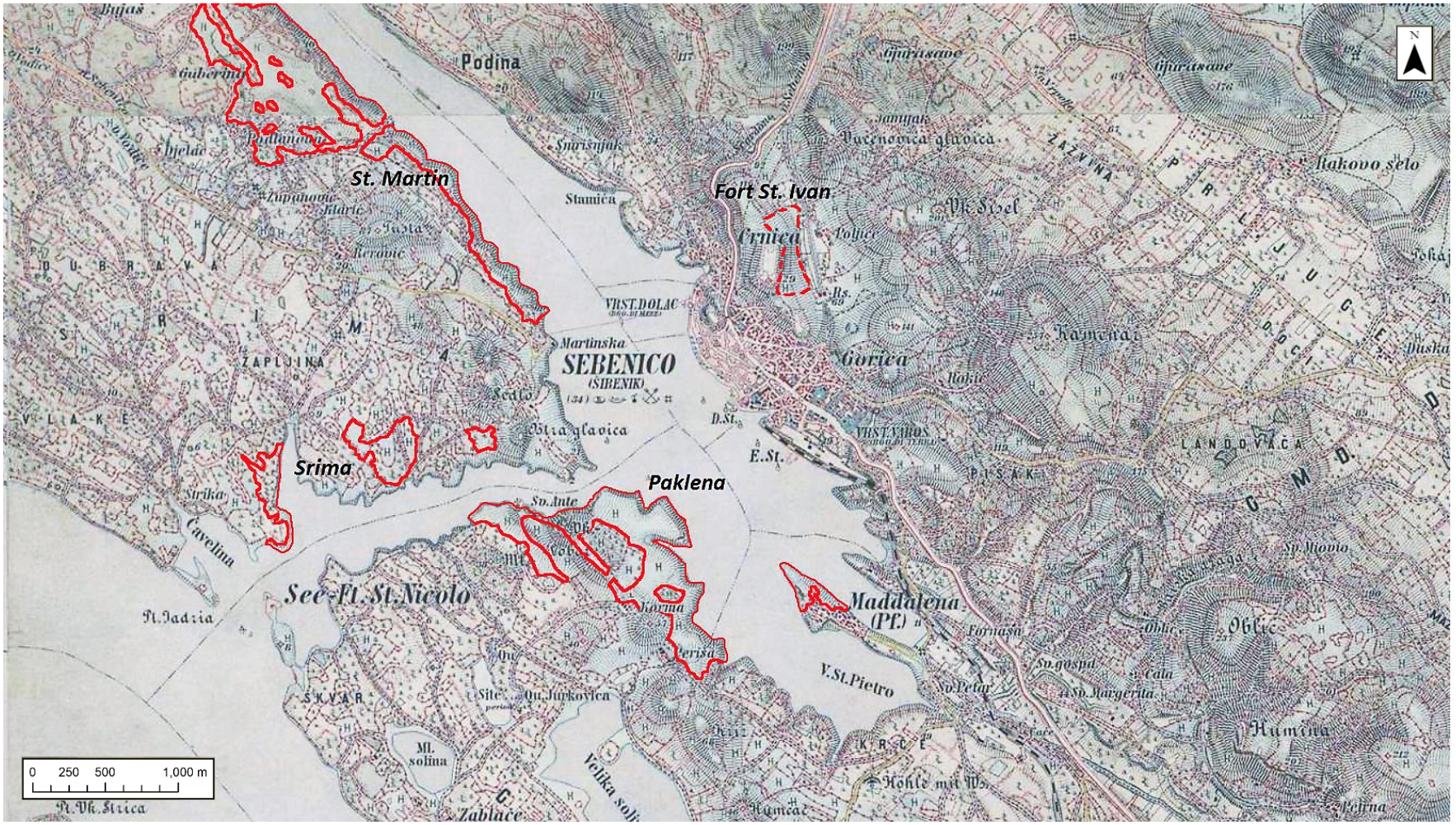


Figure 5.21. Topographic map of Šibenik channel produced in the third military survey (1869-1887). The borders of parcels and names of locations Zikmundovsky designated for reforestation in 1882 (not including Glumča) are added by the author on the original map in red. They are based on cadastral maps from 1825 (Source: MAPIRE.eu).

From 1886 the municipal authorities agreed on a decade long reforestation scheme with the forestry commissioner. This scheme, which was set to begin in 1887, contained a plan of financial costs, list of designated areas for reforestation, list of species to be planted, etc.[94] The sections where reforestation was planned included settlements Donje polje, Zaton, Vrpolje and Slivno. For the first two, it is likely that the location was the same as in the 1882 reforestation. In Vrpolje and Slivno archival records from 1892 mention the existence of a reforested area in Gorica, for the former, and Trovrh, for the latter.[95] The most striking change in these new reforestation schemes is the increased use of pine. In total, 440,000 pine trees, 440,000 ash trees and 1,400 mulberry trees were ordered (Šumarski list, 1887a). After just a few years the planting of ailanthus and oaks was abandoned, and they were never listed as important reforestation species again.

Records on reforestation become more frequent from the 1890s as this is when more and more financial funds were allocated for these activities.[96] However, it should be noted that even though the municipality kept adding new areas to the list most activity revolved around replacing young trees that had failed to grow, known as beating up. For example, records show beating up was carried out in Gorica from 1892 until 1894 and again in 1896 and 1902 while the stand in Trovrh was beat up every year from 1892 until 1896 and then again in 1907.[97] Records of repeated beating up in other stands also exist. The reason why already reforested areas were beaten up with new trees, again and again, is that in the best case scenario only 30% to 35% of planted pine trees survived the 1st year after planting and even that result would have been considered a success. These figures only improved after 1918 with advanced establishment techniques (Tomašević, 1979).

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[94] HR-DASI-Hortikultura. 9th June 1886. N. 6504.

[95] HR-DASI-Šibenik 19.-20.st. 1892. Izvješće gospodinu općinskom upravitelju. N. 97; HR-DASI-Šibenik 19.-20.st. 1st May 1892. *Izvješće gospodinu općinskom upravitelju.* N. 110.

[96] HR-DASI- Šumarstvo 19.-20.st. 18th January 1890. *Dopis.* N. 452.

[97] HR-DASI-Šumarstvo 19.-20.st. 8th February 1893. *Dopis.* N. 1933; HR-DASI- Šumarstvo 19.-20.st. 1st September 1894. N. 3451; HR-DASI-Šumarstvo 19.-20.st. 1903. *Velika gradska proljetna akcija oko pošumljavanja goleti šireg područja šibenske općine;* HR-DASI-Šumarstvo 19.-20.st. 12th July 1896. *Razjašnjenja k. Šumskom katastru o šumam stojećim pod javnom upravom i pod osobitim javnim nadzorom odlomka Perković-Slivno političke općine Šibenske na temelju poduzetih šumsko tehničkih izvida;* HR-DASI- Šumarstvo 19.-20.st. 6th October 1907. *Iskaz pašnjaka šibenske općine koji bi se morali pošumiti u godini 1907/8 iznova.* N. 9931.

The area of the Šibenik channel and the hills above the city itself were among the first that were reforested with pines in 1887. A panoramic sketch of the Šibenik channel and the hills above the city from 1850 clearly shows the prevalent bareness of the shores and hills (Figure 5.22). A colourized postcard from the 1890s (Figure 5.23) with a reversed view on the Šibenik bay documents the existence of a small pine stand in Paklena, on the left shore of the channel, and in Srima on its right shore. This was the result of the first reforestation which later spread further across the municipality owned areas on the coast. The privately-owned parcels in Paklena are clearly seen as enclosed with dry-stone walls.

After the initial reforestation with pines and ash trees in 1887, there are no surviving records of further reforestations for this area until 1899. In 1899 Aleppo pine and black pine seeds were sown, a contrast to the usual practice of seedling planting, on parcels owned by Šibenik municipality along the shores of the channel, all the way to Fort St. Nicholas[98]. This raised protests from villagers of Zablaće who filed a complaint with municipality authorities.[99] The district authorities defended the reforestation as *'*necessary to make the sides of the channel prettier'[100] and noted that reforestation of that area was ordered a long time ago by the Dalmatian governorship. They claimed that only uncultivated, barren areas owned by the municipality were reforested while public pathways that led to ship docks were left clear, so the rights of the villagers were not jeopardised.[101] The notion that district authorities were concerned with the aesthetic appeal of the landscape can be explained from the fact that at the end of the century there was an increased number of foreign visitors in the city especially after the shipping company Lloyd introduced steamship lines between Trieste and Šibenik. New hotels started opening from 1891 and the largest hotel in the city, hotel Krka, was opened in 1903 (Peričić, 2016).

[98] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1st April 1899. N. 31.
[99] HR-DASI- Šumarstvo 19.-20.st. 2nd March 1899. N. 25.
[100] *Pošumljenje je bilo nužno zbog poljepšanja strane kanala.*
[101] HR-DASI-Šibenik 19.-20.st. 6th March 1899. *Dopis.* N. 3317.

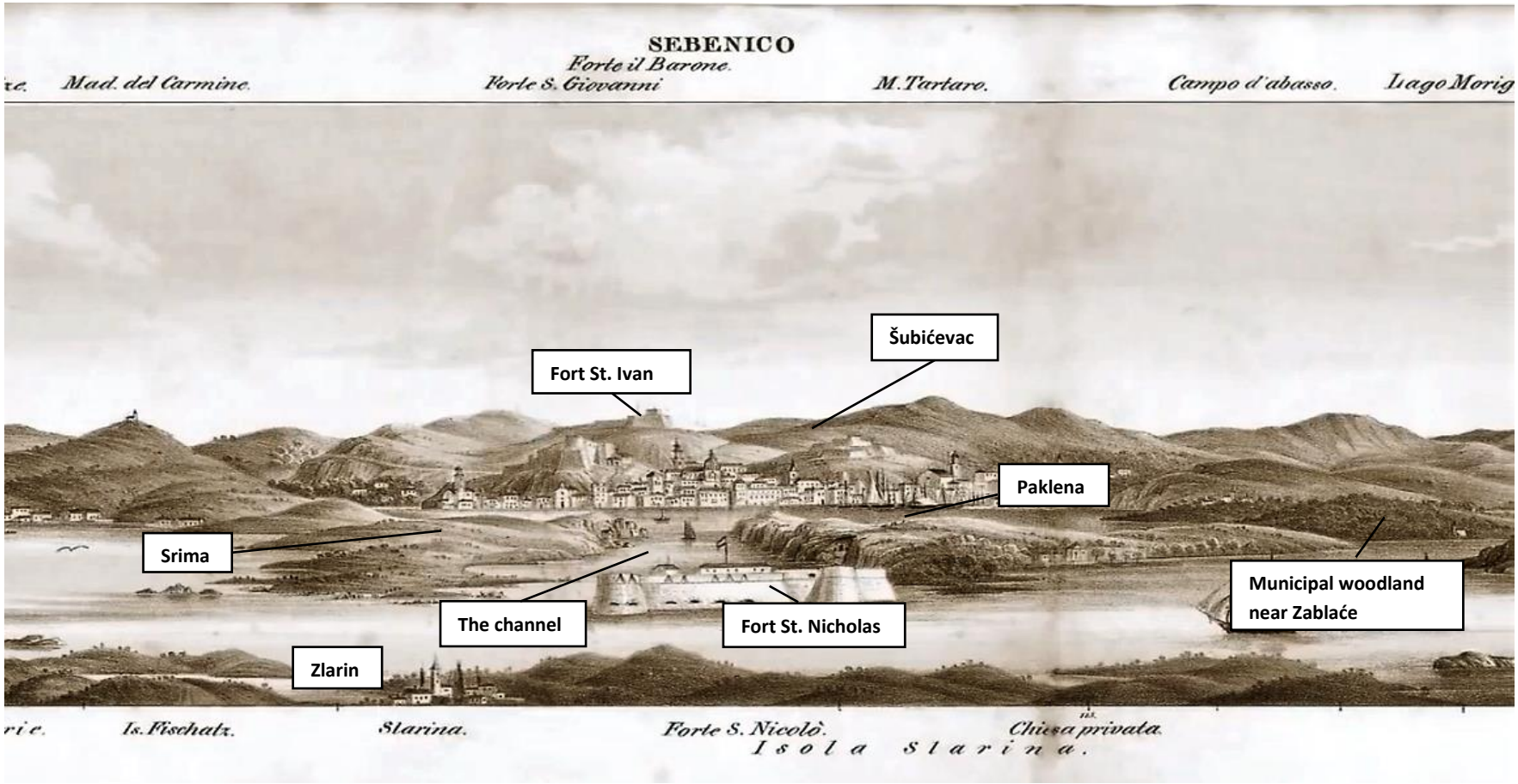

Figure 5.22. Drawing of Šibenik coastline from 1850 with place names added in by the author (Source: Rieger, 1991).

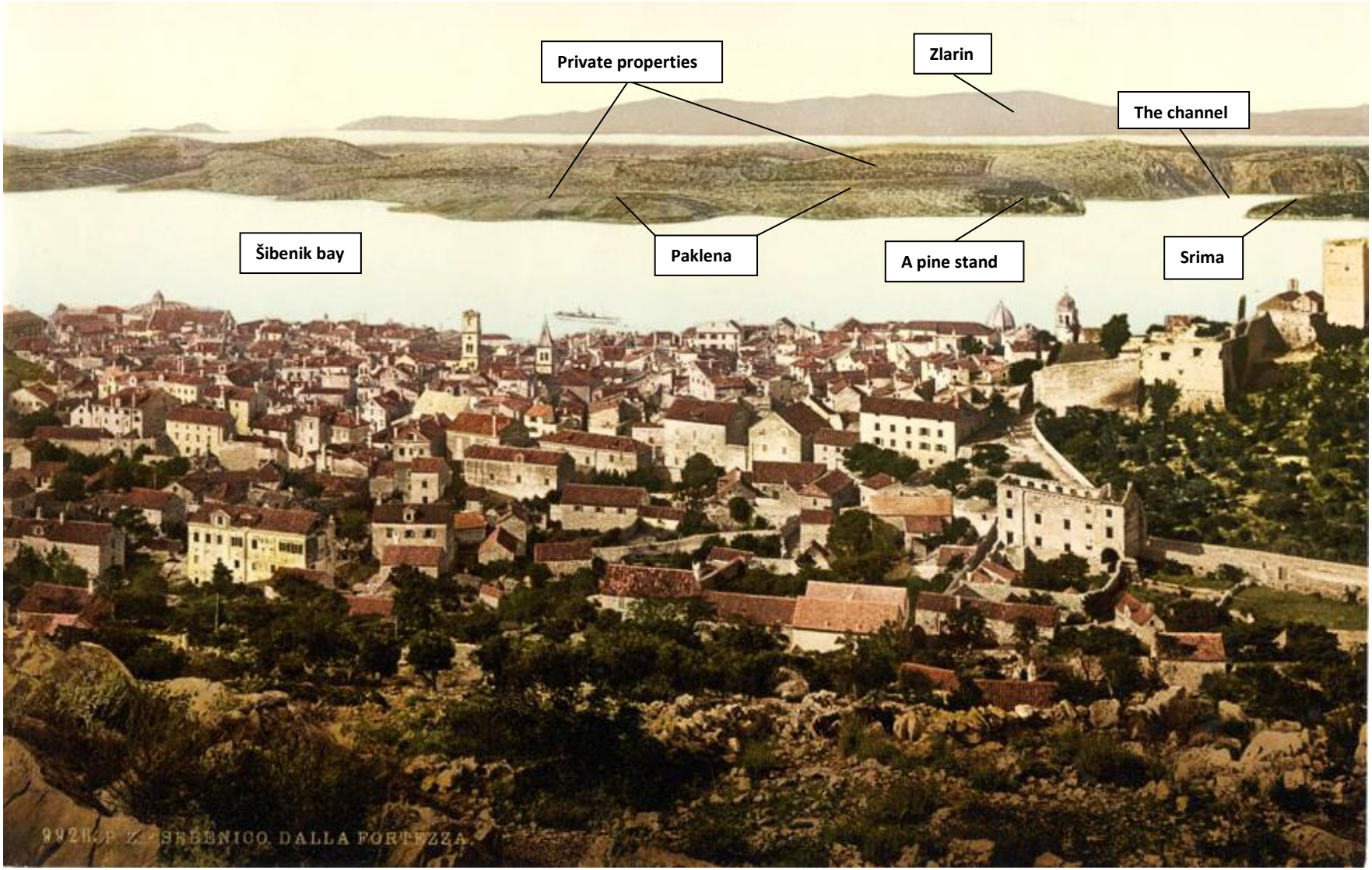

Figure 5.23. Panoramic view of Šibenik bay on a colourised postcard circulated in 1905 with place names added by the author (Source: Private archives).

In 1902 a large-scale spring event was organized by the city administration in which people helped with the reforestation. In total 45,000 Aleppo pine trees were planted in Paklena and Srima.[102] Although there are few surviving records it is clear that many other plantations were established and as evident in Figure 6.5 (p.229), by the 1930s a thick pine woodland was established in Paklena with pines also covering shores along the channel further towards Fort St. Nicholas.

The hilltops above Šibenik were also among the first areas that underwent reforestation. These areas were visibly barren, with rock formations covering most of the surfaces (Figure 5.24). Throughout the century they were used as pastures (MAPIRE.eu). The north slope of a hill with fort St. Ivan was reforested in 1887 with pines, but the south one remained barren until the later period. In 1893 reforestation activities were widened to include the municipal pasture Rupina which the municipal forester described as 'barren karst'. The records of this reforestation reveal how young trees were planted in previously dug holes, but since foresters had to obtain soil to fill the holes, the process was very expensive.[103]

Nevertheless, reforestation of Rupina was repeated in 1896 when 121,530 seedlings were planted. Most of these were Aleppo pines since other records reveal how in that reforestation season throughout the district 160,000 Aleppo pines, 20,000 black pines, 4,000 Corsican pines (*Pinus corsicana*) and 1,500 Mediterranean cypresses along with 20 Catalpa and 10 Ginkgo trees were planted.[104] Records for new reforestation of Rupina exist for 1902 when during the city spring event citizens planted 20,000 more Aleppo pines as well as 48 Turkey oaks.[105]

[102] HR-DASI- Šumarstvo 19.-20.st. 1903. *Velika gradska proljetna akcija oko pošumljavanja goleti šireg područja šibenske općine.*
[103] HR-DASI-Hortikultura. 6th December 1893. N. 4900.
[104] HR-DASI- Šumarstvo 19.-20.st. 5th April 1896. N. 73.
[105] HR-DASI- Šumarstvo 19.-20.st. 1903. *Velika gradska proljetna akcija oko pošumljavanja goleti šireg područja šibenske općine.*

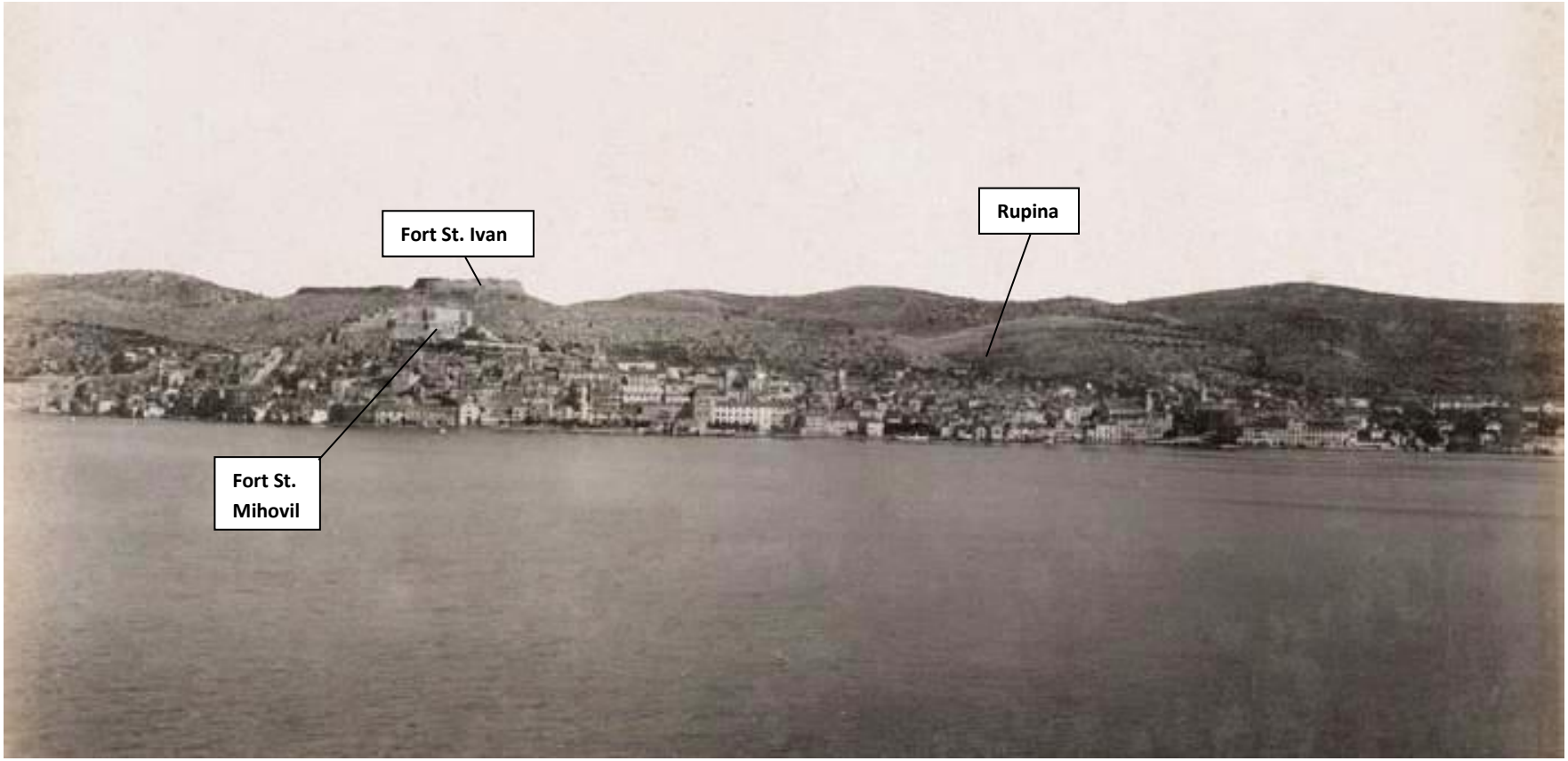

Figure 5.24. A panoramic view on Šibenik from Paklena in the late 1890s. The place names were added by the author (Source: Album von Dalmatien, Photographien aus der Anstalt von Franz Laforest in Cattaro, 1866-1898).

By the start of the 20th century, a woodland was established in Rupina and is clearly visible on an old postcard (Figure 5.25). While the previously reforested north slopes under fort St. Ivan are not visible, the south-faced slopes which were reforested in later periods are seen as entirely barren. A dark-green patch of woodland encircling the northern edge of the city is also visible. This woodland-belt was established sometime after the new hospital opened in 1883 and it spanned all the way from the hospital (right edge of the postcard) to fort Sv. Mihovil and Crnica neighbourhood. However, already by 1907, it was reported that the woodland was in a dire condition and needed beating up.[106]

A documented example of the reforestation of coastal settlements outside the city comes from Kremik in Primošten, Gradina in Krapanj and Kopara in Rogoznica.[107] In Rogoznica reforestation was carried out on the southern tip of the island, on the hill called Kopara (Figure 5.26). On the 1825 cadastral plans, the whole hill was designated as a municipal pasture, but a completely barren one as not even bushes were noted. Reforestation of Kopara was ordered in 1894 and carried out the following year. Aleppo pine was the only tree species planted, with its seeds sown over 52 ha.[108] A year later another 80,000 Aleppo pines were planted along with 10 kg of stone pine seeds.[109] In 1902 36,000 more Aleppo pine trees were planted by volunteers, along with 300 Turkey oaks and 300 agaves.[110] Beating up was carried out once again in 1907.[111] As a result, foresters successfully established a dense stand of Aleppo pine woodland that became a prominent landscape feature that was often selected for postcards from the 1920s (Figure 6.8, p.234).

[106] HR-DASI- Šumarstvo 19.-20.st. 6th October 1907. *Iskaz pašnjaka šibenske općine koji bi se morali pošumiti u godini 1907/8 iznova.* N. 9931.
[107] *Ibid.*
[108] HR-DASI- Šumarstvo 19.-20.st. 1st September 1894. N. 3451; HR-DASI-Hortikultura. 1894. *Iz arhivskih spisa općine.* N. unknown.
[109] HR-DASI-Šumarstvo 19.-20.st. 18th February 1896. N. 2389.
[110] HR-DASI- Šumarstvo 19.-20.st. *Velika gradska proljetna akcija oko pošumljavanja goleti šireg područja šibenske općine.*
[111] HR-DASI- Šumarstvo 19.-20.st. 6th October 1907. *Iskaz pašnjaka šibenske općine koji bi se morali pošumiti u godini 1907/8 iznova.* N. 9931.

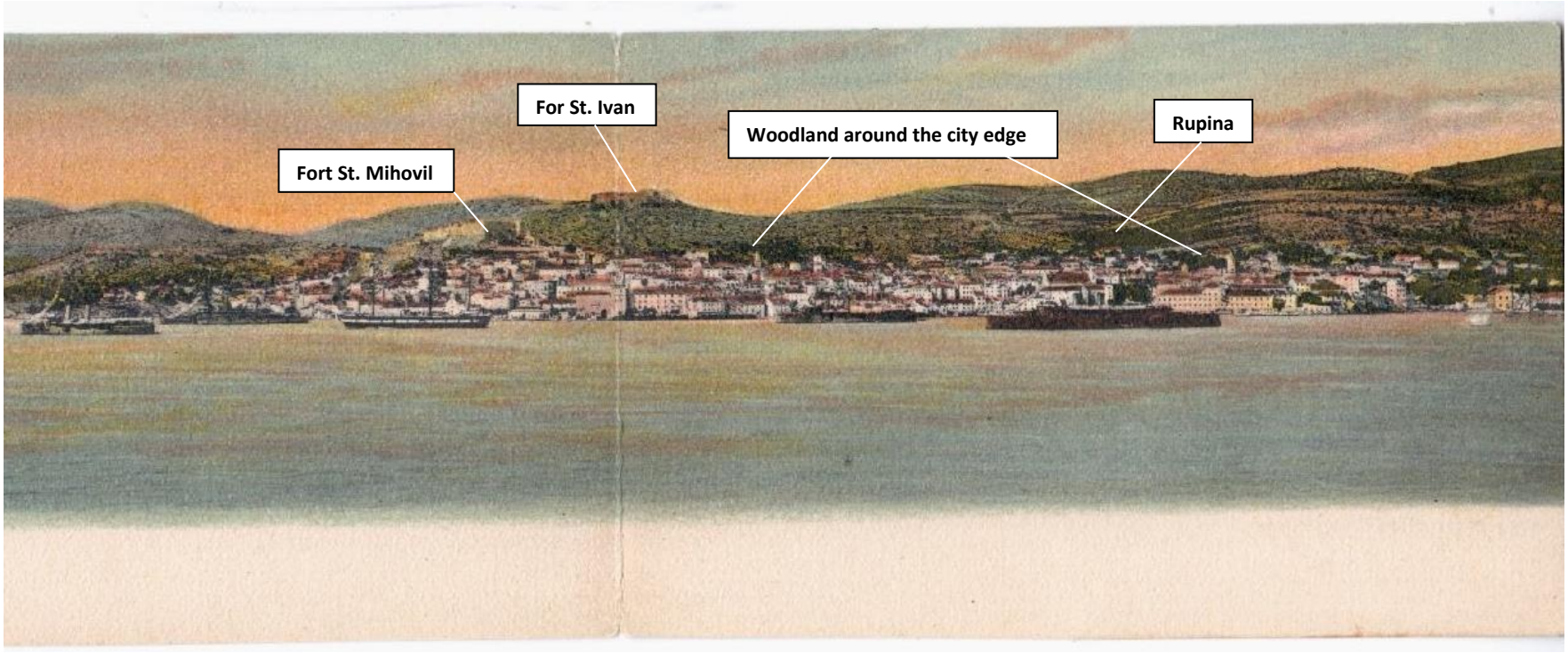

Figure 5.25. A postcard depicting a view on Šibenik from across the bay circulated in 1905. The place names were added by the author (Source: Private archives).

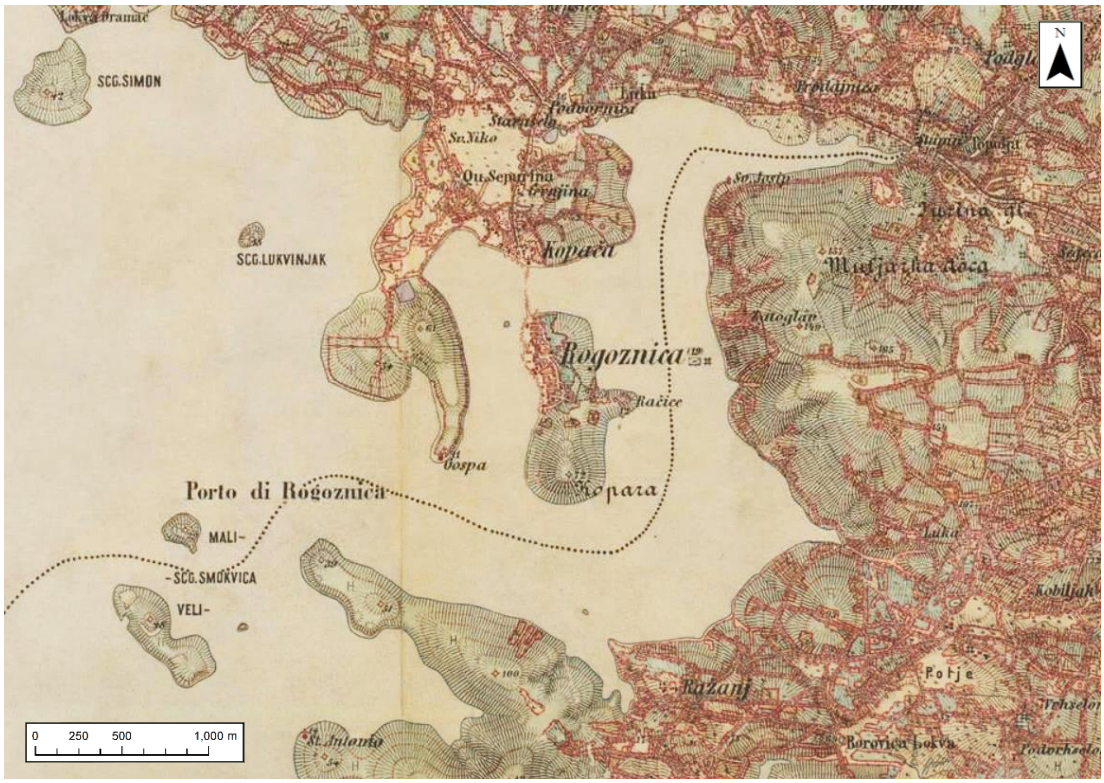

Figure 5.26. Location of Rogoznica and Kopara hill on the third military survey (1869-1887) topographic map (Source: MAPIRE.eu).

Reforestation was also present in the hinterland areas of the municipality. In 1887 440,000 pines and 440,000 ash trees were established in various areas, including in Slivno-Perković section. Records from 1892 onwards mention that only pines were used. From 1892 until 1896 in Trovrh area in Slivno-Perković pines were planted annually, although the species is not specified.[112] Its location was on the foothills of Trovrh hill along the railway and according to cadastral plans, it had been used as a municipal pasture that was covered with scattered bushes. Because Perković was an important railroad junction, there are some images of this remote area from the start of the 20th century. These show that hills were indeed barren and there is a sharp contrast with the agricultural areas in their foothills (Figure 5.28; Figure 5.28.). In 1896 more areas in this section were designated for reforestation, and they

[112] HR-DASI-Šibenik 19.-20.st. 1st May 1892. *Izvješće gospodinu općinskom upravitelju.* N. 110; HR-DASI- Šumarstvo 19.-20.st. 12th July 1896. *Razjašnjenja k. Šumskom katastru o šumam stojećim pod javnom upravom i pod osobitim javnim nadzorom odlomka Perković-Slivno političke općine Šibenske na temelju poduzetih šumsko tehničkih izvida.*

included Srednje Brdo and a part of a parcel called Japaga/stream Milinkovac. The plan was to plant these areas with maritime pine, black pine and Acacia, over the following ten years.[113]

Figure 5.27. Postcard from Slivno-Perković circulated in 1903 (Source: Private archives).

Figure 5.28. Postcard from Slivno-Perković circulated in 1901 (Source: Private archives).

[113] HR-DASI- Šumarstvo 19.-20.st. 18th February 1896. N. 2389.

In neighbouring Vrpolje section reforestation was carried out in 1887 when a pine stand was established at Gorica.[114] This pine stand was beaten up each year from 1892 to 1894.[115] However, during the spring reforestation of 1902, this area was the primary focus of activities as in total 51,000 Aleppo pines, and 544 acacias were planted.[116] Another pine woodland was established in Vrpolje after 1900 as the record from 1913 mention the existence of pine woodland in Petrinovica area, while in Jadrtovac section Podgorica pine woodland was established sometime before 1907.[117] All of the woodlands in this area were established near settlements and along the railway (Figure 5.29).

Another example of reforestation in the hinterland is the one carried out in Lozovac section where in 1898 a very large area was designated for reforestation. The reforestation was near the Skradinski Buk waterfalls on the Krka which by the late 19th century had become a major tourist attraction.[118] The designated parcels 913, 1020 and 1052 covered areas which were named Trovarija, Golo Brdo and Brina but the reforestation records refer only to the toponym Brina, which was used for the slopes on the bank of Krka river near the waterfalls (Figure 5.30). This could indicate that the first stage of reforestation was intended for those slopes only. Nevertheless, the whole area was a large municipal pasture marked with a complete absence of woody vegetation which is confirmed from the postcards circulated at the end of the 19th century (Figure 5.31; Figure 5.32).

[114] HR-DASI- Šumarstvo 19.-20.st. 8th February 1893. *Dopis.* N. 1933.
[115] HR-DASI- Šumarstvo 19.-20.st. 5th April 1896. N. 73.
[116] HR-DASI- Šumarstvo 19.-20.st. 1903. *Velika gradska proljetna akcija oko pošumljavanja goleti šireg područja šibenske općine.*
[117] HR-DASI- Šumarstvo 19.-20.st. 8th February 1913. *Oštećenje umjetnog pošumljenja Petrinovica*. N. 3567; HR-DASI- Šumarstvo 19.-20.st. 6th October 1907. *Iskaz pašnjaka šibenske općine koji bi se morali pošumiti u godini 1907/8 iznova.* N. 9931.
[118] HR-DASI- Šumarstvo 19.-20.st. 29th March 1898. N. 3841.

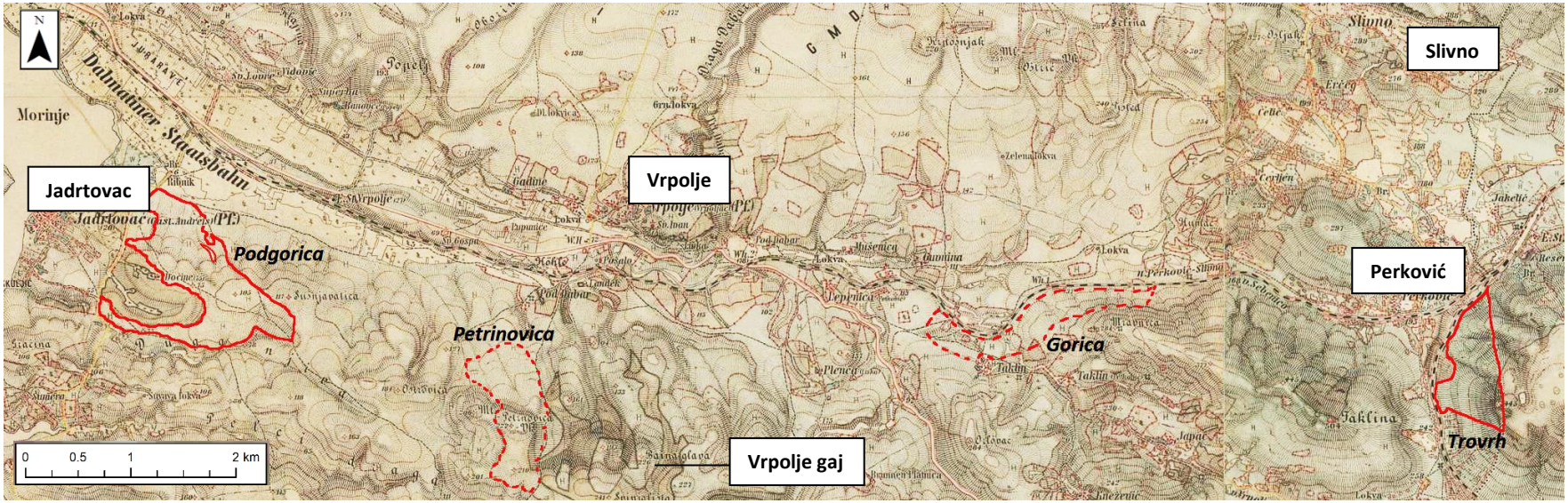

Figure 5.29. Borders of reforested parcels drawn on the third military survey (1869-1887) topographical map by the author. Borders of Podgorica and Trovrh are marked according to 1825 cadastral plans. Borders of Petrinovica are approximated according to the toponym Petrinovica and retrospectively from the known location of a pine stand based on maps and aerial images from the Yugoslav period. Borders of Gorica are approximated according to the toponym Gorica and records which stated that a pine woodland was established near the railway (Source: MAPIRE.eu).

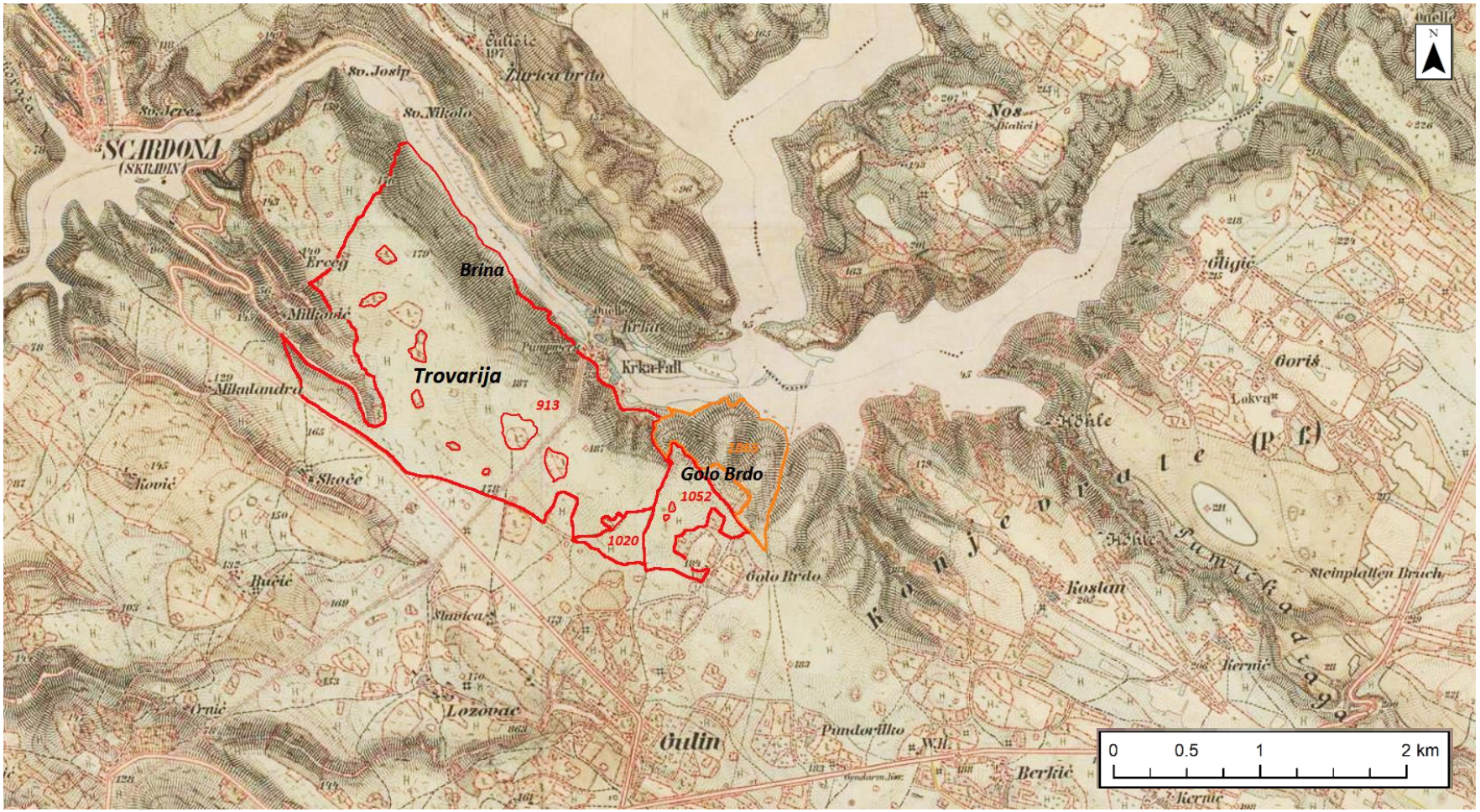

Figure 5.30. Lozovac area on the third military survey (1869-1887) topographical map. Parcels that were designated for reforestation in 1898 (red) and between 1898 and 1907 (orange) are drawn by the author. Their borders are based on 1825 cadastral plans (Source: MAPIRE.eu).

Figure 5.31. Postcard from Skradinski Buk circulated in 1898 with a view on hydro plant Jaruga built in 1895 and Brina (Source: Private archives).

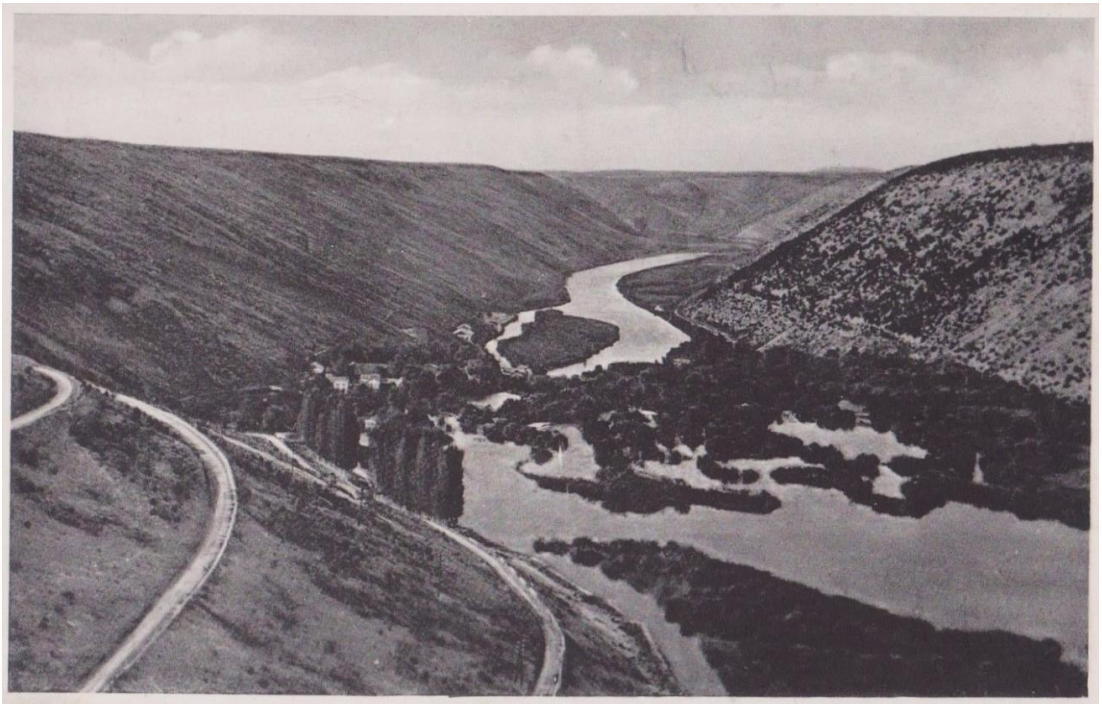

Figure 5.32. Postcard of Skradinski Buk with a view from north to south circulated at the start of the 20th century. Slopes of Lozovac Brina are to the left, while slopes of Skradin Brina are to the right (Source: Private archives).

In the 1900 planting season foresters mostly concentrated their work on Brina. Out of 600 kg of Aleppo pine, 600 kg of maritime pine and 50 kg of black pine seeds, which were obtained from south Dalmatian nurseries, half were sown only in this area.[119] Records show subsequent beating up occurred annually afterwards, and eventually, reforestation was widened to include more areas, such as parcel 1065.[120]

During the reforestation of Trovarija and Golo Brdo in 1904, an incident occurred as villagers from neighbouring settlements interrupted workers and started threatening them. The forester who was in charge of the reforestation claimed that the local village chief and several armed goat keepers were among them and that they refused to allow reforestation to continue. It was continued, however, but only after the district authorities sent an armed escort of four soldiers to keep the workers safe.[121] Records confirm that incidents like this were not unusual.

Foresters were well aware of the fact that reforestation would meet massive opposition from the local population in Dalmatia. Guttenberg (1881) explained that it was taking place in situations where both the people and the municipality authorities did not want to renounce their use of pastures. Each parcel that was designated for reforestation was considered as a protected woodland, meaning all exploitation was banned. Crnković (1882) believed that even if more strict regulations were implemented people would have still used the land as they pleased because they were doing it to alleviate extreme poverty.

In 1889 Dalmatian municipal foresters also warned the Dalmatian parliament about dire conditions in which they worked. They explained how the local people saw reforestation as an unjustified theft of land and so they started to take revenge through attacks on foresters or destruction of planted trees (Šumarski list, 1889b). Because of this, the Šibenik district authorities were careful in the selection of areas for reforestation so they advised municipality authorities to put the emphasis on those where opposition from people would be low. In 1907 the foresters and the

[119] HR-DASI-Hortikultura. 6th August 1900. N. 213.
[120] HR-DASI- Šumarstvo 19.-20.st. 6th October 1907. *Iskaz pašnjaka šibenske općine koji bi se morali pošumiti u godini 1907/8 iznova.* N. 9931.
[121] HR-DASI-Šibenik 19.-20.st. 23rd February 1904. *Dopis.* N. 1296.

district authorities were conducting talks with various villages in an effort to agree with them new places for reforestation. If such an agreement was made, the area was added to the list of those where reforestation was planned. [122]

For instance, in 1908 the municipal forester suggested progressive reforestation of Veliki vrh in Boraja area which would have also entailed a ban on exploitation of the area by local people. The forestry commissioner agreed on the area but rejected the implementation of a ban as he believed the people of Boraja would oppose it. However, it was the village head who pushed for a complete ban on pasture except in a period from 2nd February to 12th March when animals would be allowed in areas not yet reforested.[123] In contrast to that, reforested areas in neighbouring Slivno-Perković were completely banned from pasture while digging of stumps, roots or debarking planted trees was heavily fined or even punished with 14 days of solitary confinement.[124] It can be seen that the regulations were implemented very differently from village to village. After all, the Law on reforestation of karst areas for Dalmatia, whose creation was promised by the Dalmatian Parliament in 1902, was not implemented until 1912.[125]

Finally, the intensity of reforestation and the creation of monocultures of pines brought new problems for foresters in the form of invasive species. The first recorded instance of pine processionary moth (*Thaumetopoea pityocampa*) infestation occurred in 1895 in the Paklina pine stand. After the nests were immediately destroyed municipality authorities ordered a search for nests in other stands in the district.[126] In 1908 new nests were found in Paklina but also in Srima and Rupina.[127] A year later the National parliament of Kingdom of Dalmatia acknowledged the problem of infestation and informed all municipality authorities in the region about the threat.[128] In 1909 and 1910 new infestations were recorded, this

[122] HR-DASI- Šumarstvo 19.-20.st. 6th October 1907. *Iskaz pašnjaka šibenske općine koji bi se morali pošumiti u godini 1907/8 iznova.* N. 9931.
[123] HR-DASI- Šumarstvo 19.-20.st. 5th May 1908. N. 9098.
[124] HR-DASI- Šumarstvo 19.-20.st. 18th February 1896. N. 2389.
[125] HR-DASI- Šumarstvo 19.-20.st. 6th December 1902. N. 34330.
[126] HR-DASI- Šumarstvo 19.-20.st. 26th March 1895. N. 2124.
[127] HR-DASI- Šumarstvo 19.-20.st. 28th February 1908. N. 238.
[128] HR-DASI-Šibenik 19.-20.st. 26th March 1909. N. 2639.

time on Zlarin island as well, while in 1914 the insects were found in all the pine stands on Žirje island.[129]

By the time the World War I ended, and the Austro-Hungarian Empire dissolved, the majority of pine woodlands that were recorded in the mid-20th century had been established, or at least reforestation of some of their sections had started. In fact, statistical data from 1957 reveals that out of 45,874m^3 of pine wood found in Šibenik area that year, 86% was 41 to 60-year-old wood.[130] This would imply that most of the woodlands were planted in the period between 1898 and 1916. Figure 5.33 shows the known location of such stands established before 1914.

[129] HR-DASI-Šibenik 19.-20.st. 17th May 1909. *Obznana.* N. 5957; HR-DASI-Šibenik 19.-20.st. 1914. *Borov prelac u šumam poreznog odlomka Žirija*. N. 31068.
[130] HR-DASI-Hortikultura. 1957. N. 166.

Figure 5.33. The location of areas in Šibenik district known to be reforested before 1914 according to the author: 1. Brina, Trovarija and Golo Brdo 2. Rasovača 3. Fort. St. Ivan 4. Rupina 5. St. Martin 6. Sedlo 7. Srima 8. Paklina 9. Šibenik channel 10. Mandalina 11. Ražina 12. Prigrada 13. Podgorica 14. Petrinovica 15. Gorica – Kosa 16. Mala Mravnica 17. Trovrh 18. Gradina 19. Veliki vrh 20. Bilo 21. St. Joseph 22. Kremik 23. Kopar.

5.6. Woodland management in the French and the Austrian periods – case study analysis

5.6.1. Zlarin

Zlarin island experienced a rapid expansion of population primarily because of wars with the Ottomans in the 16th and the 17th century. In 1587 there were 76 houses inhabited by 496 people, while in 1680 those numbers rapidly increased to 145 houses and 1,018 inhabitants as people fled the coastal areas from the conflicts (Dean, 2004). In the 17th century it was reported that there were not enough pastures on Zlarin island, so the people started to buy or lease land on the neighbouring mainland in Srima and Zablaće areas (Stulli, 1982). By 1844 the population had increased to 1888 or 230 per sq. km.[131]

In 1849 it was reported that the wood which was required for everyday use and fishing by Zlarin locals was imported from Korčula island, in southern Dalmatia, which suggests a lack of woodlands on the island itself (Stulli, 1982). The cadastral plans from 1825 confirm this as out of the Zlarin section's area of approximately 10 km² there was not a single area designated as a woodland (Figure 5.34). Most of the island was cultivated and 64% of the total area was agricultural (Figure 5.35). These were almost entirely vineyards while arable fields covered less than 1% of the island (Table 5.3). Vineyards were distributed across all of the islands, covering fertile fields in the interior of the island but also hilltops and slopes, especially those of the east coast. The only larger patches without the vineyards were parts of hill slopes on the western coast of Podgora, in Jasenovica area and along the slopes of the southern peninsula called Rat. Here the slopes are more pronounced than on the east coast and vineyards were mostly replaced with pastures. The portolan from the early 19th century described the southwestern side of the island as the tallest part of the island that was 'sterile' (Marinei, 1830).

[131] HR-DAST-152, Arhiv mapa za Istru i Dalmaciju. KO. 745 Zlarin. *Operato dell'estimo censuario del Comune di Zlarin*, 1844.

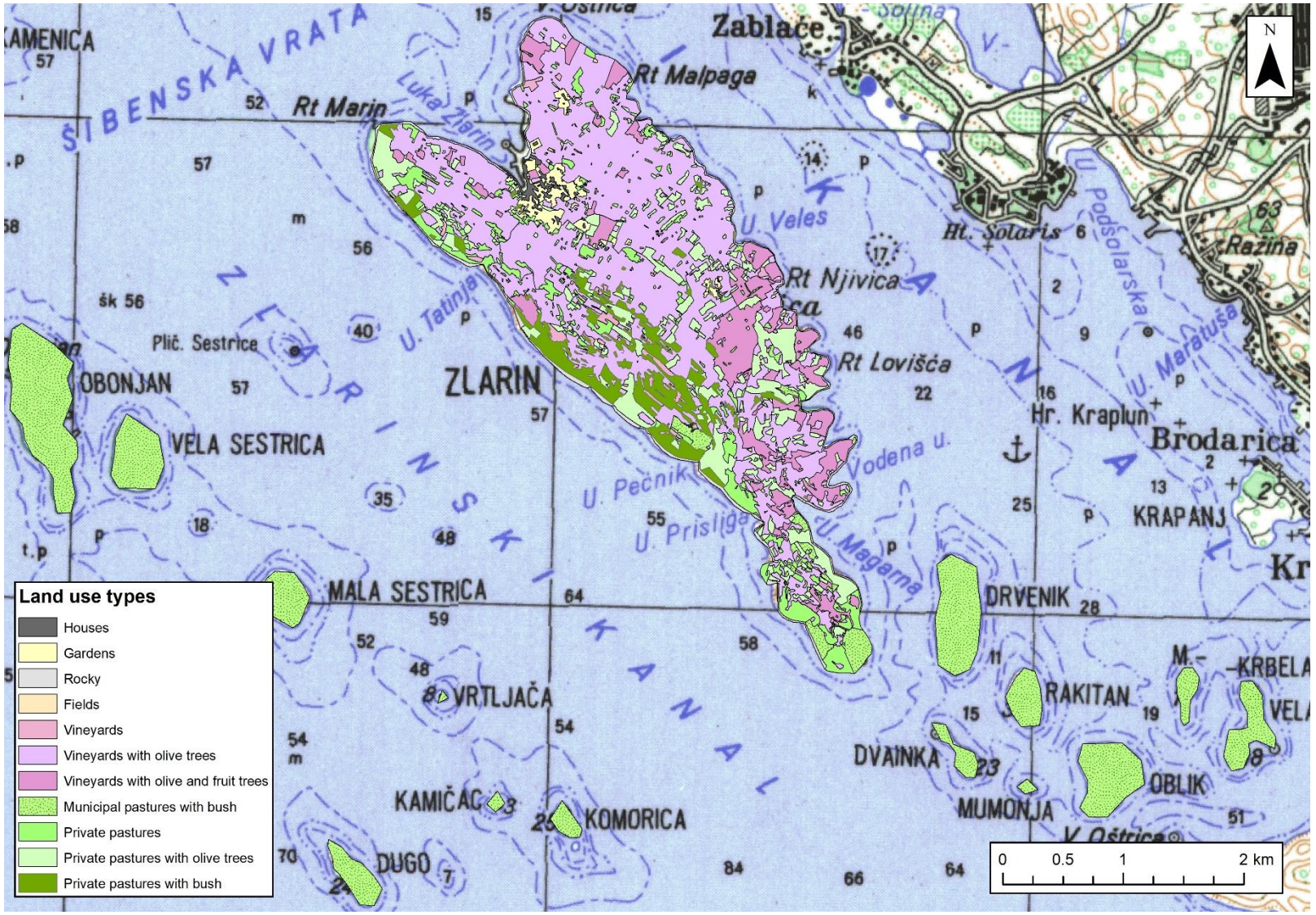

Figure 5.34. Land use map of Zlarin section made in ArcGIS based on 1825 cadastral plans obtained from State Archive in Split (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmacij, KO. 745 Zlarin. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

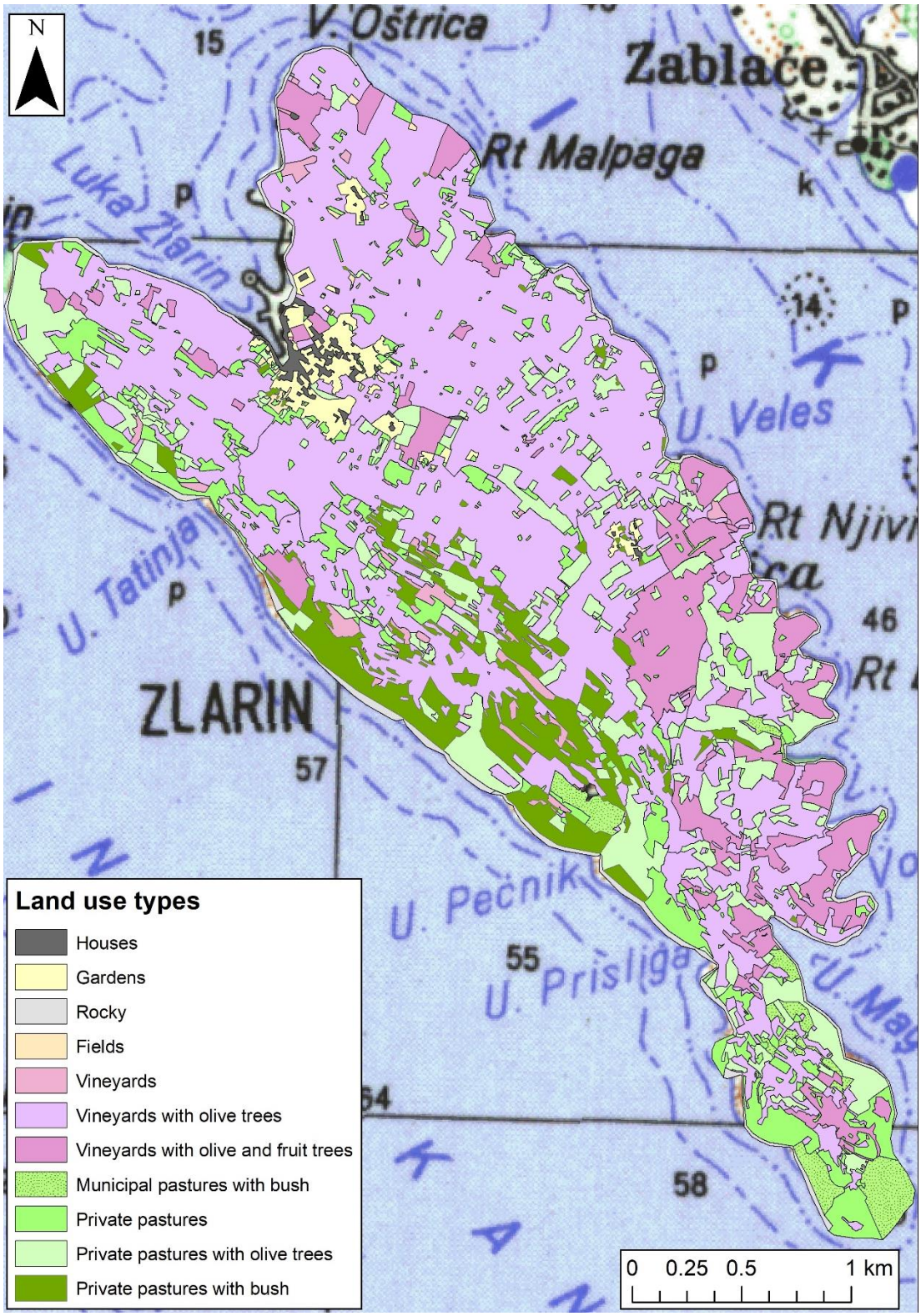

Figure 5.35. Land use map of Zlarin island made in ArcGIS based on 1825 cadastral plans obtained from State Archive in Split (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmacij, KO. 745 Zlarin. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

Table 5.3. Distribution of land use types in Zlarin section in 1825.

Land use type	Original name	Land use label	Area (km²)	Area (%)		General category
				Whole section	Zlarin island	
House	*Casa d'abitazione*	Built areas	0.05	**0.5**	**0.6**	Other
Rocky	*Scoglio nudo*	Barren	0.22	**2.2**	**2.7**	
Uncultivated	*Incolto*	Uncultivated	0.001	**0**	**0**	
Garden	*Orto d'erbaggi, orto d'erbaggi con frutta…*	Garden	0.176	**1.7**	**2.18**	Agricultural
Field	*Arativo*	Fields	0.008	**0.1**	**0.1**	
Field with olive	*Arativo con olivi*		0.0009			
Field with fruit trees	*Arativo con frutta*		0.002			
Vineyard	*Vigna*	Vineyards	0.11	**49.5**	**62**	
Vineyard with olive trees	*Vigna con olivi*		3.985			
Vineyard with olive and fruit trees	*Vigna con olivi e frutta*		0.893			
Pasture with olive trees	*Pascolo con olivi*	Pastures with crops	0.93	**11.1**	**14**	Pastures
Pasture with mixed crops	*Pascolo con - vigna, frutta, vigna e olivi…*		0.108			
Pasture with olive trees and bush	*Pascolo con olivi e cespugli*		0.084			
Municipal pasture	*Pascolo comunale*	Pastures	2.193	**34.5**	**18.2***	
Private pasture	*Pascolo*		0.683			
Pasture with bush	*Pascolo con cespugli*		0.593			

**Only 0.187km² (8%) of municipal pastures were located on Zlarin island while the remaining 92% were found of surrounding islands.*

Although vineyards dominated the landscape, pure vineyards covered only 1% of the island; most were a mixture of vineyards and olive trees. According to the medieval Šibenik statute olive trees had to be planted within vineyards, so the two were often grown together. Fruit trees, especially figs, were planted among them as well (Stulli, 1982). The cadastral survey showed that olive trees were often planted on private pastures as well, so when all the plots which contained olive trees are taken into account, olive trees were scattered across 74% of the island.

Since so much of the island was cultivated there were not many domestic animals. In the 1844 census 115 donkeys, 1 horse, 2 mules and 450 sheep were recorded on the island.[132] Goats were not present probably because of the damage they did to the agricultural areas and the lack of vegetation for browsing. Pastures, which were in the census described as of meagre quality, covered 32% of the island and most of these were privately owned with only 2% of the island designated as municipal pasture. Larger patches of municipal pastures were found on smaller islands around Zlarin. These islands were significant for local people not only because of pasture but because they were overgrown with bushes, so people could freely collect firewood there.[133] Even some of the names of the islands were derived from their importance in firewood collection such as Drvenik (*drvo* in Croatian translates as wood) and Rakitan (the local name for holm oak was *rakita)*.

Driven by the increase in price, the vineyards on Zlarin underwent further expansion after the 1850s which likely led to a further decrease of pastures and parcels where woodland could have developed. However, by the end of the century, the expansion of vineyards came to a stop across Dalmatia with the onset of phylloxera. The first blow to the wine industry was given by the so-called Wine Clause negotiated between Italy and Austria-Hungary in 1892 that lasted until 1903. It led to substantial duty cuts in the import of Italian wines which devastated local production (Stulli, 1982). In the same decade phylloxera appeared in north Dalmatia and in 1898 it spread across the Šibenik district devastating the livelihood of many people,

[132] *Ibid.*

[133] HR-DAST-152, Arhiv mapa za Istru i Dalmaciju. KO. 745 Zlarin. *Operato dell'estimo censuario del Comune di Zlarin*, 1826.

especially on Zlarin where vineyards dominated the agriculture (Peričić, 2016). On Zlarin island, the effects of phylloxera on the well-being of the community were intensified with the collapse of sailing in the Adriatic Sea in the late 1880s due to the spread of steamships.

Some of the population left during a massive emigration wave which occurred in Dalmatia from 1910 until 1914, but with the outbreak of the World War I and the return of sailors to Zlarin because of the collapse of Lloyd shipping company in Trieste, the population experienced an increase. It was also the peak of Zlarin's population as after the 1920s intense emigration followed (Stulli, 1982; Nejašmić, 2014) (Figure 5.36).

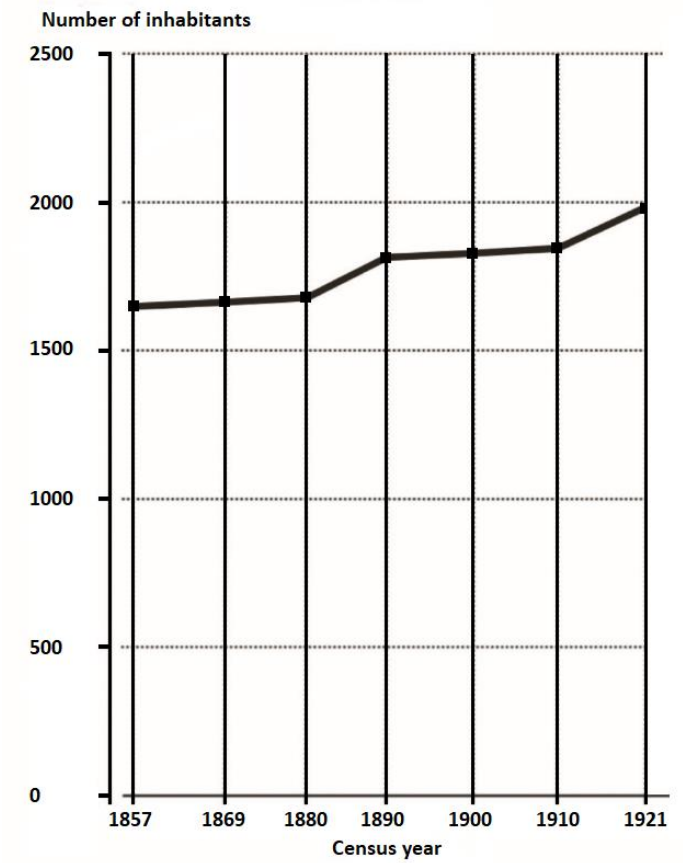

Figure 5.36. Number of inhabitants on Zlarin island according to the official census from 1857 to 1921 (Source: Klempić Bogadi and Podgorelec, 2011).

Emigration before World War I and the collapse of vineyards were crucial for the introduction of pines on the island. According to Mladen Bjažić, 91-year old journalist and writer from Zlarin who gave an interview to the local newspapers, a certain Ante Dean brought pine seedlings to Zlarin at the start of 20th century. He planted the seedlings on what used to be his devastated vineyard in an area called Marin and started charging swimmers one dinar for lying in the shade. Soon after, he planted another stand (Pavić, 2015). It is likely that more pine stands were established on abandoned vineyards parcels as records from the 1900s confirmed pine processionary infestations in 1909 and 1910.[134] However, since the intensive land abandonment on Zlarin did not start until the emigration of the 1920s it is likely these stands were small and limited to privately owned parcels.

5.6.2. Krapanj/Grebaštica

In 1844 there were 891 people living in Krapanj section. Most of the people lived on the island and in the village of Krapanj, with 75 out of 110 houses located there, while the rest were located in Grebaštica.[135] From 1882 Grebaštica was separated as an individual section. The period until 1918 was marked with slow population growth in Grebaštica so it is unlikely that woodlands experienced any substantial increase of pressure as a consequence of population expansion (Figure 5.37). Krapanj, however, experienced a much larger population increase, although the pressure on the landscape may have been mitigated by the traditional focus of its people on maritime activities.

[134] HR-DASI-Šibenik 19.-20.st. 17th May 1909. *Obznana.* N. 5957.
[135] HR-DAST-152, Arhiv mapa za Istru i Dalmacij. KO. 279 Krapanj. *Operato dell'estimo censuario del Comune di Crapanno*, 1844.

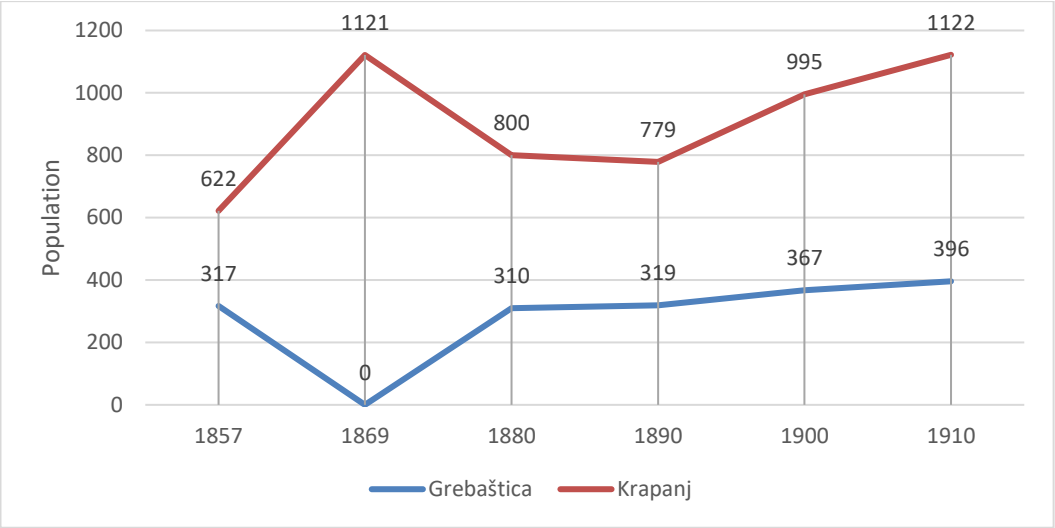

Figure 5.37. Population change of Grebaštica and Krapanj settlements from 1857 to 1910. The data for Krapanj in 1869 includes settlement Grebaštica (Source: DZS, 2018).

The 1825 cadastral plans of Krapanj section (with Krapanj island excluded because it was primarily built up) confirm the land use statistical data from the late 18th century which depicted landscapes of Dalmatia mostly uncultivated and dominated by pastures (Figure 5.38). Out of total area of 30km², only 10% was cultivated, with agricultural areas almost equally represented with fields and vineyards, and olive trees again scattered on most parcels (Figure 5.39). The remainder of the landscape was mostly made up of municipal pastures which covered 80% of the section (Table 5.4). These municipal pastures were not completely barren but in fact, covered with bushy vegetation while a further 6% of the landscape consisted of private pastures with bushes. These areas, although primarily providing pasture for domestic animals, also provided local people with some firewood.[136]

Pastoralism had a significant role in the livelihood of people here. In 1844 there were 13 horses, 40 donkeys, 48 oxen and 10 pigs recorded while sheep and goats prevailed with 1,720 sheep and 1,293 goats. The ratio of 1.3 sheep per goat was well beyond the district's average of 5 sheep per goat (Peričić, 2016) which signified the importance of goats to local people. Moreover, they were more adapted

[136] HR-DAST-152 Arhiv mapa za Istru i Dalmaciji, KO. 279 Krapanj. *Protocollo delle particelle dei terreni*, 1825.

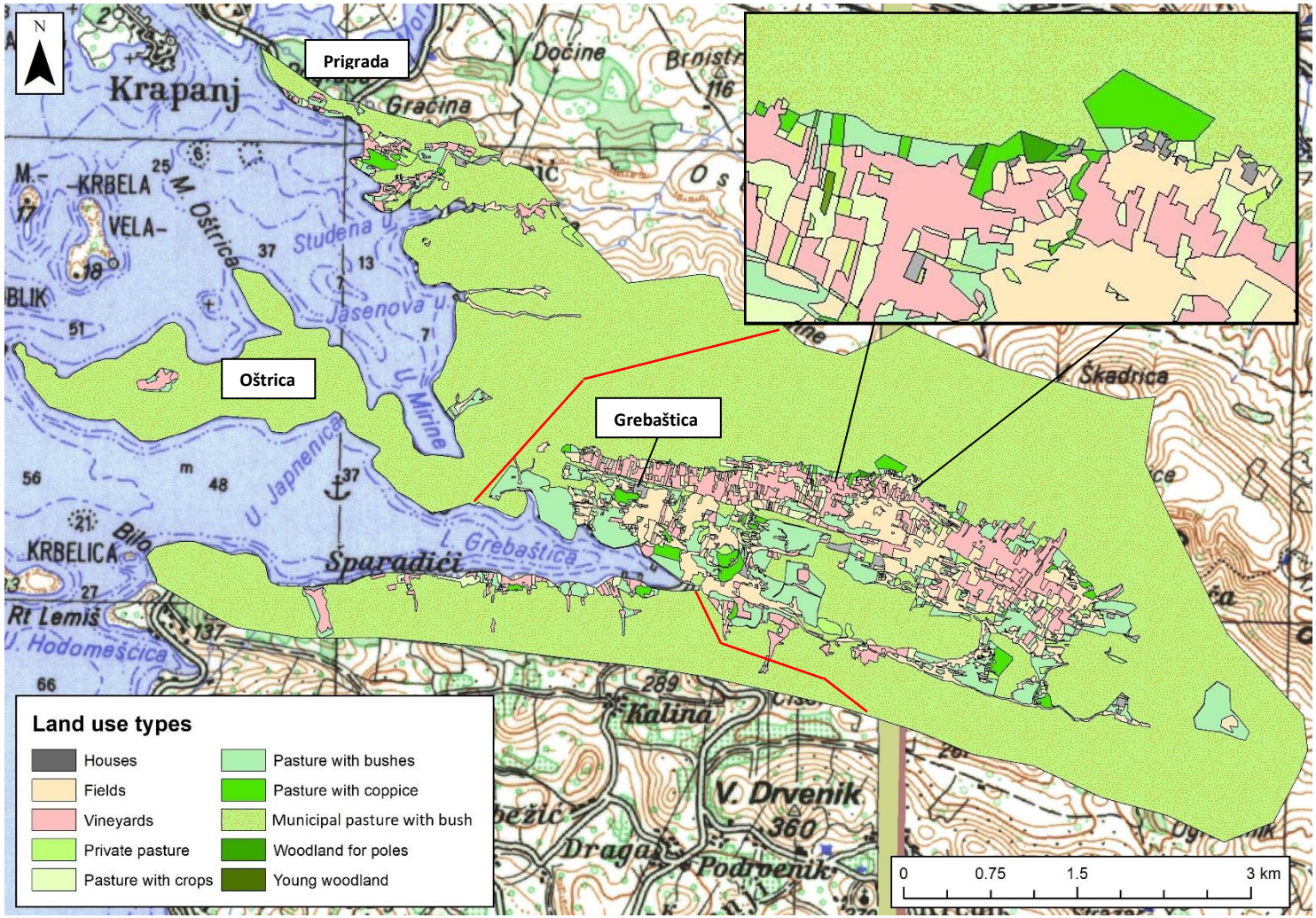

Figure 5.38. Land use map of Krapanj section made in ArcGIS based on 1825 cadastral plans derived from State Archives in Split. The agricultural land use types are simplified for presentation purposes. The border between Krapanj and Grebaštica sections that was established in the 1870s is marked with a red line. The area with only woodland parcels is enlarged (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmacij, KO. 279 Krapanj. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

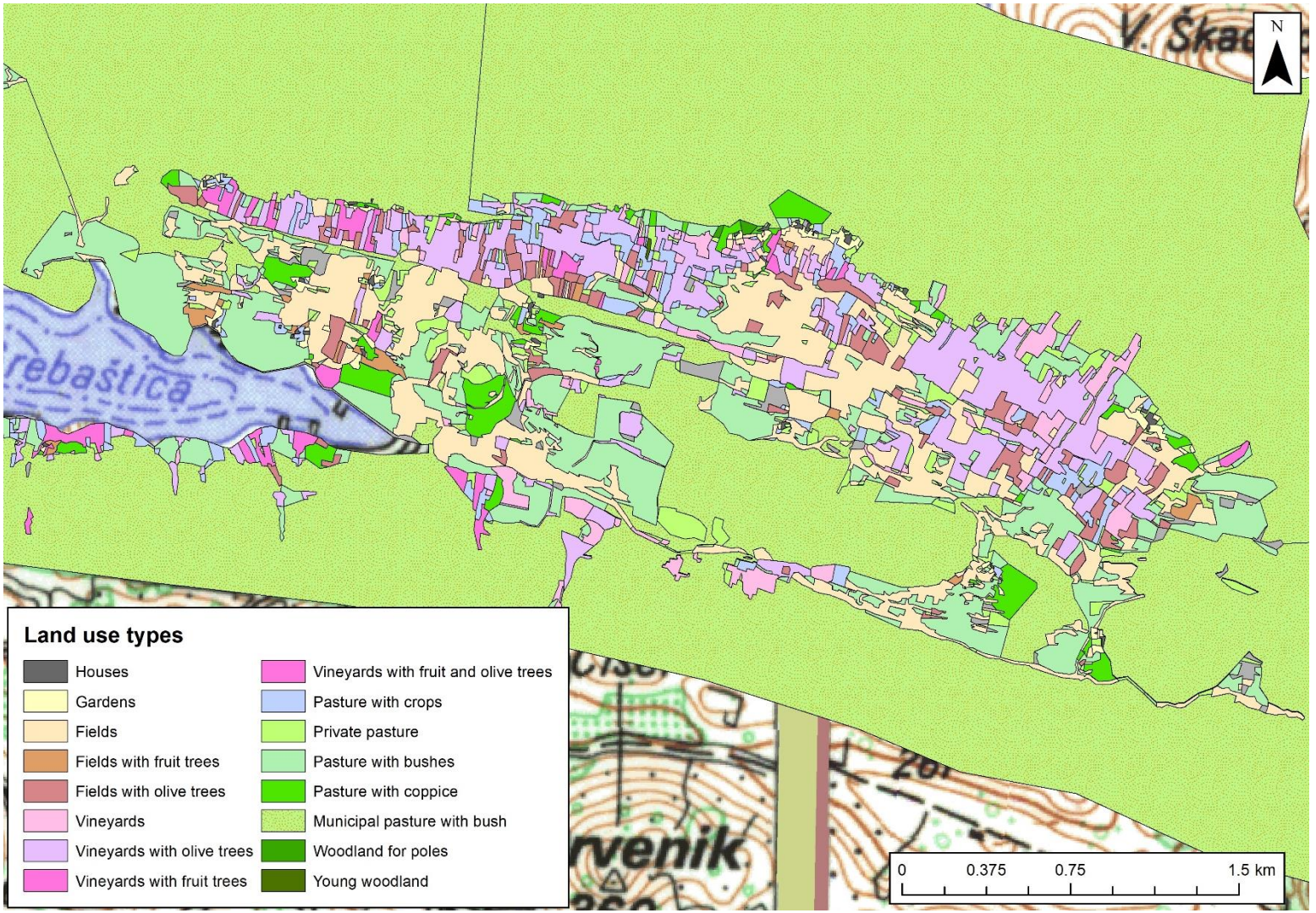

Figure 5.39. Land use map of Krapanj section made in ArcGIS based on 1825 cadastral plans obtained from State Archives in Split with the focus on the agricultural area of Grebaštica (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmacij, KO. 279 Krapanj. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

Table 5.4. Distribution of land use types in Krapanj section in 1825.

Land use type	Original name	Land use label	Area (km²)		Area (%)	General category
House	*Casa d'abitazione*	Built areas	0.018		**0.06**	Other
Rocky	*Scoglio nudo*	Barren	0.022		**0.07**	
Uncultivated	*Incolto*	Uncultivated	0.128		**0.4**	
Garden	*Orto d'erbaggi, orto d'erbaggi con frutta…*	Garden	0.06		**0.2**	Agricultural (10.6%)
Field	*Arativo*	Fields	1.36	1.69	**5.6**	
Field with olive	*Arativo con olivi*		0.23			
Field with fruit trees	*Arativo con frutta*		0.06			
Fields with mixed crops	*Arativo con – vigna, olivi e frutta…*		0.04			
Vineyards	*Vigna*	Vineyards	0.27	1.51	**5**	
Vineyards with olive trees	*Vigna con olivi*		0.93			
Vineyards with fruit trees	*Vigna con frutta*		0.04			
Vineyards with olive and fruit trees	*Vigna con olivi e frutta*		0.27			
Pasture with olive trees	*Pascolo con olivi*	Pastures with crops	0.23	0.29	**0.9**	Pastures (87,8%)
Pasture with fruit trees	*Pascolo con frutta*		0.02			
Pasture with mixed crops	*Pascolo con - vigna, frutta, vigna e olivi…*		0.04			
Private pasture	*Pascolo*	Pastures	0.3	26	**86**	
Municipal pasture	*Pascolo comunale*		23.95			
Pasture with bush	*Pascolo con cespugli*		1.76			
Pasture with coppiced trees	*Pascolo con piante cedue*	Wooded pastures	0.27	0.3	**0.9**	
Young woodland	*Bosco giovine*		0.001			
Woodland for poles	*Bosco di stanghe*		0.004			

to pastures in this section which surveyors described as covered with rocks, positioned on very steep slopes and with little or no soil.[137] The number of goats probably decreased considerably after the ban on goats was implemented in the 1870s.

There were only three parcels designated as woodland in the 1825 cadastral survey, and these were very small and privately owned (Figure 5.38). Two were recorded as young woodland (*Bosco giovine)* and one as *Bosco di stanghe*. There is no written record of what *stanghe* woodland is, but Berenger (1859, p.508) mentions *stanghe di pino* and describes them as long and straight pine poles of a small diameter.[138]

The documents supplementing the cadastral survey of Boraja section reveal that poles for vineyards were extracted from trees and shrubs found in wood pastures.[139] Records from the village council meeting in Skradin reveal how council members instructed people to leave juniper trees intact when carrying out clear-cutting in woodlands, as the middle branch of a juniper tree provided the best poles for vineyards.[140] It is likely then that *stanghe* woodland was the one where poles for vineyards were obtained from many juniper trees so it will be referred to as woodland for poles.

These three woodland parcels were also classified as wooded pastures according to their 'Money value'. This means they were comprised of bushes of holm oak, mastic and terebinth trees, myrtle and deciduous oak and were used as pastures and for firewood collection. Firewood was used for everyday purposes and sometimes sold at Šibenik market.[141]

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[137] HR-DAST-152 Arhiv mapa za Istru i Dalmacij, KO. 279 Krapanj. *Estimo della rendita in naturali del Comune di Crappano,* 1841.

[138] Passer-Gross (1962, p.968) explained that *stanga* means wood commercially defined as a 'set of round logs with a length from 4 meters forward presenting a diameter at the tip of not less than 5 cm and, at from the origin, a diameter not smaller than 10 cm'.

[139] HR-DAST-152, Arhiv mapa za Istru i Dalmacij. KO. 52 Boraja. *Protocollo di classificazione dei terreni del Comune di Boraja,* 1841.

[140]HR-DASI- Šumarstvo 19.-20.st. 4th December 1908. *Zapisnik o sjednici obćinskog vijeća Skradinskoga sazvana načelnikovim pozivom.* N. 7509.

[141] HR-DAST-152 Arhiv mapa za Istru i Dalmacij, KO. 279 Krapanj. *Protocollo di classificazione dei terreni del Comune di Crappano,* 1841.

Another large tract of wooded pasture was located on Oštrica peninsula, along with several smaller ones along the main road. The difference was that the land use type in these parcels was designated as a pasture. Additionally, the archival records from 1821 reveal the area had been designated as a forbidden grove. The same was done in Prigrada area which was neither a woodland nor had the value of a wooded pasture, although archival records document there were scattered pine trees and bushes of oaks there.[142] The groves were described as encircled with a dry-stone wall, although a damaged one.[143]

However, the cadastral plans and records of 1825 do not make a record of any of this. As already mentioned, the forbidden groves in these two areas were first established by the French, so the renewal of regulations on forbidden groves issued by the Austrians implied the ones in Oštrica and Prigrada had to be re-established because they were devastated. If they had been re-established, however, strict regulations which excluded pasture and firewood collection would also mean the areas could not be used as municipal pastures, which is how they were recorded in the plans. It seems therefore that the paper regulations had little impact on the ground. This is supported by a document from 1848 which discussed woodlands of Krapanj section but did not mention Oštrica and Prigrada forbidden groves. It does mention, however, that the section had '*genuine richness in the woodland of cape Oštrica*' and this was very important for villagers of Krapanj.[144]

The fact that the area was then referred to as a woodland instead of a municipal pasture means that either the surveyor made a mistake when they did not designate what was a wooded pasture as woodland or the woodland category was implemented sometime later. In either case, the topographical map of the second military survey (1851-1854) does depict Oštrica area as a woodland (Figure 5.40). Prigrada area remained a pasture.

[142] HR-DASI-Šibenik 19.-20.st. Šumarstvo. Undated, *c.* the 1820s. *Prospetto de' Boschi Sacri eretti al Circondario Comunale di Zlarin*.
[143] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1821. *All' Imp.Reg. Pretura in Sebenico.* N. 735.
[144] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 4th June 1848. Šumarstvo*. Prospetto degli spazi poco produttivi, produttivi ed improduttivi…del Sindacato di Zlarin.* N. 1394.

With the division of municipal land in 1876 a notable increase of woodland areas in Krapanj section occurred (Figure 5.40). Oštrica woodland remained in its previous borders, while a large part of what used to be municipal pastures in the SE part of the section were now designated as a woodland. These areas, which covered the hills and slopes of Ciser, Gorice and Raduča, were characterised by scattered bushes according to the 1825 cadastral plans and people had the right to exploit them freely for firewood collection and pasture. Once the woodland category was implemented, the exploitation became regulated by the forest guards so cutting and pasture were limited. In Oštrica woodland the management also included periodical thinning of woodland. Each year the twentieth part of woodland was treated, and the wood obtained was distributed to the families in the area.[145]

Finally, with the division of municipal lands some of the areas were selected for reforestation. Records place the first reforestation activities in 1896 when at Prigrada 50,000 Aleppo pine trees were planted and 15kg of stone pine seeds sown.[146] Another round of reforestation followed in 1900 when 300 kg of maritime pine, 100 kg of Aleppo pine and 150 kg of black pine were sown into holes at Bilo. The same year at Prigrada 50 kg of maritime pine seeds were sown across an area of 30ha.[147] Although the exact year of reforestation is not known, in this period a pine stand was also established in Gradina. Further beating up was carried out in 1907 at both Gradina and Bilo (Figure 5.41).[148]

There is evidence that reforestation was also opposed by the local people. An incident was documented in 1899 at Bilo when the municipal forester, Krapanj village head and workers were attacked by 20 villagers from Tribešić and Pod Greben villages (from neighbouring Primošten section). According to the report, the villagers destroyed all demarcations which were placed to delineate reforested area and 'shouted and swore they would not allow reforestation anywhere'. Since the

[145] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1st May 1892. *Izvješće gospodinu općinskom upravitelju*. N.97 and N. 110.
[146] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 18th February 1896. N. 2389.
[147] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 20th February 1900. N. 65.
[148] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 6th October 1907. *Iskaz pašnjaka šibenske općine koji bi se morali pošumiti u godini 1907/8 iznova.* N. 9931.

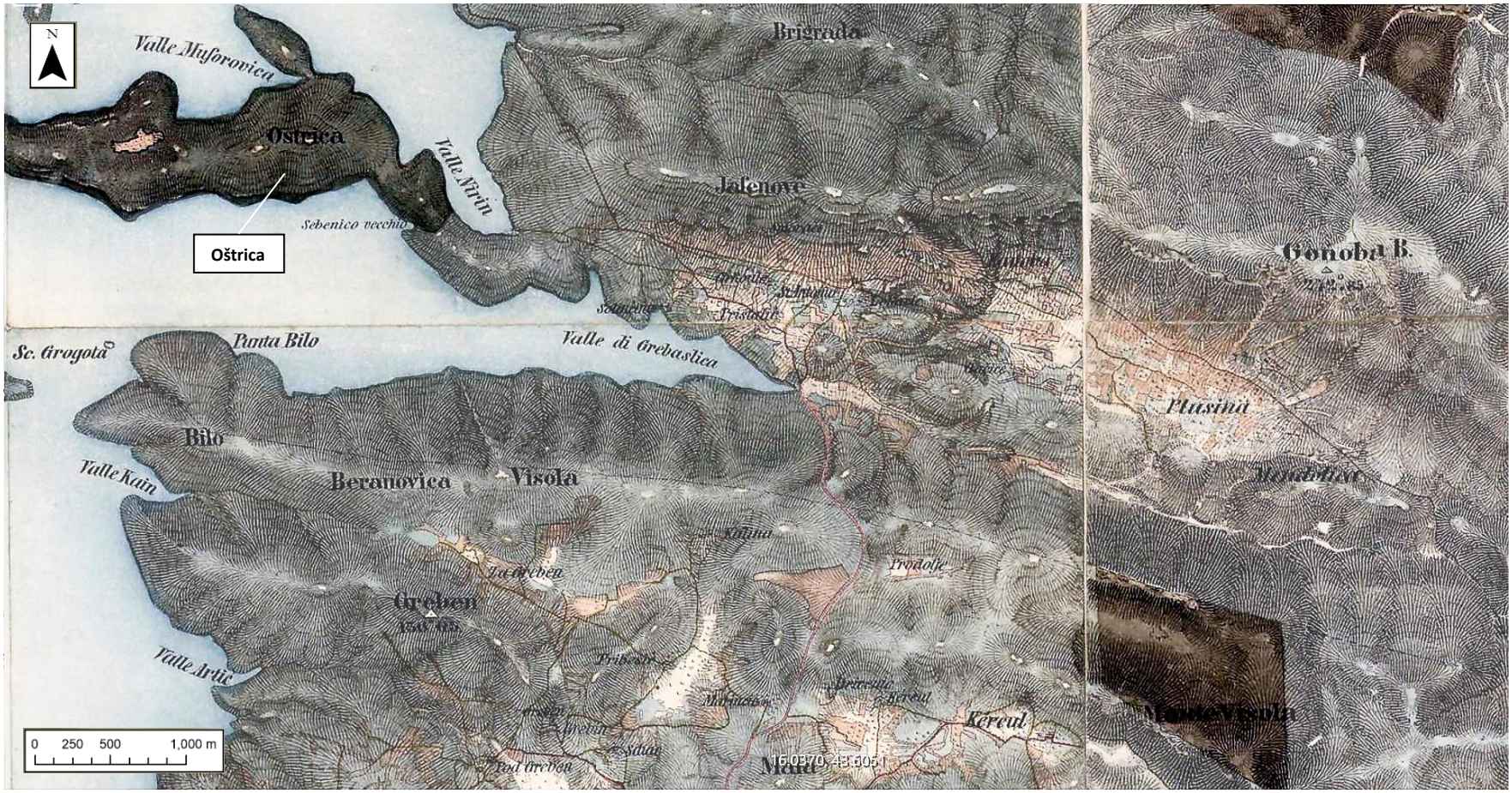


Figure 5.40. Krapanj section with a focus on Grebaštica area on the second military survey (1851-1854) topographic map. The woodland area of Oštrica is depicted in dark grey and represented the only municipal woodland in this section, while the two other visible woodland patches (top-right and bottom-right) belonged to neighbouring sections (Source: MAPIRE.eu).

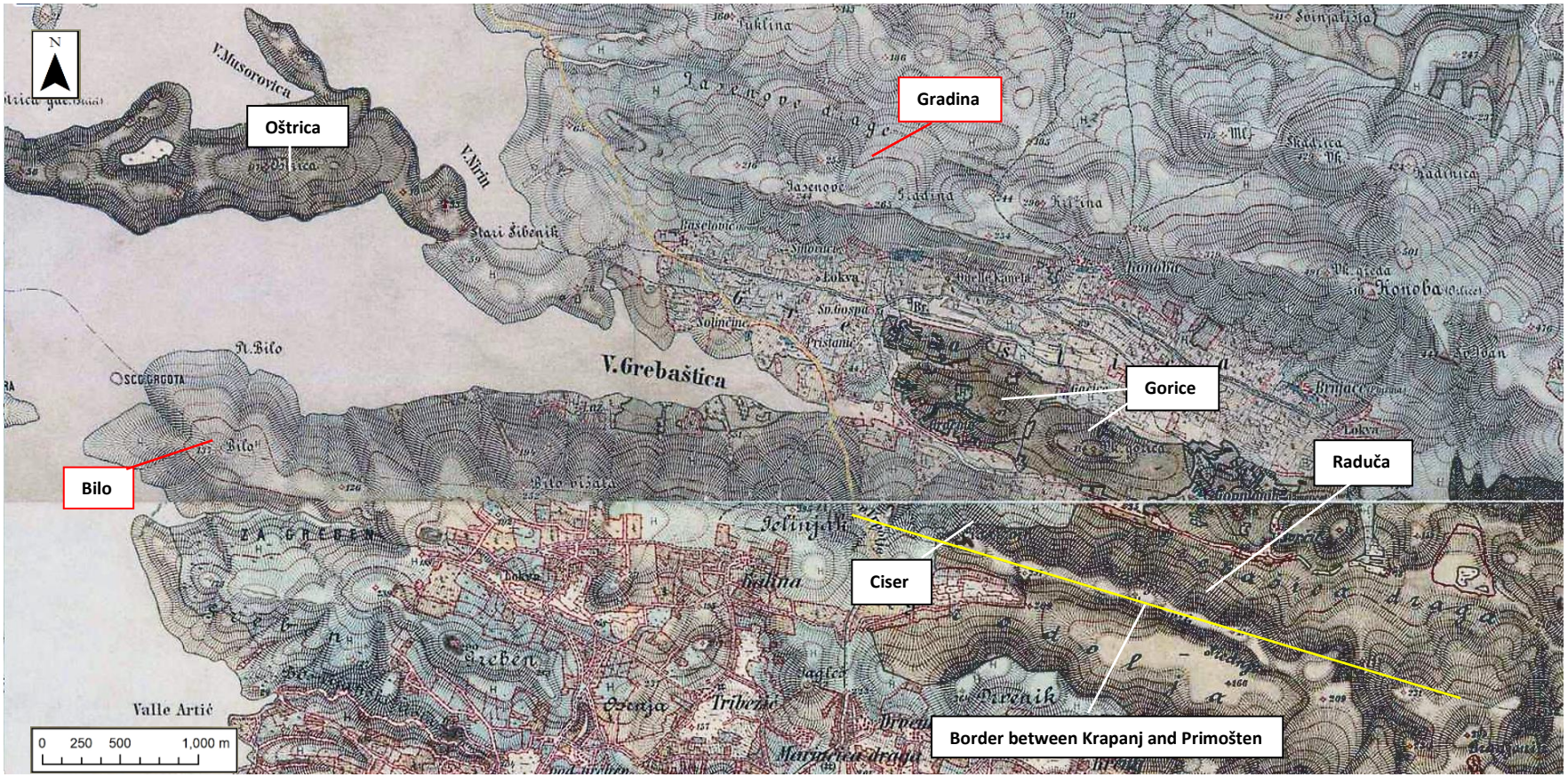


Figure 5.41. Grebaštica area on the third military survey (1869-1887) topographic map with the location of municipal woodlands (white) and established pine stands (red) drawn in by the author (Source: MAPIRE.eu).

location of demarcations stones was agreed between their village heads and land surveyors, it showed how certain interest groups did not obey agreements even if they were officially agreed with the village elders.[149]

5.6.3. Boraja section

Unlike Krapanj and Zlarin sections, Boraja section was entirely part of Nuovo Acquisto, territories Venice captured only at the very start of the 18th century. Because of the conflicts, the area was heavily depopulated during the 16th century and only 11 houses were noted in the population register. During the peace times, fields were cultivated by citizens of Šibenik while the Ottoman Morlachs used pastures for their animals (Juran, 2014). It is not known how many people settled here during the two centuries of the Ottoman rule, but analysis of surnames conducted by Božić-Bužanić (1988) revealed that a number of families remained in the area after it came under the Venetian rule. In the 18th century, Venice acknowledged these subjects as their citizens and gave them land to use freely.

A century of peace during the 18th century allowed an increase in the population and cadastral records show that 553 people lived here in 1844.[150] They lived in scattered clusters of houses based on family groups. Many of these developed from *katuni*, basic shelters built by pastoralists (Juran, 2014). Four of these clusters of houses formed the core of villages later defined as Boraja, Vrsno, Mravnice and Podine. This area provided difficult living conditions and people often shared their roof with animals during cold winters since there was no other shelter (Obad, 1974). Agriculture was the only economic activity, but it yielded poor revenues.[151] Wheat and barley were the main crops while more lucrative ones such as vineyards, olives or fruit trees were planted only on 10% of the agricultural area.

Underdevelopment of agriculture only increased what was seen as a traditional orientation towards pastoralism among the hinterland communities.

[149] HR-DASI- Šumarstvo 19.-20.st. 22nd August 1899. N. 80.
[150] HR-DAST-152 Arhiv mapa za Istru i Dalmaciju. KO. 52 Boraja. *Operato dell'estimo censuario del Comune di Boraja,* 1844.
[151] *Ibid.*

Cadastral records show that in 1844 there were 190 oxen, 33 cows, 27 horses, 50 donkeys, 114 pigs, 2,952 sheep and 2,040 goats in the commune.[152] These figures are likely to have been considerably higher before the 1829-1833 period when it was reported that disease had decimated pastoralism in the region (Obad, 1974). The number of goats was particularly high in Boraja as in 1847 the whole Šibenik district counted 7,286 goats which means that almost 30% of them were located in this area only (Peričić, 2016). Since 87 families lived here, that means there were on average 23 goats per family.[153]

The Croatian priest and professor Matas (1866) described the Dalmatian hinterland, including Boraja, as a true 'terra incognita, the desolate fields of harsh karst tangled with rocky hills and slopes, divided by low-yielding valleys, as the barren rock is everywhere, where you sow and where you pasture'[154] (Figure 5.42). The land use map produced according to the 1825 cadastral plans supports this description as it shows that 89% of the area was used as pastures and only 10% of it was used for agriculture(Figure 5.43; Figure 5.44). The appearance of a barren landscape can be explained with the fact that 55% of the area was covered with those pastures that consisted only of grass and bushes (Table 5.5). The fact that surveyors distinguished the category of 'pastures with bushes' from 'pastures with bushes and coppiced trees' indicates that bushes were not those of tree species.

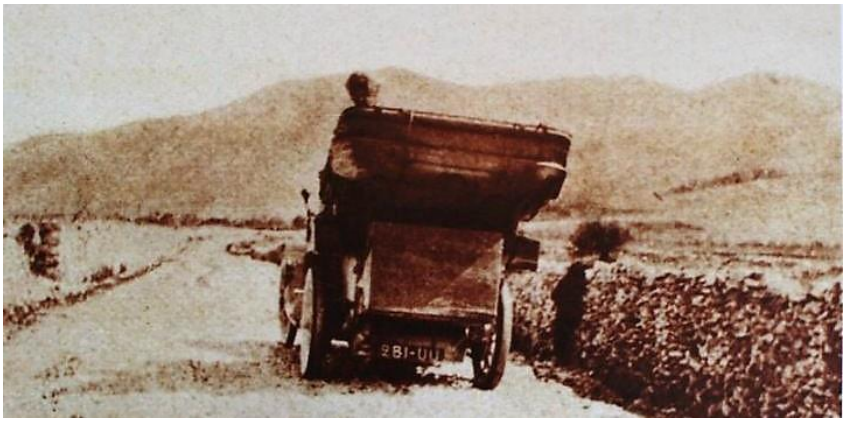


Figure 5.42. The view towards barren hills south of Boraja settlement from Šibenik – Split road in 1908 (Source: Private archives).

[152] *Ibid.*
[153] *Ibid.*
[154] *… prava terra incognita, polje pusto ljuta krša isprepleteno povorkam vrletnih humaca i strana, rastavljenih slaborodim dolinom, jer goli je kamen svukud i kud se ore i kud se pase.*

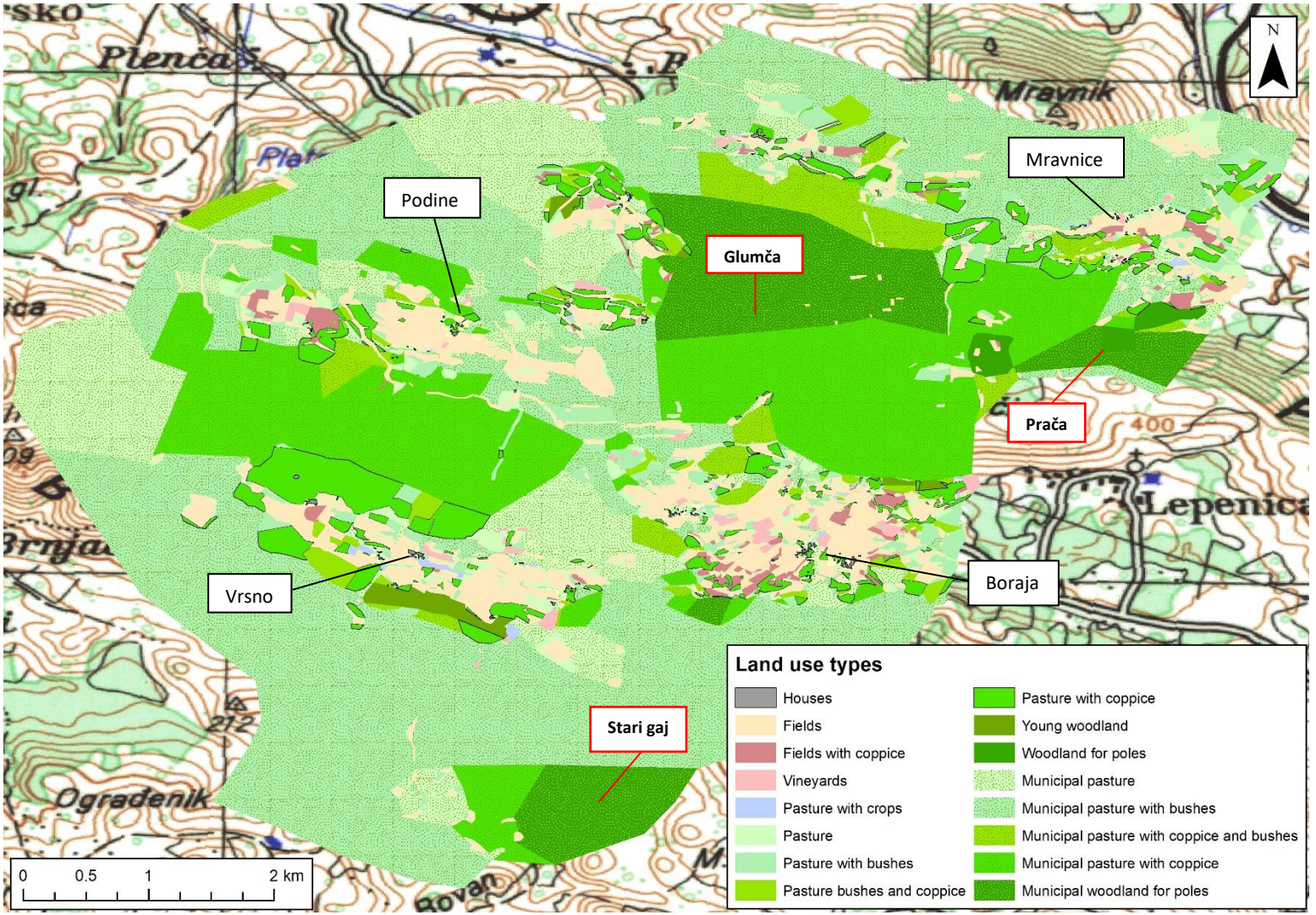


Figure 5.43. Land use map of Boraja section made in ArcGIS based on 1825 cadastral plans obtained from State Archives in Split with the location of villages (black) and municipal woodlands (red) (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmaciju, KO. 52 Boraja. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

Table 5.5. Distribution of land use types in Boraja section in 1825.

Land use type	Original name	Land use label	Area (km²)		Area (%)	General category
Built areas	*Casa d'abitazione*	Built areas	0.03		0.1	Built areas
Road	*Strada*					
Garden	*Orto d'erbaggi, orto d'erbaggi con frutta…*	Garden	0.03		0.1	Agricultural (10%)
Field	*Arativo*	Fields	2.42	2.83	9.2	
Field with olive	*Arativo con olivi*		0.01			
Field with fruit trees	*Arativo con frutta*		0.11			
Field with coppiced trees	*Arativo con – vigna, olivi e frutta…*		0.28			
Vineyards	*Vigna*	Vineyards	0.11	0.17	0.57	
Vineyards with olive and fruit trees	*Vigna con olivi e frutta*		0.06			
Pasture with vineyards	*Pascolo con vigna*	Pastures with crops	0.01	0.05	0.16	Pastures (89%)
Pasture with fruit trees	*Pascolo con frutta*		0.04			
Pasture	*Pascolo*	Pastures	0.67	16.97	55.2	
Municipal pasture	*Pascolo comunale*		3.79			
Pastures with bush	*Pascolo con cespugli*		0.87			
Municipal pasture with bush	*Pascolo comunale con cespugli*		11.64			
Pasture with bush and coppiced trees	*Pascolo con cespugli e piante cedue*	Wooded pastures	0.38	10.36	33.7	
Municipal pasture with bush and coppiced trees	*Pascolo comunale con cespugli e piante cedue*		1.01			
Pasture with coppiced trees	*Pascolo con piante cedue*		1.46			
Municipal pasture with coppiced trees	*Pascolo comunale con piante cedue*		4.93			
Young woodland	*Bosco giovine*		0.16			
Woodland for poles	*Bosco di stanghe*		0.16			
Municipal woodland for poles	*Bosco di stanghe comunale*		2.26			

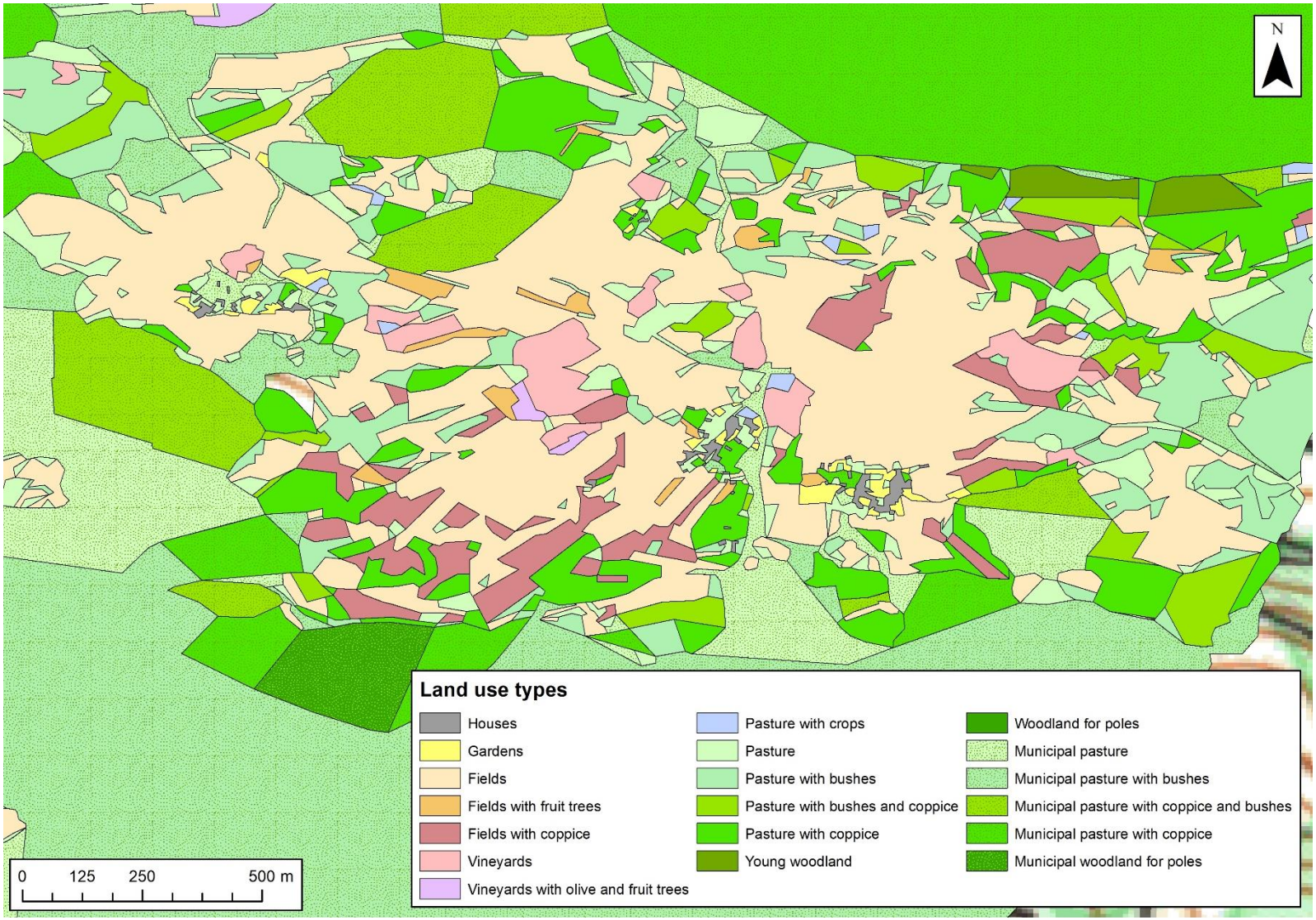


Figure 5.44. Land use map of Boraja section with a focus on Boraja village made in ArcGIS based on 1825 cadastral plans obtained from State Archives in Split (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmaciju, KO. 52 Boraja. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

The importance of pastures with coppiced trees lays in the fact that those parcels had the 'Money value' of a wooded pasture, like woodland parcels, which means they could be used for firewood collection. Most of the larger parcels were in municipal ownership, and in total 76% of the section's areas could have been freely used. However, there were many privately owned parcels marked with coppiced trees (Figure 5.44). It is likely that these areas were what Guttenberg (1872) and Wessely (1878a) called *ograde* or 'dry-wall enclosures'. Guttenberg describes them as woodlands of small extent dispersed near houses in rural settlements used for collection of firewood and as shelter of domestic animals. Wessely (1878a) regarded them as the only remaining 'green places' in the otherwise barren karst wasteland and attributed their preserved condition to the private ownership in contrast to similar parcels that were owned by the municipality.

Just like in Krapanj section, there were two types of woodlands – young woodland and *bosco di stanghe* or woodland for poles. While parcels with young woodland were significantly smaller in extent and always privately owned, woodland for poles were larger in extent and in both private and municipal ownership. The 'Money value' of these parcels was of wooded pasture. Woodland pastures for Boraja section were defined as those that produced not only bushes but also plants of oak, hornbeam and ash. Juniper, which was the best source of poles for vineyards, was either absent or was considered to be a bush.[155]

A custom originating from distant times allowed each woodland in the section to be used by individual families only. The exploitation consisted of pasture, the collection of acorns, manure and litter. A document from 1855 about grazing rights in Boraja section identified four woodlands, each according to the village it belonged to.[156] However, there were also reports about families from one village allowing their animals to pasture in woodland belonging to other villages.[157]

[155] HR-DAST-152-Arhiv mapa za Istru i Dalmacij. KO. 52 Boraja. *Protocollo di classificazione dei terreni del Comune di Boraja,* 1841.
[156] HR-DASI- Šumarstvo 19.-20.st. 17th May 1855. Unnamed.
[157] HR-DASI-Šumarstvo 19.-20.st. 13th February 1860. *Nota.* N.29.

The third military survey (1869-1887) topographical map shows a significant change in the woodland areas of the section in the late 19th century (Figure 5.45). Most notably, Glumča woodland was no longer classified as woodland. The woodland Prača south of Mravnice was also considerably reduced and its eastern section was converted to pastures. The privately-owned young woodland south of Vrsno retained its borders, but additionally, a patch of what used to be a municipal pasture with coppiced trees had then been designated as a municipal woodland. Finally, the woodland Stari gaj at the southern border of the section was physically joined with the newly designated municipal woodland that traversed from the hinterland of neighbouring Krapanj section. However, its old borders were clearly delineated with a borderline which may have indicated it was proclaimed a protected area.

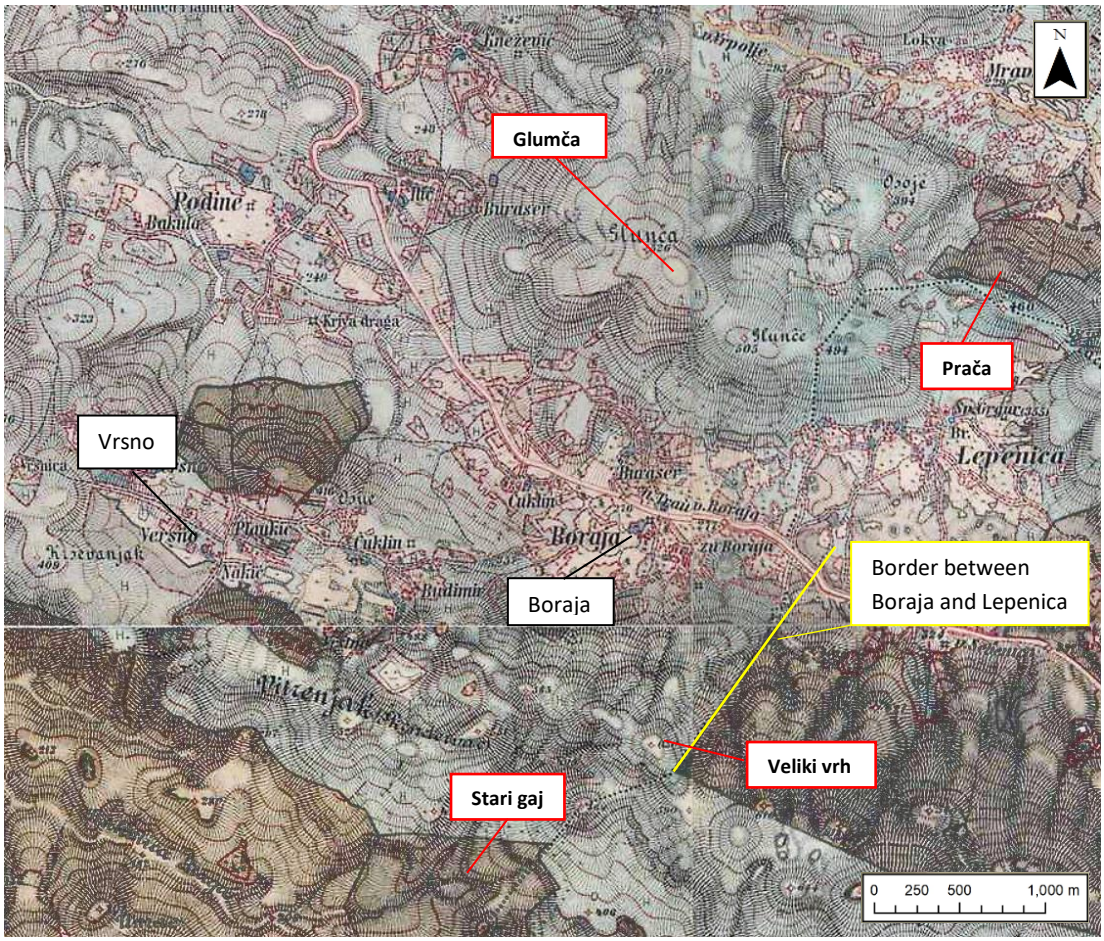


Figure 5.45. Boraja section on the third military survey (1869-1887) topographical map with names of location added by the author (Source: MAPIRE.eu).

Interestingly, the Boraja hill, south of the same-named settlement, remained classified as a pasture. However, the remainder of the hill that was located in the neighbouring Lepenica section had been wholly designated as a woodland. This emphasises how parts of the same hills but in different sections often had different land use types.

In 1882 Glumča area was among the first in the Šibenik municipality selected for reforestation. The activity was supposed to be carried out with ailanthus and oak trees, and it represented the only area selected for reforestation which was not in immediate vicinity of Šibenik. The parcel that was selected for reforestation was not the one that used to be categorised as woodland in the 1825 cadastral plan, but rather parcel 2671 was selected, which according to the 1825 cadastral plan used to be a sizeable municipal pasture with coppiced trees (Figure 5.46). In 1893 the municipal forester referred to Glumča as woodland so the category may have been implemented again.[158] Two years later in 1895 the forester observed that Glumča woodland was in good condition, but that damage from illegal cutting was found in its protected part.[159] It is possible then that the protected part of Glumča was the one that was reforested in 1882.

The reforestation of Boraja hill was also considered but was rejected because the forestry commissioner believed vegetation would regenerate on its own without additional actions needed.[160] There is no evidence that Glumča was anytime later included in reforestation and can, therefore, be taken as an example of a change in reforestation practices after the 1890s and introduction of pines. Namely, pines were used on barren areas that could have been used only as poor pastures, while Glumča represented a wooded landscape with many coppiced trees that were valuable for firewood collection and browsing.

[158] HR-DASI-Šumarstvo 19.-20.st. 1st August 1893. N. 189.
[159] HR-DASI-Hortikultura. 1st October 1895. N.113.
[160] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 10th November 1882. *Ugledno općinsko upraviteljstvo!* N. 286.

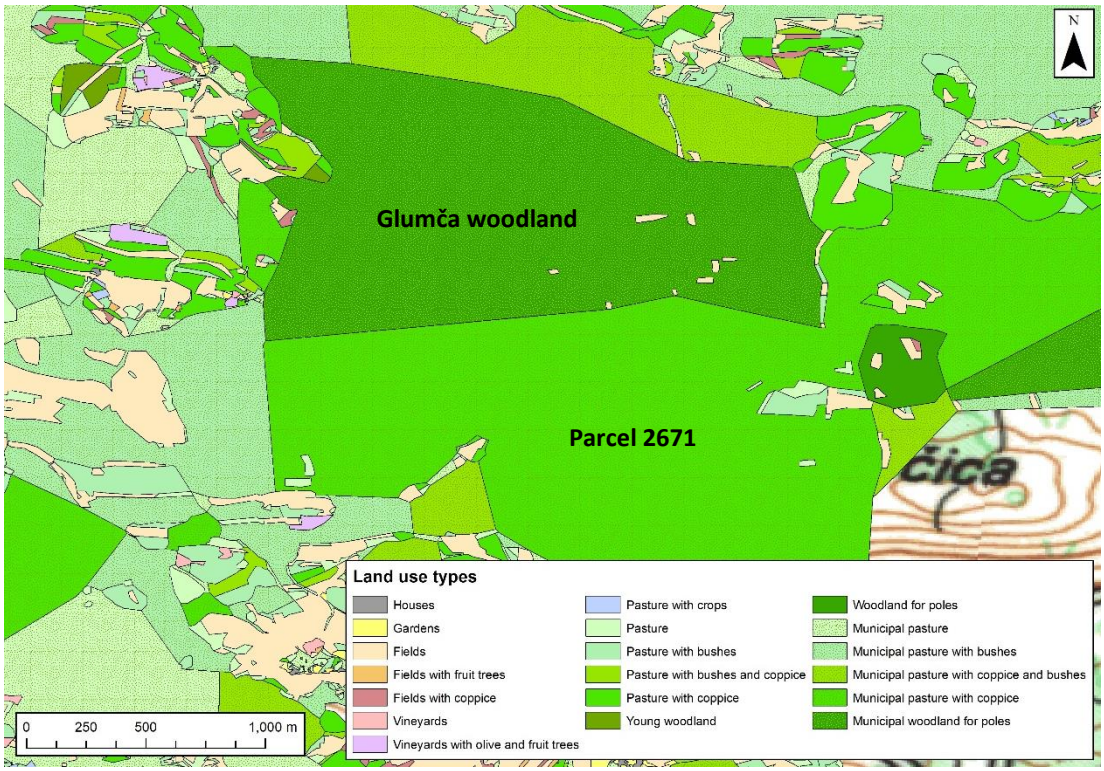


Figure 5.46. Land use map of Boraja section with a focus on Glumča area made in ArcGIS based on 1825 cadastral plans obtained from State Archive in Split (Source: HR-DAST-152 Arhiv mapa za Istru i Dalmaciju, KO. 52 Boraja. *Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine).*

The first pine stand in Boraja section was established in the first decade of the 1900s in Veliki vrh, south of Boraja settlement, on north-facing slopes along the border with Lepenica section (Figure 5.45). In 1907 it was reported that beating up was needed since a lot of seedlings had died.[161] At this date the usual practice was to establish black pine stands in more elevated areas or those further away from the sea and although the records do not note the species, the pines existing there today are black pines so it is likely they were planted. (Figure 5.47). At least until the Yugoslav period Veliki vrh remained the only pine stand established in this large section.

[161] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 6th October 1907. *Iskaz pašnjaka šibenske općine koji bi se morali pošumiti u godini 1907/8 iznova.* N. 9931.

Figure 5.47. Veliki vrh pine woodland in Boraja (Ivan Tekić, May 2016).

5.7. Conclusion

Archival records, travel accounts and land surveys all tell that the woodland landscape of Dalmatia in the late 18th and the 19th century was dominated by bush-shaped coppiced trees that were exploited for firewood and pastoralism. Most of such areas were in municipal ownership and were crucial for the livelihood of the local people. However, despite often being similar in appearance and structure, some areas were designated as woodlands while other remained as pastures and people referred to them as *gaj.* Regulations in *gaj* were light, while in woodlands local authorities and later foresters, implemented different management regimes. Most of them included prohibition of exploitation after cutting for firewood, but this was not always respected by the people. Unlike what foresters from the late 19th century claimed, the implementation of protective woodland regulations did not stop with the change from the praised French to the criticised Austrian one. The Austrians

adhered to and even renewed most regulations that formerly existed. Despite this, the officials regularly viewed woodlands as in the process of being devastated.

In the second half of the 19th century, woodland areas were greatly increased at the expense of municipal pastures. By limiting exploitation foresters tried to resurrect woodlands from remnants of stumps and roots on former pastures. However, from the 1880s foresters began carrying out reforestation on barren areas as well. At first this was done with ailanthus and oaks, but by the 1890s this was abandoned in favour of pines. Established pine stands across the municipality were protected from exploitation which consequently led to opposition from the people, as they lost access to important pastures. Nevertheless, the increase of pine woodland in the municipality was documented and by the start of World War I many successful plantations had become established. This success was tempered to some extent by the recording of the first outbreaks of pine processionary moth.

6. Woodlands in the Yugoslav periods (1918-1990)

6.1. Introduction

With the dissolution of the Austro-Hungarian Empire in 1918 parts of the Dalmatian territory, including Šibenik, were briefly occupied by Italian forces. The situation was resolved by the Treaty of Rapallo in 1920 when only Zadar remained under Italian rule while the rest of Dalmatia finally merged with Croatia and became a part of the State of Slovenes, Croats and Serbs. In 1929 the State was renamed to the Kingdom of Yugoslavia. During the World War II for a brief period a fascist-supported Independent State of Croatia interrupted the Yugoslav administration, but it was continued from 1945 as the Federal People's Republic of Yugoslavia or the Socialist Federal Republic of Yugoslavia from 1963. Croatia left Yugoslavia in 1991 after which it was engulfed in the War of Independence until 1995.

This chapter will focus on the management of woodlands in the Yugoslav period. It will continue to explore the management in the municipal woodlands that were identified in the preceding chapter as well as the development of previously established pine plantations and those newly created. These will be viewed together with the ideas that developed among the forestry communities in both Croatia and Dalmatia. The first section will focus on the inter-war period and how the government in the new state approached the management of traditional woodlands and reforestation. The second part of the chapter will focus particularly on the 1950s as this decade saw the implementation of regulations concerning traditional woodland management. It was also the most intensive period of reforestation activities after World War II. The period from the 1960s to 1990 will focus on the crucial economic and social changes in Dalmatia and how these affected woodland landscapes. Finally, the chapter will end with a more detailed analysis of woodland changes in the Yugoslav period based on the three case studies that were also analysed for the Austrian period.

6.2. Woodlands in the inter-war period

6.2.1. Traditional woodland management in Šibenik district between the World Wars

It is hard to assess the damage woodlands endured during World War I as the archival records from this period are particularly scarce. However, the adverse effects of the war did not stop immediately after the truce was signed. In 1918 Šibenik district authorities issued an alarming warning to municipalities that woodlands under their authority were being destroyed at such a rate that consequences would be visible for decades if not centuries to come.[162] At the time it was possible to sell wood for a lucrative price, so the people in war-torn areas, especially in villages, saw this as an easy way to earn some extra profit.[163]

One of the woodlands in Šibenik municipality that was particularly devastated was Trtar (Figure 5.16, p.150). It was reported that in December 1918 every day between 150 and 200 villagers of neighbouring Lozovac, Dubrava and Konjevrate villages went to this woodland. According to foresters, they searched for larger, more developed trees and cut them with blunt objects in an unprofessional way, damaging the stumps in the process and disenabling natural regeneration. In total, an area of 590 ha was devastated, which included 203 ha were every single tree was cut entirely while some were even dug up with roots. Very young trees with barely developed shoots were also damaged by goat browsing. In order to mitigate the damage and rejuvenate the woodland clear-cutting near the ground was carried across the whole woodland, but foresters expressed doubt that traditional woodland management could continue. The devastation of Trtar, however, continued as more parcels were reportedly damaged in 1921 as well.[164]

Woodland devastation was reported in other parts of the district as well. Woodland Podi in Boraja section was reportedly devastated by illegal cutting and

[162] HR-DASI-Šumarstvo 19.-20.st. 16th December 1918. N. 46211.
[163] HR-DASI-Šumarstvo 19.-20.st. 10th May 1920. *Plijemtbeni zapisnik sastavljen na obali kod ribarnice u Šibeniku 10/5 1920.*
[164] HR-DASI-Šumarstvo 19.-20.st. 12th January 1919. *Copia 1, Gaj Trtar u Konjevratim bezpovlasna sječa;* HR-DASI-Šumarstvo 19.-20.st. 13th December 1918. *Zapisnik sastavljen u uredu kotarskog poglavarstva*. N. 40149; HR-DASI-Hortikultura. 24th June 1921. N. 3856.

pasture. In Perković – Slivno section three woodlands showed evidence of massive devastation. Since remaining stumps showed potential for regeneration, clear-cutting of the area was ordered in each of those woodlands. After the cutting, a ban on cutting and pasture was implemented, although in some cases envoys of village councils tried to repeal the ban on pasture. Rejuvenation and stricter protection of woodlands in Primošten area were also needed as two out of three woodland areas were described as devastated.[165] As a consequence, many woodland areas were cut down, but their regeneration was dependent on efficient protection from pasture.

The devastation occurred because political turmoil impeded woodland protection by forest guards even though Italian occupational forces did not abandon woodland regulations which existed in the preceding Austrian period. For instance, in 1920 people were fined for selling illegally cut wood according to the 1873 regulations.[166] Forest guards were stripped of some of their powers, but most of them retained their positions and appointment of new ones was also considered. If no forest guard was available in a particular area, the municipality was instructed to ask the occupation army personnel for help.[167] However, district authorities in 1919 reported that with the change of government some people 'became reckless and senseless because of fear and political uncertainty, so they started to massively cut municipal woodlands'.[168] The regulations which existed were largely disregarded by both the local people and the municipal authorities so forest guards alone could hardly stop illegal cutting.[169] Municipalities were supposed to restrict cutting in municipal woodlands so that no individual could cut more wood than that needed by his household.[170] Since district authorities kept sending warning letters to municipal

[165] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 17th November 1921. N. 5967; HR-DASI-Šibenik 19.-20.st. Šumarstvo. 5th November 1921. N. 9435; HR-DASI-Šibenik 19.-20.st. Šumarstvo. 21st July 1921. N. 5107/21.
[166] HR-DASI-Šumarstvo 19.-20.st. 10th May 1920. *Plijemtbeni zapisnik sastavljen na obali kod ribarnice u Šibeniku 10/5 1920.*
[167] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 24th January 1919. N. 354.
[168] HR-DASI-Šumarstvo 19.-20.st. 10th May 1920. *Plijemtbeni zapisnik sastavljen na obali kod ribarnice u Šibeniku 10/5 1920.*
[169] HR-DASI-Šumarstvo 19.-20.st. 12th January 1919. *Copia 1, Gaj Trtar u Konjevratim bezpovlasna sječa.*
[170] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 24th January 1919. N. 354.

authorities about failures to respond to woodland devastation it is likely that restrictions were not imposed.

In at least one instance district authorities directly intervened to stop woodland devastation when in 1919 they completely banned commercial cutting of woodlands on Žirje island (Figure 6.1). This move angered the local people, so they rebelled against the village head who was tasked with implementing the ban. According to the village head, the villagers repeatedly asked him 'who gave him the right to stop them from cutting their woodlands'.[171] Because of this, he was forced to resign his position.

Figure 6.1. Žirje island on the third military survey (1869-1887) topographical map with woodland areas (in dark grey) located on the southern part of the island (Source: MAPIRE.eu).

The municipal authorities also showed their discontent towards the district's decision by arguing such a move financially ruined the islanders.[172] Because of the administrative chaos, the district authorities could not appoint a forest guard to protect the woodlands because this was supposed to be done in accordance with the municipal authorities. The devastation of woodland caused by the three-year absence of a forest guard was reported in 1921.[173] It took five more years for a forest

[171] *A zašto da nam ti zabranjuješ sječi naše šume.*
[172] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 23rd September 1919. *Zabrana sječa šume na otoku Žirju.*
[173] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 24th June 1921. N. 113.

guard to be finally appointed which means the island's woodlands were unprotected for almost a decade. After he was appointed, villagers agreed to respect his authority, and illegal cutting was reduced to the occasional cutting of holm oak branches by shepherds while 80% of woodland crimes were related to pasture in the prohibited parcels.[174]

Even after the retreat of the Italian forces in 1920, Šibenik district authorities continued to blame village heads who did little if nothing to mitigate woodland crimes for woodland devastation. They also reminded municipality about the importance of woodlands for the people's livelihood and their wellbeing and warned about the consequences of its destruction and especially excessive pasture.[175]

The same letter also provided a list of provincial regulations concerning woodland protection and management. These regulations, similar to the ones existing in the Austrian period, were not a part of the nation-wide law, as the first Forest Law for the new state was implemented only in 1929. They included the prohibition of woodland devastation, change of land use on woodland parcels, pasture in areas where cutting was carried out as well as mandatory prosecution of woodland crimes. For simpler supervision, the cutting period was limited only to the period between the 1st September and the 31st March. The only difference in these regulations, comparing them to the Austrian ones, was that outside cut areas all animals were generally allowed in woodlands in numbers that did not surpass available food.[176]

Since there was no Forest Law until 1929, the municipality and the district were operating on these provisional regulations which seriously undermined the authority of forestry officials for the whole decade. Ugrenović (1927a; 1927b; 1927c), who was the editor of the *Forestry Journal* from 1925 to 1929 and one of the most important figures in the development of the 1929 Forestry Law, argued that the implementation of forestry policy in this period was much less efficient than in the Austrian period. For instance, there was no statistical data on the woodlands which

[174] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 4th February 1926. N. 187.
[175] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 29th July 1921. N. 5672.
[176] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 29th July 1921. N. 5672.

made it impossible to assess their area, condition, composition and to determine their management. Because of this, he described forestry policies as improvised and without a proper programme. He particularly objected to the fact that some of the issues related to forestry fell under the administration of the Ministry of Agriculture which caused problems with the Ministry of Forests and Mining as it had the power in woodland issues. Therefore, for some key forestry questions, decisions were being made by non-forestry professionals, and this led to severe problems in the development of guidelines for forestry policies and their implementation. All of this was made even worse when in 1927 a new state budget reduced the number of foresters by 868 out of 3,375. Ugrenović concluded that professional foresters had lost the fight against government officials.

This deterioration in the highest levels of state forestry administration was accompanied by the problems with forest guards. As in the Austrian period, municipal woodlands were under the rule of a village assembly (all voters in the village), or more precisely, the village elder who was elected by this assembly. Unlike in the Austrian period where forest guards were elected in agreement with the municipal authorities, in the inter-war period forest guards were nominated by the village elder and needed to be confirmed by the village assembly. This meant that both the governor of the woodlands (village elder) and the village forest guard were elected by the village assembly or in other words, the same group of people that had the greatest interest in the use of municipal woodlands. Since the political suitability of the guard was one of the key factors in his election, it was common for disputes to arise because of the guard himself, and not because of the woodland crimes, and these disputes often led to the further devastation of woodlands (Oraš, 1938).

However, forest guards were only responsible for finding the perpetrators and stopping them, while the municipal authorities were responsible for enforcing punishments. For instance, in 1926 Šibenik district authorities refused to prolong the service of forest guard Mate Petković because the survey of the woodlands under his jurisdiction found they were in derelict condition while the damage was not reported. However, he argued that damage was not reported because in his experience prosecution by the municipality was never seen through to the end and because of

this, people simply rejected his authority.[177] Furthermore, in 1928 the forest guards of Šibenik district complained to the municipal authorities that woodland crimes had been poorly punished and the enforcement of punishment by the municipality was very slow. They also warned the municipality that its forest guards would be punished as it was reported that they often left their posts in the villages without the consent of their supervisors and came to the city.[178] Because of all this, they believed their authority had diminished significantly as people stopped fearing them and they had difficulties in preventing devastation.[179]

This issue was often discussed by foresters in the *Forestry Journal* as well. Oraš (1938) explained that most of the woodland crimes were committed by the poorest people and since they had no means to pay for the damage, sanctioning them would mean sending them to prison. However, this would only increase the financial burden on the municipality which is why he argued that only around 10% of the woodland crimes were actually sanctioned. Beltram (1935) also agreed that despite 27,021 forest crimes that were reported in Dalmatia in 1934, it was likely that the real number was larger than 100,000 because municipalities did not register the crime or did not press forward with prosecution.

On the other hand, the local people also complained about the work of the forest guards. In 1928 villagers of Krapanj wrote to the county authorities in Split that their territory was the most wooded area of Šibenik district for a long time because they had a strict and professional forest guard before the War. After he was dismissed when the War ended, he was replaced by a new guard who ignored his duties and exploited the woodlands for the benefit of his family, so the villagers feared the woodlands were becoming more and more devastated.[180]

Beltram (1932) argued that the service of forest guards deteriorated considerably compared to the Austrian period because their pay was considerably lower in the new state and municipalities also made them supervise the fields as well.

[177] HR-DASI-Šumarstvo 19.-20.st. 2nd November 1926. N. 8427.
[178] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 11th July 1934. N. 7100.
[179] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 18th January 1928. N. 381.
[180] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 12th March 1928. N. 3349.

Already at the beginning of the new state, the district authorities warned Šibenik and Zlarin municipalities that forest guards were not paid enough for protection of a 'resource that is worth millions' which is why they carried out the work less conscientiously.[181]

Finally, the forest guard service was also impeded by their lack of knowledge since they were elected from the ordinary villagers and did not go through forestry education. Professional education was mandatory for foresters only, and this was later required by the 1929 Forest Law. However, Šibenik municipality did not have a single forestry professional for management of woodlands. According to the municipal authorities, since there were no larger wooded patches in its territory, only patches of low growth vegetation and pastures with bushes, they did not require a professional forester and were confident that their existing official could handle the work as he became experienced over the years.[182]

There was great concern about the effect of goats on woodland. With the establishment of the new state, karst areas of Slovenia, Croatia, Bosnia, former Military Frontier, Serbia, Montenegro and Dalmatia were now all under the same administration but had a different history of regulations concerning goat browsing. This was particularly the case for Bosnia where pastoralism was a major component of the economy. Therefore, different ideas were present among foresters as they tried to find common ground between woodland protection and the rural economy.

For instance, in 1919 Dojković argued that pasture and browsing in woodlands should not have been banned because villagers depended on this. Instead, he argued that proper ways of regulating it should have been developed. In 1924 Živko Petričić, commissioner for Croatian economy, wanted to remove restrictions on goat keeping but after consulting Croatian foresters and foreign nationals decided not to go forward with the idea because they warned him about the damage goats did to woodlands (Petračić, 1924).

[181] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1922. *Izvadak iz šum. predračuna za 1922.* N. 8173; HR-DASI-Šibenik 19.-20.st. Šumarstvo. 28th July 1922. N. 9562.
[182] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 5th February 1935. N. 13997.

It is not clear whether the restrictions on goat keeping were as strict as in the Austrian period, but the number of goats in Šibenik district in 1927 reached 6,511 which is similar to the numbers in 1900 which means the decreasing trend had been reverted. However, most of these were located in the hinterland municipality of Skradin, as the municipality of Šibenik had only 691 goats because the city had started to develop other economies outside agriculture.[183]

The debate about goats heated up in 1929 when the new Forest Law was implemented. According to the Forest Law, pasture of all animals except goats was allowed in those woodlands where trees were developed enough to sustain the damage and only in numbers that were sustainable for the management of woodland, which was supposed to be determined by the municipality and regulated by forest guards. Because shepherds were considered to be a danger to woodlands as they cut young shoots for animals, from then on, every area had to employ a communal shepherd who was supposed to look after all the animals (Balen et al., 1930).

Goats, however, were banned from entering all woodlands except that in special circumstances district authorities could allow woodland browsing for a certain number of goats for poorest families that did not pay more than 50 dinars of taxes. Kids were not counted in the allowed number of goats and could freely browse. Forest guards again had a crucial role in this regulation as they determined the browsing areas for goats and supervised their number (Balen et al., 1930). The professional foresters from the University of Zagreb believed that a small number of goats held by the poorest families posed no threat to the woodlands and concluded that there was no need to discuss the issue of goats anymore (Nenadić, 1930).

However, the newly implemented ban on the goats caused opposition among the population and the articles concerning goats in the Law were immediately revoked (Anić, 1933). The municipality of Šibenik received an order that the 1873 Law on goat browsing was replacing these articles, which meant that free-roaming goats

[183] HR-DASI- Poljoprivreda 1918-1942. 16th January 1927. Stoka – Cio srez Šibenik. Poljoprivredna statistika. N. 787.

were completely banned, and they could only be kept on private properties with a leash. Since these regulations were even stricter than the 1929 Law, the district received instructions to change the articles of the 1873 Law which completely prohibited goat browsing and to replace it with ones that allowed small numbers but only where it had been allowed before.[184] In 1932 Beltram reported that the issue of goats and their effects on woodlands was again considered unresolved as the wealthiest people in the rural areas again kept the largest flocks of goats.

Despite being ordered to ease the regulations, Šibenik district authorities disregarded this. There is evidence that in 1933 the authorities completely banned goat keeping for all villagers of Vrpolje and Grebaštica sections and gave them a year to remove all goats either by killing them or selling them.[185] The order was given exclusively because of the perceived threat goats posed for woodland Vrpolje gaj where foresters had plans to establish a low-growth woodland.

In 1935 a new regulation concerning goats was implemented. It was decided that in Dalmatia all families that paid less than 100 dinars of taxes could keep three goats per family member until 1936, two goats until 1937 and one goat until 1939. However, since some areas already had a custom of keeping one goat per the whole family it was feared that the number of goats would triple as the average number of family members was five, so the regulation was again withdrawn (Beltram, 1935). Regulations underwent further changes so in 1939 in Zlarin municipality it was reported that one goat was allowed per four family members.[186] The legal chaos concerning goats resulted in an increase in the number of goats (Oraš,1940).

The importance of goats for the local people was directly connected to the importance of agriculture which employed approximately 75% of people in the district (Blažević, 2007). Viticulture, again, was the most lucrative business and Šibenik district produced as much as 25% of all wine in Dalmatia by 1939 (Tambača, 1998). However, according to the historian Blažević (2007), only a few people depended entirely on the yields from their fields, and those who could make some

[184] HR-DASI-Šumarstvo 19.-20.st. 8th June 1932. *Puštanje koza na šumski pašu.* N. 2712.
[185] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 30th October 1933. N. 26579.
[186] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 22nd November 1939. N. 3569.

profit were even fewer. He argued that this was a consequence of a lack of broader initiative for improvement of agricultural production and non-existence of strategy for the development of agriculture. The situation was partly alleviated through the development of the industry in Šibenik which accelerated due the occupation of Zadar, the largest settlement in north Dalmatia, by Italy until 1945. This also led to the development of the port of Šibenik as a major trade hub. The availability of jobs in industry and transportation in Šibenik also accelerated the social stratification in Šibenik villages (Blažević, 2007; 2010). Moreover between 1921 and 1927 approximately 3% of the Dalmatian population had emigrated to either overseas countries or other regions of Croatia (Figure 6.2) and the trend was picking up in intensity. Among these, half were between 18 and 30 years old, while further 30% were between 30 and 50 years old. The majority had been living off agriculture, and more than 80% were men. This meant that Dalmatia was rapidly losing its most productive population (Mirošević, 2006).

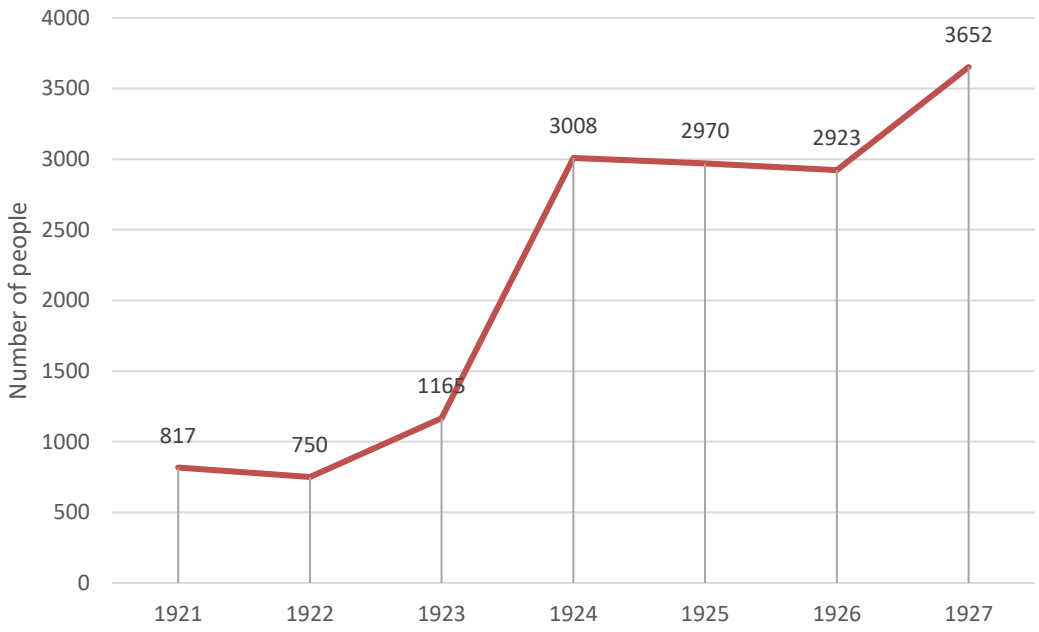


Figure 6.2. The number of people that emigrated from Dalmatia from 1921 until 1928 (Source: Mirošević, 2006).

Despite emigration the pressure on woodlands had not decreased considerably, since after all most of the population still lived from agriculture. In 1939 Dalmatia 87% of agricultural parcels were smaller than 5 ha, which was considered as a minimum for the economic independence of a rural household. According to Oraš (1939), this was the main reason why most of the villagers were forced to use municipal lands and in 1939 the majority of woodlands (63%) were still in municipal ownership. Due to continuous exploitation, the composition of woodlands had remained similar to the Austrian period as 70% were used primarily as pastures. The remaining 30% were characterised by low-growth vegetation or *šikara*[187] and Oraš (1939) argued that the lack of proper management only led to further degradation.

There is archival evidence that the pressure on municipal woodlands in the district increased over this period. In 1939 woodlands Rašeljka and Velika Glava near Danilo Kraljice were reportedly heavily devastated. The local people repeatedly illegally cut young ash, hornbeam and oak trees, and used rocks and wires to cut off the branches.[188] In 1940 the district authorities banned all cutting in municipal woodlands because villagers were relentlessly cutting wood and selling it to other villages. A special permit for selling wood was then introduced, while the selling, giving away or exchanging of wood supplied to the villagers for personal use by the municipality was also banned.[189]

It is evident that the inter-war period in terms of traditional woodland management was very similar to the Austrian period as there was no record of any significant changes in the management. Foresters were mostly preoccupied with the protection of woodlands from illegal cutting and pasture. The economic changes in Dalmatia led by increasing industrialisation were not significant enough to transform the basis of village economy, so access to municipal woodlands was still crucial for rural communities. It is likely, however, that the inefficient forest guard service,

[187] Šikara was defined as a permanently anthropogenically influenced low-growth coppice with trees deformed in forms of shrubs and with lots of bushes (Šumarski list, 1957).
[188] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 20th October 1939. N. 19139.
[189] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 20th February 1940. N. 551.

coupled with severe woodland damage from World War I, brought woodlands in Dalmatia and Šibenik district under increasing pressure for pasture and fuel.

6.2.2. Reforestation in the interwar period

There are no records of damage from cutting and fires in previously established pine woodlands of Šibenik district during World War I, but a lot of damage was caused by pine processionary moth infestations since it was hard to organise cleaning activities during the fighting.[190] Although most of the stands were infested many trees survived. The stands also escaped cutting mostly because the Italians retained regulations which prohibited exploitation of previously reforested areas, and district authorities also ordered that each woodland that was illegally cut had to be reforested immediately although it is not known whether this was actually carried out.[191]

With the occupation by Italians lasting until 1921, it took several years for reforestation to regain its momentum and in 1924 a boost was provided when the government established a reforestation fund for the whole country.[192] In the same year county authorities in Split informed the municipality of Šibenik about the need to organize data for further 'intensive reforestation of barren areas and karst'. In order to avoid resistance from the local people, the municipality was instructed to call a village council before the reforestation and agree with villagers which sections of municipal pastures could be selected for reforestation. Regarding privately owned parcels, the municipality was supposed to contact the owner and draft a written agreement with them in which the owner acknowledged reforestation and promised to adhere to forestry regulations and protect the stand, while the municipality guaranteed that their ownership of the parcel would be unchanged.[193]

[190] HR-DASI-Šumarstvo 19.-20.st. 29th November 1916. *Nedjeljnja imenica*. N. 128.
[191] HR-DASI-Šumarstvo 19.-20.st. 13th September 1919. N. 5477 HR-DASI-Šibenik 19.-20.st. Šumarstvo. 24th January 1919. N. 354.
[192] HR-DASI-Šumarstvo 19.-20.st. 22nd March 1924. N. 2808.
[193] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 26th January 1924. N. 744.

Similar to the Austrian period, this approach emphasised a top-down implementation of reforestation where the incentives and funding were coming from the government through the county and district authorities, but it was ultimately up to the municipalities and village councils to carry out the reforestation. For instance, in 1926 the village council of Vrpolje unanimously rejected further reforestations as they believed there was already too much in their section.[194]

Evidently, the government in the new state placed much more emphasis on the consent of people for the reforestation that the Austrians did, at least in theory. The forestry community was particularly critical of Austrian reforestation practice in the Croatian karst and in 1919 the Croatian Forestry Society decided to remove from the association all foreign foresters because they believed they had led forestry astray and ruined its reputation (Šumarski list, 1919). Balen (1925) argued that reforestation had been forcefully carried out by the foreigners without taking into account the needs of people. Dojković (1919) criticised previous forestry legislation as being drafted according to the foreign standards and viewed them as oppressing Croatian people and their economy. Ugrenović (1925) acknowledged that Germany was the one that established the science of reforestation whereas Croatia adopted it through the Austrians, but he believed that their research was based on woodlands that did not have the same history of exploitation as those in the Mediterranean and their principles were not valid for Yugoslav karst. Dojković (1919) and Ugrenović (1925) concluded that Yugoslav foresters should have developed their own legislation and science of reforestation based on the biology, ecology and traditional economy of the region.

Among articles and publications on reforestation, the one that is most representative of this period is the book 'Our barren karst: Economic issues with emphasis on reforestation' (*Naš goli krš: Gospodarska pitanja s naročitim obzirom na pošumljavanje)* written by Josip Balen (1931) who was a forestry professor at the University of Belgrade. The Royal administration of Primorska banovina in Split recommended that the Šibenik municipality authorities should purchase many copies

[194] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 28th November 1926. N. 286.

as they believed it would benefit not only the forestry staff but also other officials, teachers and farmers.[195] It is likely then that this was the work that was most widely circulated among decision-making personnel.

According to Balen, karst regions of Yugoslavia were inhabited mostly by peasants who lived of the land, and they were mostly very poor. He believed that the 'lack of fertile soil was one of the main constraining factors of economic development on karst' (p.52), however, 'where there is forest, the soil remains even on the slopes' (p.64). In order to boost economic progress, he argued that barren areas of karst had to be primarily protected from further degradation and after that was achieved, effort should be made to make them more productive. This is where reforestation had the key role, as 'shallow, rocky soil of karst that comes in different levels of degradation can only be maintained in the productive state if reforested; only forest is capable of ameliorating that soil' (p.70). Therefore, Balen tied reforestation directly to the issue of economic development which was a theme that had been widely promoted by the Austrian foresters as well. This attitude is also visible in the writings of other prominent foresters. Ružić (1925) argued that the new state had a historical mission to return to cultivation barren areas of karst as fast as possible for the benefit of people. Petračić (1924) wrote that forests on karst were a source of rich material for the whole economy as they created humus which was transported onto the plains and farms; Premužić (1937) also stressed the fast production of humus as a crucial role of reforestation.

In another publication, Balen (1929) promoted the need to implement reforestation in areas that were in need of protection from natural hazards. This included settlements, pastures, roads and other transport routes as well as the soil. This was supported by Oraš (1940) who claimed that the purpose of reforestation was to mitigate deluges and to improve not only the soil, but also the climate, and only then should direct economic benefits for people be considered.

Balen (1931) explained that the dominant way of establishing woodland in areas with remnants of woody vegetation was through natural regeneration with the

[195] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 3rd October 1930. N. 24387.

prohibition of exploitation, so no reforestation was needed. On barren areas where there was no woody vegetation, but soil could support woodland (and in most cases nothing else) woodland was supposed to be established through reforestation. The stands established this way he labelled as transitional since they had a role in preparing the habitat for a more profitable type of cultivation. This could have been either agriculture or a type of woodland which would yield more profit and would be more appropriate from the forestry-economic point of view. He believed that in most of karst areas oak would be the most feasible crop in the long term but that most suitable tree species for the first or transitional phase of reforestation were Aleppo pine, maritime pine and black pine.

The way Balen explained reforestation objectives shows that principles of reforestation espoused by Yugoslav foresters were very similar to the Austrian period. The fact that little had changed is evident from the rising opposition local people showed toward reforestation, even though foresters emphasised the necessity to take into consideration peoples' needs. Balen (1931) claimed these needs were mainly food for animals, but his advocacy of conifers instead of broadleaves was in direct conflict with these needs. Balen (1929) also argued that 'reforestation was regularly facing problems where pastoralism represented one of the main sources of income. In the view of peasants, every reforestation was bad because thier pastures were being taken away' (p.164). This is why in areas such as coastal Dalmatia, where people relied on other economic activities outside pastoralism, it was easier to implement reforestation.

One of the most striking differences in reforestation policy of Dalmatia in the interwar period, compared to the Austrian one, was the increasing importance of tourism. For instance, Krajač (1927), who was Croatian Minister of Commerce and Industry, advocated the need to increase cooperation of different ministries with the Ministry of Forests and Mining, as he believed a lot could be achieved for tourism if systematic reforestation was carried out. Premužić (1937) also argued that foresters as educated professionals should have a greater influence on the development of tourism which was becoming increasingly important in the overall economy (Figure 6.3).

Balen (1929) argued reforestation of locations on the coast where it was in the interest of tourists should have priority over that of barren areas inland. Zaluški (1935) thought the purpose of woodlands in the coastal areas should have been the development of tourism. Because of that, he argued reforestation should have been focused on areas near settlements, along roads and where swimming areas were located.

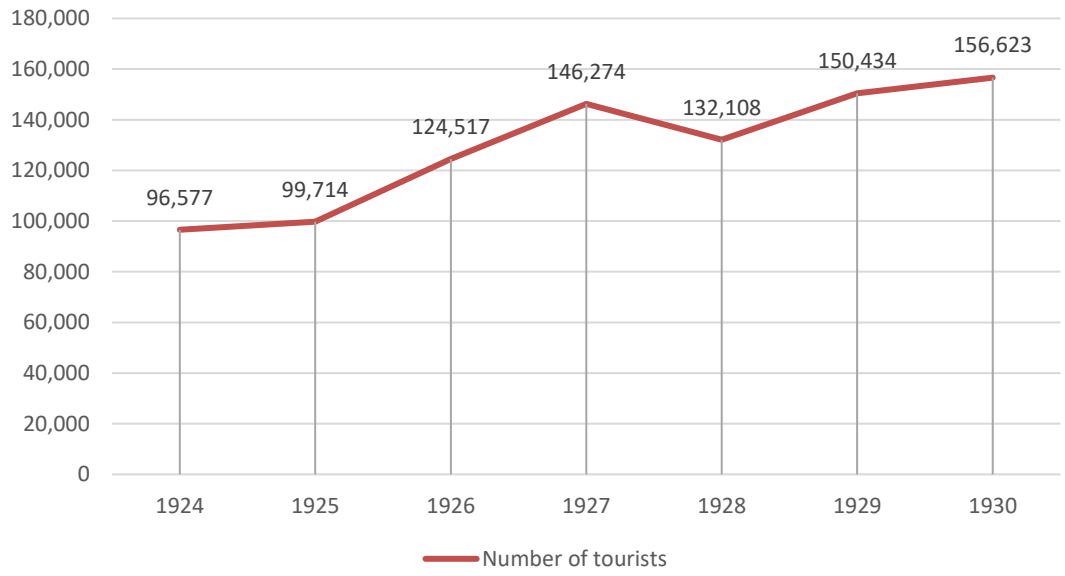


Figure 6.3. The number of tourists in coastal areas of Yugoslavia (Source: Balen, 1931).

In 1924, the county authorities in Split sent Šibenik municipality a list of specific locations on which reforestation should focus. In general, they advised focussing on areas characterized by karst that are unfit for any cultivation, either municipal or private, and all devastated woodlands or barren lands where land use was woodland. More specifically they advised choosing parcels near settlements, roads and railways and sandy and gully areas on slopes. Areas near the sea, which also included those around ports, bays, channels, as well as coastal locations and islands that were positioned along the primary maritime routes were also listed as additional areas of interest for reforestation.[196]

[196] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 26th January 1924. N. 744.

Following these guidelines, the records show that in 1926 the coastal areas of Zlarin and Tijat islands were designated for reforestation.[197] In another example the municipal foresters was instructed to plant trees in Šibenik channel to 'cover with green those areas that are barren' and to make sure Jadrija city beach, which opened in 1922, was 'well stocked with new plants for the following season', particularly with ones that were 'large and quickly develop into trees'.[198] A postcard from the 1930s (Figure 6.4) shows that a pine stand with well-developed trees was already present in Jadrija, so the activities probably meant that the woodland was being expanded. More stands were created in the vicinity of coastal settlements while those established in the Austrian period were restocked and expanded.

In 1935 the municipal authorities reported that all high forest in its territory, which were pine woodlands established through reforestation in the Austrian period, primarily had a decorative or hygienic purpose.[199] Therefore, tourism quickly became the dominant drive of reforestation in the coastal part of the Šibenik district. This also emphasises how foresters' desire to alleviate poverty in karst regions through reforestation had changed its focus, from increasing productivity of the land, either for agriculture or timber production, to the rapidly developing tourism industry for which woodlands were seen as crucial and beneficial.

The push for reforestation for the development of tourism was also given by the provincial authorities. In 1935 it was reported that authorities of Split Banovina, to which Šibenik belonged, freely gave away 2,000,000 pine seedlings each year and these were used to create many small woodlands in the coastal areas that were important for attracting tourists (Marčić, 1935).

[197] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1927. N. 1910.
[198] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 22nd October 1926. N. 6680.
[199] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 5th February 1935. N. 13997.

Figure 6.4. Jadrija city beach in the 1930s with changing rooms and a pine stand in the back (Source: Private archives).

Some of the most extensive sections of pine woodland in the municipality were located in the immediate vicinity of Šibenik city. These were pine woodlands that the Austrian administration established along the shores of Šibenik channel and in Paklena, as well as those on hills to the north of the city. When compared to the late 19th century (Figure 5.23, p.171) the woodland in Paklena was expanded along the coast of the bay to the south-east. Although new reforestation was carried out in the 1920s and the 1930s, a photo from the 1930s shows that woodland mainly consisted of trees that were at least two decades old (Figure 6.5). It was similar with the woodland on Šubićevac hill above the city (Figure 6.6). This woodland had developed from reforestation on Rupina municipal pasture in the late 1890s (Figure 5.24, p.173 and Figure 5.25, p.175) and was expanded on neighbouring hills, effectively eliminating the toponym Rupina pasture from use. The distinction between the pine woodland and the other types of vegetation on hills in the vicinity of Šibenik is clearly visible.

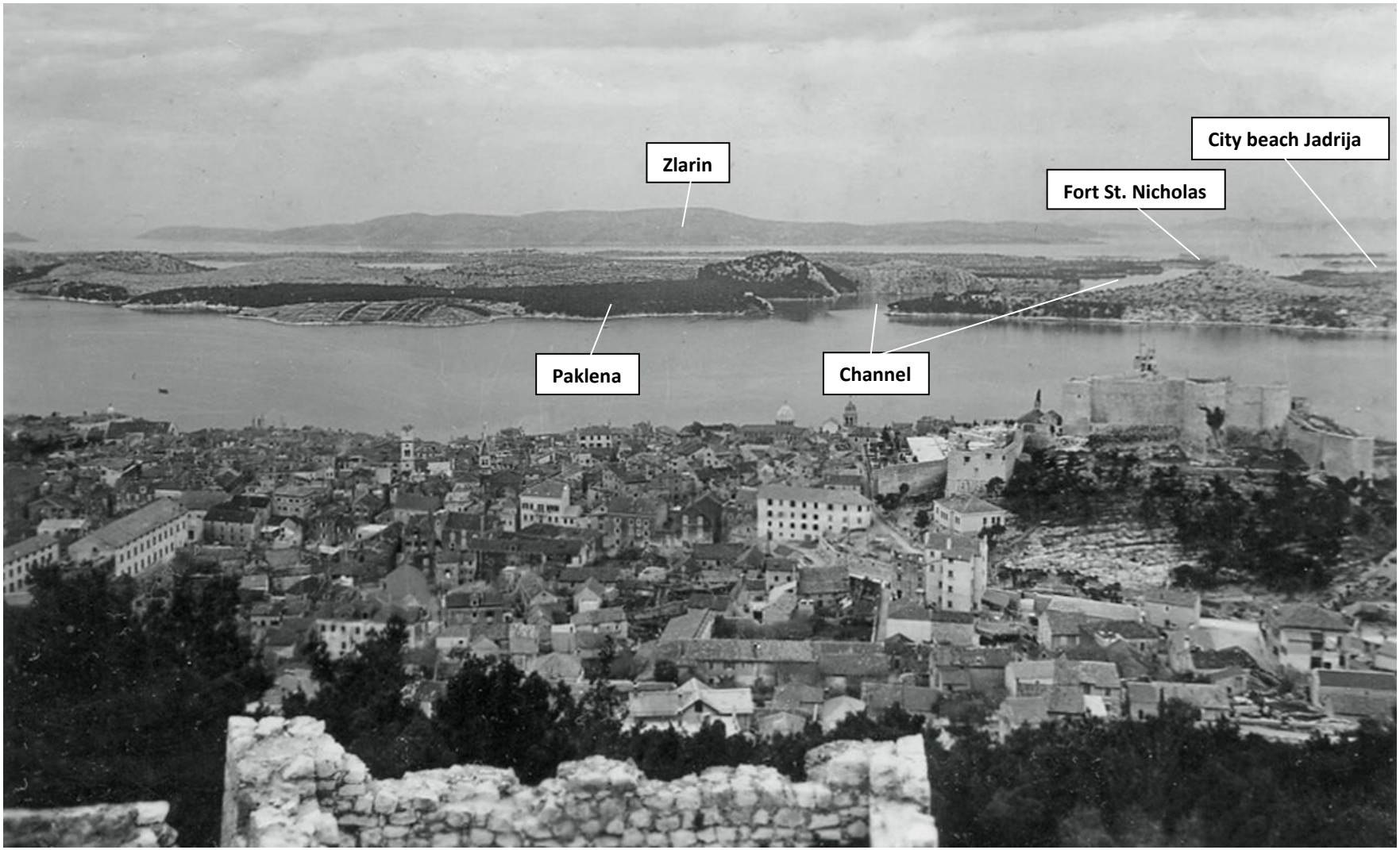


Figure 6.5. Photo of Šibenik bay from the 1930s with a view of pine woodland in Paklena and along the channel with place names added by the author (Source: Private archives).

Figure 6.6. A woman is fishing on the shores of Šibenik bay in the 1930s while the pine woodland on Šubićevac hill can be seen above the city (Source: Private archives).

The distinctiveness of pine woodlands in the landscape of Šibenik can be even better understood from a view of the city from the direction of Šubićevac (Figure 6.7). The pine woodlands of Mandalina, which was established in the late 1880s and around city hospital are easily distinguished. The rest of the rural landscape is largely unwooded. In the bottom-left part of the photo, the top of a what is probably a cedar tree is visible, which confirms that although pines were the dominant species planted, other species were occasionally planted.

In other coastal areas, there is also evidence that the reforestation started by the Austrians, and continued by the Yugoslav foresters, led to the establishment of pine monocultures. In Kopara hill in Rogoznica, a pine woodland whose establishment commenced in the 1890s became a prominent landscape feature and a symbol of Rogoznica settlement by the 1930s and was often printed on the postcards of this small village (Figure 6.8).

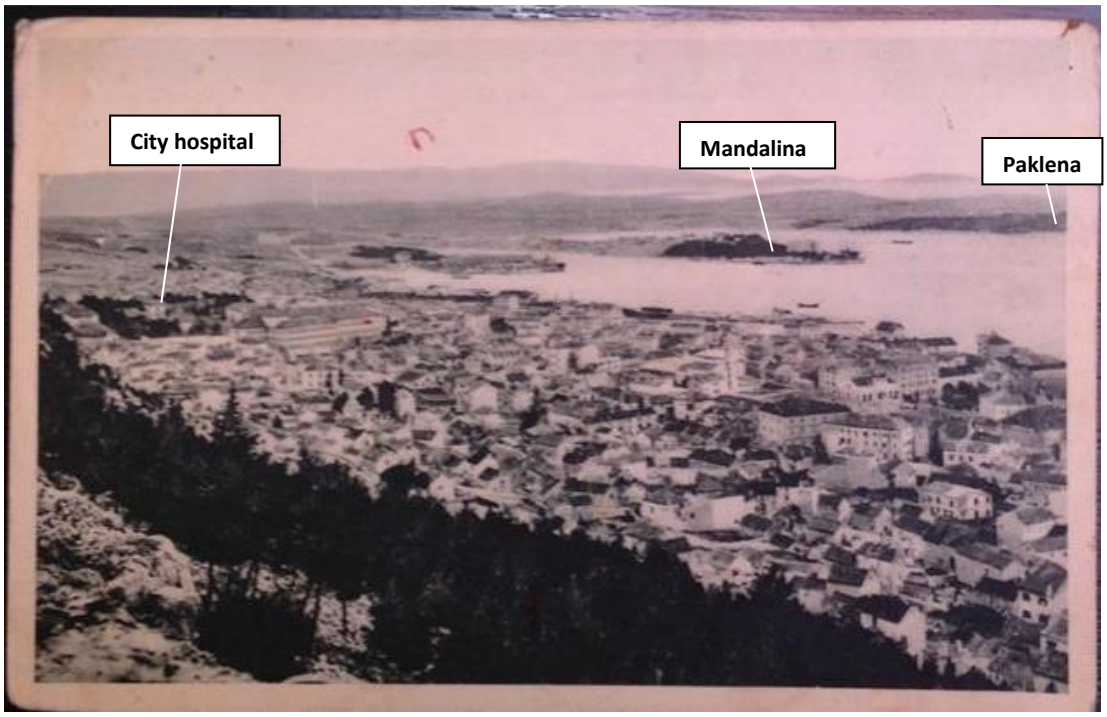


Figure 6.7. The view on Šibenik from Šubićevac in a southwest direction in the 1930s (Source: Private archives).

Figure 6.8. '*View of Kopara'* postcard from 1932 (Source: Private archives).

In some areas, such as in Brina along the River Krka in Lozovac and Skradin areas in the hinterland, the reforestation was not proceeding so quickly, and the establishment of a continuous woodland cover was difficult. A postcard of Skradinski

Buk from 1932 shows that slopes that the Austrians reforested with black pine and Aleppo pine (Figure 5.31, p.181) also had a large volume of spruce and fir. However, the woodland cover was not continuous, and wide gaps reveal the difficulty foresters had in establishing trees: frequent beating up was needed because many seedlings died immediately after planting.

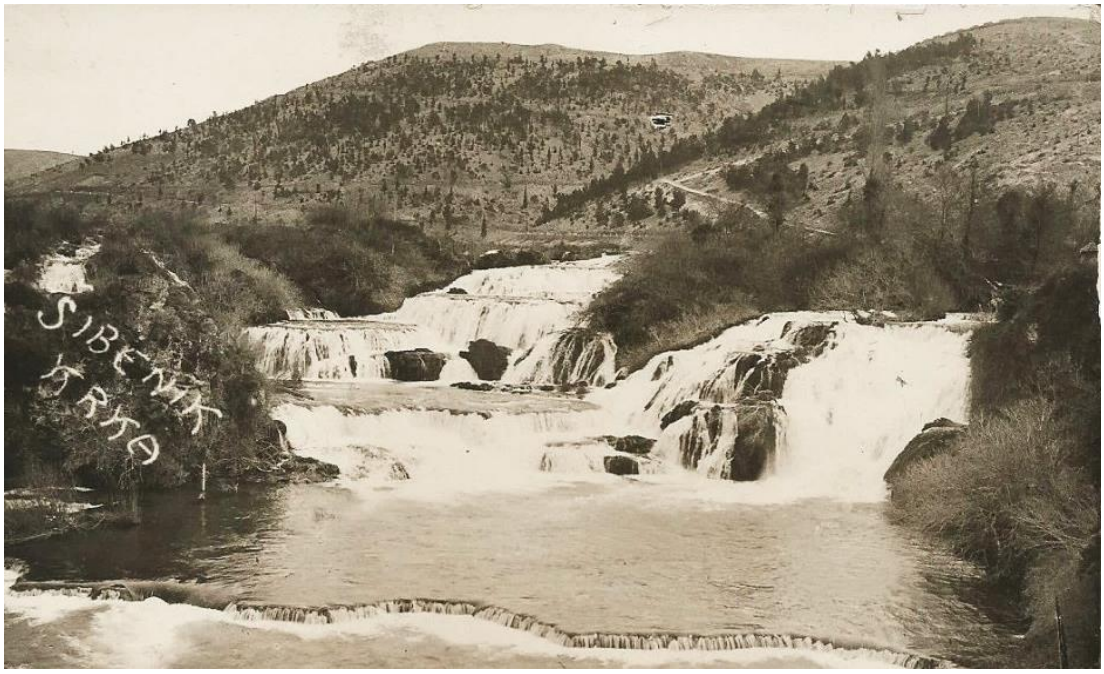


Figure 6.9. Postcard of Skradinski Buk circulated in 1932 with a view of the slopes of Brina (Source: Private archives).

Foresters in this period planted mainly Aleppo and maritime pines on the coast and black pine in the hinterland areas. Balen (1928) and Marčić (1935) explained the environmental benefits of using pines in degraded, harsh landscapes of karst and listed cedars and cypresses as good options as well. Balen (1928) pointed out that 'since the first works were very successful with the use of conifers, especially black pine, while broadleaves failed, broadleaves did not gain much attention later on' (p.476). Beltram (1935) argued that too much effort was put into reforestation of barren karst, as it was very costly and challenging, while little was invested into management and conservation of already existing natural low-growth broadleaved woodlands. He believed that high forest could be achieved through their conversion, which could not be done without financial investment and proper management

plans. Premužić (1937), on the other hand, argued that research on pioneering species such as pines attracted very little interest in Croatia.

Afanasijev (1937) was unusual in his strong criticism of the standardised use of pines in reforestation. He believed that foresters disregarded the quality of soil where planting was done and chose inappropriate species because they were influenced by a harmful template. For instance, he argued that if black pine succeeded in one place, it became widely used for years without considering the characteristics of the terrain. The same was happening with *Robinia*. He also argued that foresters were trying to reforest as much as terrain as possible at the expense of the quality of reforestation, which led to repeated expensive beating up since more than 80% of seedlings often died off. In addition, he believed that the use of pines caused people to be distrustful towards reforestation in general, as they never saw any use of this tree and could not grasp the benefit of the milder climate which would occur after a century. After all, he argued, the pines were not allowed to be cut for firewood nor was grazing allowed in reforested areas because it wold have damaged young pines.

These were not the only issues that existed with reforestation, and even after reforestation in the new state gained its legal basis in the form of 1929 Forest Act, many foresters pointed out other unresolved problems. For instance, forester Panov (1933) explained that in the process of designating areas for reforestation the owners of such parcels had the right to influence the selection of species and the type of management, which he believed should be exclusively forestry issues. However, according to the Law, all pine woodlands created through reforestation were supposed to be proclaimed as protective woodlands and other types of management, other than for protective purposes, were not allowed. Beltram (1935), on the other hand, pointed out that the 1929 Forest Law demanded a large body of professional foresters and forest guards, which simply did not exist in Dalmatia, so there was nobody to enforce it. Also, as in the Austrian period, the Forest Law did not define precisely what a forest or a woodland was, instead, stating that this could be assumed. The Act does mention the category of an ‘absolute forest soil’, that is the type of terrain that is predisposed to support a woodland but stopped short of

defining it legally. According to Koprivnik (1935), this led to a lot of legal problems for political authorities and foresters alike.

The government was optimistic about reforestation and the Forest Law of 1929 stated that all areas classified as 'absolute forest soil' had to be reforested within the next 50 years. This was one of the key reasons for the continued planting of pines on large areas of karst. However, Beltram (1935) argued that not even 10% would be achievable in those 50 years as there was no private initiative, people did not cooperate, there was no adequate forestry staff, and it was hard to find available land. Oraš (1939) concluded that the first thing the government needed to accomplish is to at least stop people from obstructing reforestation activities. Beltram (1935) also argued that propaganda regarding the positive benefits of reforestation should be provided in schools, on radio and in the newspapers to reduce mistrust about foresters and reforestation.

Reforestation in the interwar period did not progress as fast as in the Austrian period, at least in Šibenik district. The statistical data from 1957 reveals that out of a volume of 45,874m^3 pine timber in the Šibenik area that year, 86% was in trees forty to sixty years of age.[200] This suggests that most of the woodlands were planted in the period between 1898 and 1916. However, this does not mean that young woodlands with trees younger than five to ten years did not exist, as records show considerable reforestation activities in the 1950s. These trees would have been very young and would not have contributed to the overall volume of the available pine wood. However, the record does indicate a dramatic lack of pine timber from the period between 1916 and 1940.

[200] HR-DASI-Hortikultura. 1957. N. 166.

6.3. Woodlands during the periods of World War II and Socialist Federal Republic of Yugoslavia (1945-1990)

6.3.1. The effects of World War II on traditional woodlands and their management in the 1950s

Yugoslavia was invaded by the Axis powers in 1941, and while much of Croatia became a part of the newly established puppet state of Independent Croatia, the territory of Šibenik was incorporated into the Italian Governorate of Dalmatia. After Italy changed sides to the Allies in 1943, Šibenik territory was annexed by the Independent State of Croatia until 1945 when Yugoslavia was restored. In addition to the fighting between Allies and the Axis powers, a guerrilla war by the partisan troops loyal to Yugoslavia and Tito ravaged the country throughout the whole period of the War.

The effects of the war on the woodlands in Dalmatia and Šibenik district were devastating. Administrative officials from Šibenik reported that by 1945 at least 70 to 80% of the woodlands in the district had been 'destroyed'.[201] The war contributed in several ways.

Firstly, the demand for firewood increased greatly as the armies were stationed in and around the city. The situation was aggravated when the fighting forced the closure of the local coal mine in Siverić, so coal, as the supplementary fuel for cooking and heating, had to be completely replaced by firewood. Also, the import of coal or wood from Bosnia was not possible since there was no railway. Secondly, the Yugoslav army was responsible for a lot of unsupervised cutting which continued even after the War ended, especially on private properties around the city. In December 1944 the Šibenik district authorities reported that 'in order to obtain supplies, the army is cutting wherever they can and continue to devastate woodland without any questions raised'.[202] The district also reported that a lot of land was

[201] HR-DAŠI- Šumarstvo 19.-20.st. 6th January 1945. N. 550; HR-DAŠI-28 ONOŠ 5.1.1.-5.1.5., number 8. 4th December 1944. N.618/44.
[202] HR-DAŠI-28 ONOŠ 5.1.1.-5.1.5. number 8. 30th December 1944. N.812/44.

cleared for military purposes during the War. Finally, during the difficult years when fighting obstructed normal economic activities, firewood became one of the rare resources that local people could trade for other goods, primarily food. [203]

This is also supported by oral histories I collected in the area:

G12: You would get a portion of wheat for a wage, nobody would give you money. You had to search across the fields [for food], you had nothing to live from. And many people, my mother told me, starved – they had nothing to eat. It was poverty everywhere. There was war, nobody provided any help.

(G12: 70s, Grebaštica, F, retired/civil servant)

The woodlands and collection of firewood, however, proved to be crucial for survival:

G14: At the time there was Jelinjak [nearby hill], you know, and in order to survive they [her ancestors] carried firewood. They cut it, and they carried it on their own back to Konoba. And then – one day you cut, the next you carry - they walked to Šibenik with a donkey… in order to find some polenta or corn! You gave them, citizens who lived in Šibenik, some wood because they did not have any, in order to get something in return'.

(G14: 80s, Konoba, F, retired/farmer)

District authorities reported that in the coastal areas and on islands a lot of wood was specifically consumed to heat seawater in order to produce salt. A report from Zablaće, for instance, describes how people were so desperate for firewood that they cut down 3,000 olive trees which were then used to heat the sea water.[204] The salt was used mostly for trade:

G15: My mother, I remember, told us that she would trade salt for polenta and corn, near Drniš in the hinterland. She took it from the sea and evaporated it. I do not know how. Everybody was poor, hungry at that time.

(G15: 60s, Grebaštica, F, retired/civil servant)

[203] HR-DAŠI- Šumarstvo 19.-20.st. 24th December 1944. N. 782; HR-DAŠI- Šumarstvo 19.-20.st. 30th December 1944. N. 1061; HR-DAŠI- Šumarstvo 19.-20.st. 25th November 1944. N. 543.
[204] HR-DAŠI- Poljoprivreda i Šumarstvo. 17th September 1945.

The devastation was felt in pine stands as well, particularly those on private parcels. The district reported that although there were reports that local people cut pine woodlands, they were severely damaged by the Italian occupation army. For instance, in Vrpolje section 50% of pine woodlands were damaged with some of the stands, such as in Dabar near the railway, completely cut down. Some stands were also damaged by fires: at Krapanj area 5,000 burned pine trees were found.[205] Moreover those stands that avoided damage were seriously damaged by severe pine processionary moth infestation as cleaning activities were not organised during the War.[206]

Towards the end of the War in 1944, Šibenik district authority began works on the renewal of the economy and woodlands had a particular role in this. Although the need to protect woodlands was stressed, at first the focus was put specifically on the provision of firewood, timber for construction and wood for charcoal production. This required the district authorities to locate the remaining patches of woodland that survived devastation and immediately carry out clear-cutting.[207]

For the next several month's firewood in the district was cut for the needs of the army and civil institutions and in February 1945 the authorities proclaimed that 'all of the remaining woodlands had been exhausted'. The forestry section decided not to give out any more permits for cutting in the district until further notice and instructed those who needed firewood to seek cutting permissions in other districts.[208] However, because the scarcity was so pronounced, authorities revoked the prohibition and continued to cut what little was left.[209] The regulations for the protection of woodlands that had existed for decades before were often disregarded. For instance, the army was still one of the main consumers of firewood and to renew their supplies a large section of woodland in Boraja was designated by the district for cutting firewood in summer 1945. Cutting of trees during the summer months was prohibited by law during the Austrian and the first Yugoslav period because trees

[205] HR-DAŠI-28 ONOŠ 5.1.1.-5.1.5. number 8. 24th December 1944. N.303.
[206] HR-DAŠI- Šumarstvo 19.-20.st. 23rd April 1945. N. 583; HR-DAŠI-Šibenik 19.-20.st. Šumarstvo. 8th December 1945. N. 1514.
[207] HR-DAŠI- Šumarstvo 19.-20.st. 14th September 1944. N. 797.
[208] HR –DAŠI-28 ONOŠ 5.1.6.-5.1.7. number 9. 17th February 1945. N.307.
[209] HR –DAŠI-28 ONOŠ 5.1.6.-5.1.7. number 9. *Report for March 1945*. N. 676.

were in the growing period. The county authorities warned the district that cutting in the summer period would cause more devastation than the whole war did and to mitigate the damage they instructed them to carry out cutting in a way that left at least a few shoots on each stump. Otherwise, its regenerative potential would have been destroyed. After the growth period was over, the remaining shoots were allowed to be cut.[210]

Many pine trees were cut to assist in the rebuilding efforts: the felling of 1,000 pine trees was approved as timber was needed to rebuild burnt houses in many villages.[211]

Some cutting was done for the lime kilns as well (Figure 6.10). Records reveal four lime kilns were being used in four separate woodlands in the south of the district, in woodlands Raduča, Vrsnički gaj, Plošnjak and Stari Gaj-Raduča.[212] The process of lighting the lime kilns was well known among the local people:

G1: They would bring lime from Brač island in April and then they would extinguish it [after setting it on fire] by putting the water in the holes, so it does not break. It was used for covering vines in the fields.

(G1: 60s, Grebaštica, M, retired/electrician)

According to a retired civil servant from Vrsno (B5: 60s, M) it was also used as mortar for building houses and walls which is why lime kilns were particularly needed in the post-war period, despite the high consumption of firewood:

G1: They would cut the vegetation in the vicinity of kilns, put it in kilns and then set it on fire. It would burn for eight days, non-stop, day and night, until the stone was baked.

(G1: 60s, Grebaštica, M, retired/electrician)

The material for kilns was gathered from coppice areas characterised as maquis and 'šikara' – shrubland that consisted of coppiced trees and bushes. Since coppicing was also the way foresters managed woodlands not only for firewood production but to promote their regrowth, the authorities believed cutting for lime

[210] HR-DAŠI- Šumarstvo 19.-20.st. 23rd April 1945. N. 583.
[211] HR-DAŠI-28 ONOŠ 5.1.7. 5008/14871. number 10. 28th July 1945. N.8505/45.
[212] HR –DAŠI-28 ONOŠ 5.1.6.-5.1.7. number 9. 23rd April 1945. N. 490.

kilns did not significantly differ from those practices. However, Marinković (1950) argued that such cutting was carried out throughout the whole year, and not in periods determined by the foresters, which is why it was deleterious for woodland regeneration.

Figure 6.10. Example of an abandoned lime kiln in Paklena area near Šibenik channel (Ivan Tekić, April 2017)

Woodlands were considered crucial for national recovery in the new state and the new central government began work on finding ways to integrate forestry in the new social system. Regulations concerning woodland management in the new state were implemented with the Provisional directions for woodland management in 1946 according to which an inventory of woodlands for the whole state was carried out. The General Forest Law was rapidly implemented in 1947. The new social-political system of federal Yugoslavia was in the early post-war period marked by the strong role of the state over federal units, i.e. the Republics, including Croatia (Bogoev, 1991). Immediately after the war a sweeping process of nationalisation was undertaken in which all woodlands, except small private properties, were proclaimed

national property and were put under the direct control of the state. This made implementation of the different management systems quicker and easier (Law on proclamation of woodlands as national property, 1947).

Nationalisation of woodlands marked the end of more than two centuries of management of municipal woodlands by the villages to which they belonged. Pastures, many of which had many remnants of trees and bushes, were also nationalised. Many sections of these woody pastures were designated as national woodlands so that overall more than 70% of the total area of woodland in Dalmatia was classed as state forest, the rest were small private woodlands. From 1947 the woodlands were managed by the Yugoslavian Ministry of Forestry through district forestry officers and forest guards, who formed the local sector of forestry management. At the national level of the Republic of Croatia, forestry was dealt with as part of the Administration for reforestation and deluge mitigation.

The Yugoslavian government introduced a new woodland management system and its policies were based on the 1947 inventory of woodland. The whole territory of Yugoslavia was divided into forestry-management regions, areas and units. Management units formed the basis of a new territorial division of woodlands and consisted of groups of stands that shared the same vegetation structure, rotation of cutting and management goals. These management units were grouped into management areas, which, in turn, were then grouped into management regions. Additionally, five-year management plans and twenty-year management programmes were developed and formed the basis of woodland management during the whole socialist period (Klepac, 1947). With woodlands now being under the jurisdiction of the state, the records for the study area reveal that the village councils were not allowed to give out permits for activities such as pasture, cutting wood or using lime kilns. Instead, the process had to go through Šibenik district authorities. Overall the district and municipal authorities retained a high level of authority and control over economic matters, despite the fact that the Republic of Croatia's policies were strongly influenced by the central government (Petak, 2006).

In the early post-war period, the Yugoslavian government strove to consolidate administrative units so in 1951 the local and republic sector of forestry management were replaced with an institution called *Dalmatia Forestry Enterprise* (Šumsko gospodarstvo Dalmacija). The Enterprise was made up of individual Forestry Offices through which woodland management was carried out (Vrdoljak and Jedlowski, 1965). The Forestry Office at Šibenik was founded on 1 September 1951, and since woodlands were national property, its role was to manage and supervise all woodland areas of the political Šibenik district, both national and private ones. This included improvement of degraded woodlands and reforestation (Šibenski list, 1952). This type of woodland management continued throughout the socialist period and was, with minor modifications, adopted in the post-1991 period.

The new management of woodlands encountered the same problems as did the administrations of the Austrian and first Yugoslav periods. According to five-year management plans, the establishment of protected woodland areas was crucial for renewal of woodlands. However, this was again met with opposition from people. For instance, in 1950 members of the village council of Danilo Kraljice and Gornje Danilo went in the field with the foresters and approved the establishment of the protected woodland area. They also contributed to the determining of the border of that area. Despite this, foresters reported that the villagers completely disobeyed the protected woodland area as they claimed that they did not have other areas where they could take animals for pasture. They claimed this even though outside of 120 ha of the protected woodland area, there were 1,000 ha of free pastures.[213] This emphasises the importance woodlands for the provision of pasture.

Two years later foresters still struggled to implement protected woodland areas in these parts, but in the neighbouring Konjevrate section as well. Two meetings between villagers and the head of the Forestry Office were held where the villagers were presented with arguments for protection of woodlands. On both occasions, they firmly rejected the idea. The Forestry Office believed that the reason of rejection was that in woodlands of Trtar and Ravni gaj, both designated as protected

[213] HR-DASI-Šumarstvo 19.-20.st. 3rd November 1950. N. 5707.

woodlands areas in the Austrian period, villagers of three nearby villages let animals roam free without a shepherd and the proclamation of a protected area would have limited this.[214]

The reason why villagers still chose woodlands for pasture instead of free municipal pastures was that the pastures could not feed their animals because of the poor quality of the grass. This was confirmed in the 1953 report compiled by the Forest District in which they strongly argued that improvement of pastures was crucial for prevention of woodland damage.[215] Beltram (1946) pointed out that improvement of pastures was promised by both the Austrian and the first Yugoslav administrations and it would have brought foresters and villagers together. However, little was done on that matter and it continued to be neglected after 1945 as well.

In 1953 the Forestry Office Šibenik reported that protection and nurturing of woodlands had improved since its establishment, but illegal cutting and other woodland crimes were slowing down their efforts. The main reasons for continued illegal malpractices included scarcity of firewood, the scantiness of pastures, and inefficiencies in enforcing penalties for woodland crimes. Among these, the fact that woodland crimes were rarely levied was singled out as the biggest problem. Forest guards were not allowed to fine the culprits immediately at the place of cutting; rather the whole process had to go through complicated and lengthy administration. In 1951 there were 889 woodland crimes reported with an estimated damage of 386,093 dinars. However, only 4,859 dinars were collected through fines which amounted to 1.3% of the damage from crimes. In 1952 1,155,399 dinars of damage was reported, which was a substantial rise primarily because of the increase in prices of woodland products, but only 2.9% was collected. [216]

Just like during the first Yugoslav administration, some of the blame for frequent woodland crimes was attributed to local forest guards. The inspection of their work determined that five or six guards were inefficient but they were not

[214] HR-DASI-Šumarstvo 19.-20.st. 5th May 1953. *Čuvanje i uzgajanje šuma - primjedbe*. N.280/53
[215] HR-DASI-Šumarstvo 19.-20.st. 5th May 1953. *Čuvanje i uzgajanje šuma - primjedbe*. N.280/53
[216] HR-DASI-Šumarstvo 19.-20.st. 5th May 1953. *Čuvanje i uzgajanje šuma - primjedbe*. N.280/53

sacked because replacements could not be found.[217] The Šibenik district commissioner for agriculture and forestry attributed some blame to local authorities in villages as well. He accused them that they ignored the problem of woodland protection by colluding with forest guards in allowing pasture or cutting in protected woodland areas.[218]

However, starting from 1954 things started to change. The problem of forestry in the district was the main topic of a meeting of all local authorities which were represented at the National Liberation [herein NL] Councils. The president of the district's NL Council warned the council members of the importance of protecting woodlands and promised to improve the relations between the district's forestry officials and forest guards (Šibenski list, 1954a). Consequently, the speed of processing of woodland crimes increased significantly from 1954 compared to previous years. In 1954 out of 1,014,000 dinars of woodland damages, 72% were charged and in 1955 69% out of 1,396,000 dinars of damages were charged.[219] Despite the cost of the damages being on the rise, prosecutions had started to function properly. From 1954 the Forestry Office started to charge a pasture tax for each animal that was pasturing on the nationally owned lands, that is woodlands. This not only encouraged some of the people to start using municipal pastures more, but it brought substantial revenues to the Forestry Office which were then used for further management of woodlands.[220]

The district National Liberation Council also decided to reduce the demand for firewood through the 'implementation of strong propaganda among village population for the use of stoves, as it was determined that open fireplaces use up three to four times more firewood than stoves' (Šibenski list, 1954a). Open fireplaces were present in every household according to the interviews with the elderly villagers in the area. According to a retired farmer in her 80s (G14: Konoba, F), houses were built of dry-stone walls with often just one room in the house. In the middle of the

[217] HR-DASI-Šumarstvo 19.-20.st. 5th May 1953. *Čuvanje i uzgajanje šuma - primjedbe*. N.280/53.
[218] HR-DASI-Šumarstvo 19.-20.st. 25th November 1950. *Stanje šumarstva na području kotare.* N.26253/50.
[219] HR-DASI- Poljoprivreda i Šumarstvo. 27th March 1956. N.606/56.
[220] HR-DASI-Šumarstvo 19.-20.st. 26th April 1954. *Cjenovnik za 1955. g za sporedne šumske proizvode: pašu, ljekovito bilje, kamen i dr*. N. 912/55.

room was an open fireplace which served for cooking and heating. When asked whether they searched for a particular type of wood for burning, the answers were negative:

G16: No, never. For firewood, you used various things, all mixed together – figs, juniper, holm oak… Whatever you brought home'.

(G16: 70s, Konoba, M, retired/factory worker)

G13: We would burn all those bushes, branches that were scattered around, that were thrown away. There were no logs that you would throw in the fireplace, so we would always carry wood from the woodlands.

(G13: 70s, Grebaštica, F, retired/housekeeper)

Only a retired civil servant from Krapanj (G22: 60s, F) recalled the practice of using young juniper branches for making poles for vineyards and some harder holm oak and ash wood for agricultural tools. All the rest confirmed that the wood people cut in the woodlands was not used for anything other than firewood.

Q: The wood you gathered in the woodland, did you use it for anything?

G14: For firewood.

Q: That was the most important use? Did you not use it for something else?

G14: No, no, for nothing. We used it as firewood. We prepared wood for the fireplace.

(G14: 80s, Konoba, F, retired/farmer)

In an interview entitled 'Open fireplaces are destroying a large part of our woodlands' given to the local newspapers in 1954, the president of the district's NL Council explained that the woodland fund of Šibenik district was very poor (Figure 6.11) and amounted to only 115,000m^3 while the annual consumption amounted to 34,000m^3. The annual growth of the woodland fund was 14,000$m^{3,}$ and further 15,000m^3 were derived from agriculture and outside of the district, which still procured an annual loss of 5,000m^3. This had to be satisfied with the district's existing woodland fund, and if unchecked, it would have led to complete deforestation in just 23 years.

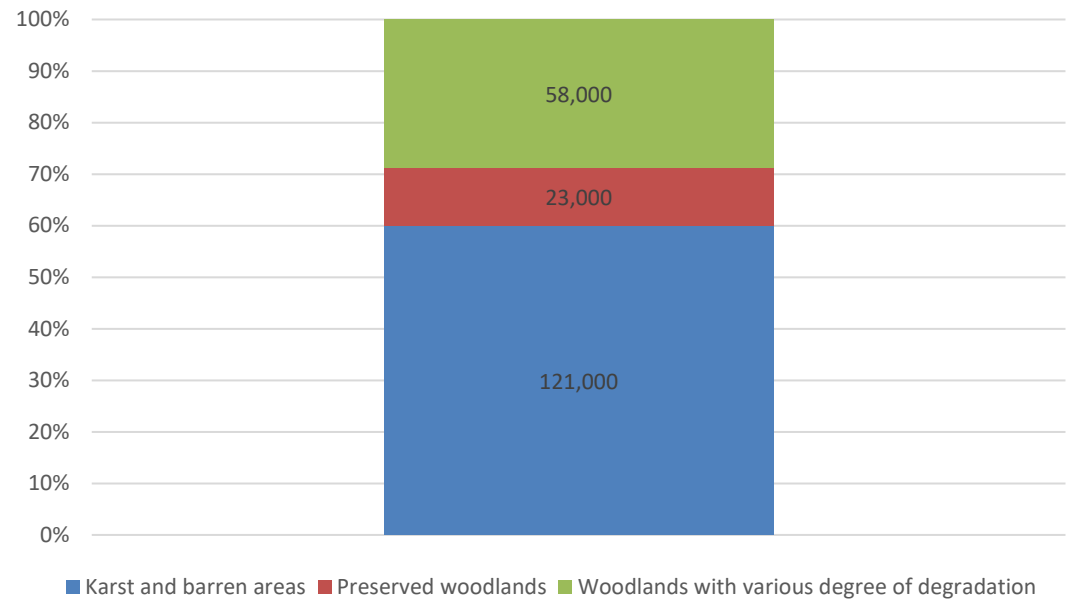


Figure 6.11. Types of woodlands areas in Šibenik district in hectares in 1957. More than half of the area statistically considered as woodland was actually a barren area (Source: HR-DASI- Šumarstvo 19.-20.st. 25th June 1957. *Šumarstvo, tab. 2-Š).*

Aerial images from 1968 reveal that many of the woodland areas that were designated as such in the Austrian period also had been reduced to barren areas. The woodland Guduča on the north banks of Prokljan lake in the hinterland of Skradin, where citizens of Šibenik had the right of firewood collection (Figure 5.6, p.134) ever since the French period, and possibly before, can be taken as one such example (Figure 6.12). In 1968 this woodland was, in fact, a completely open landscape with scattered bushes. The existence of trees, probably olive or fruit trees, in one of the agricultural parcels emphasises the differences in the size of vegetation. The image also confirms the longevity of land use practices in these areas, as private woodland parcels that can be seen on the topographic map from the third military survey (1869-1887) are also visible on the 1968 aerial image. It serves as one of the best examples of how woodland areas in Šibenik district, in fact, had a minimal resemblance of a proper woodland.

Another example of the appearance of woodlands in the post-war period comes from Ravni gaj woodland. Ravni gaj was designated as a woodland after the 1870s as in 1825 cadastral plans it was depicted as a municipal pasture. In 1968 the woodland was characterised by an open landscape with denser patches of trees and

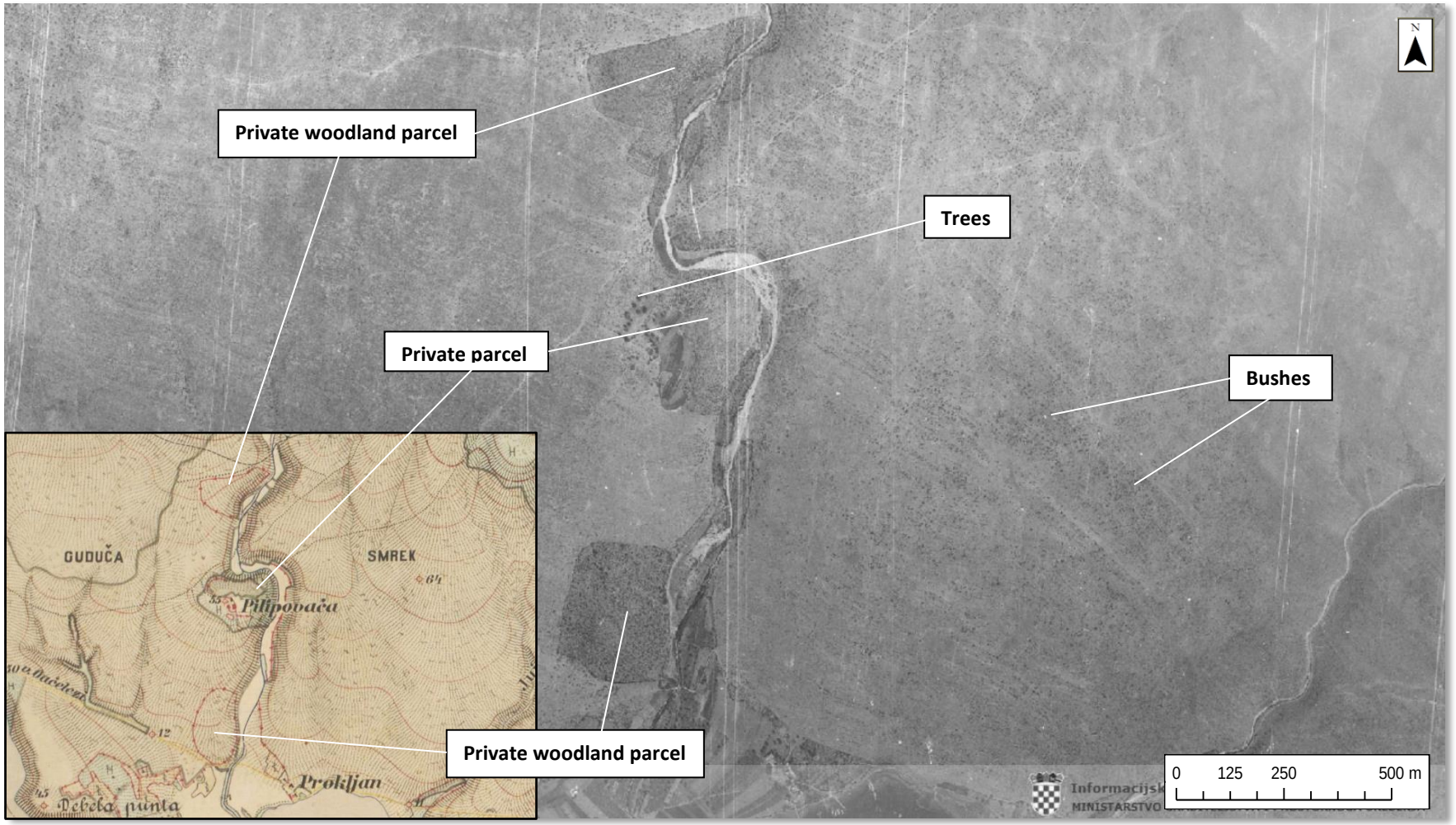


Figure 6.12. A part of Guduča woodland on the third military survey (1869-1887) topographic map (bottom-left corner) and 1968 aerial image with labels added by the author (Source: MAPIRE.eu; MGPU-ISPU, 2018).

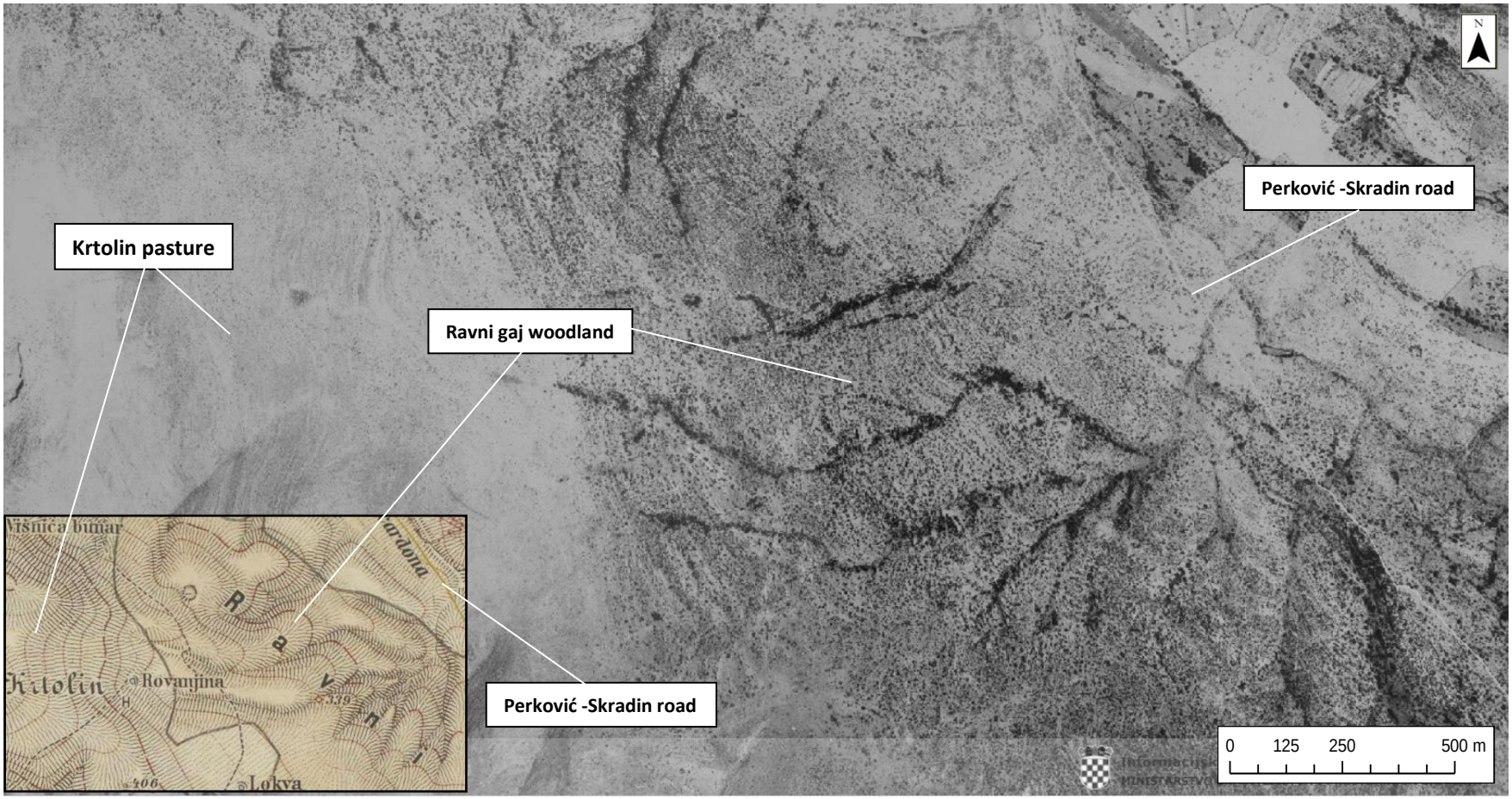


Figure 6.13. A part of Ravni gaj woodland on the third military survey (1869-1887) topographic map (bottom-left corner) and 1968 aerial image with labels added by the author (Source: MAPIRE.eu; MGPU-ISPU, 2018).

bushes distributed along the ravines (Figure 6.13). The border between the woodland area and the pasture of Krtolin is clearly identifiable as the latter hardly supported any vegetation.

The president of Šibenik district's National Liberation Council identified open fireplaces as the largest consumer of wood, and he believed that the most critical thing that was necessary for woodland preservation was the replacement of open fires with electric stoves. Since many villagers were poor, he also expressed the willingness to support people with loans for electric stoves (Šibenski list, 1954b). Šibenik district's efforts on the procurement of stoves and woodland protection, in general, were quickly recognized by the foresters and Piškorić (1955) presented them as the right step in the development of Dalmatian forestry.

Finally, the jurisdiction of the Forestry Office over woodlands started to limit significantly the activities of people in the woodlands, something which local people had a problem getting used to. In 1955 the Forestry Office Šibenik informed the Šibenik municipality that they noticed members of the Krapanj village complicated the work of forest guards by behaving 'as if woodlands where their property, where they can do as they please'. Because of this, the Forestry Office ordered the municipality to make sure people understood that such areas were 'national property for which the Forestry Office pays taxes. Accordingly, the Forestry Office does not allow any villager of Krapanj to arbitrarily appropriate any woodland area or freely enjoy any of its resources. The villagers are supposed to be warned that no activities are allowed in woodlands and woodlands areas, no matter the type of ownership, without the approval of the corresponding governing body for woodlands which is this Forestry Office'.[221]

One of the factors that favoured woodland protection and regeneration was the fact that pastoralism was severely disrupted during the War. In 1944 the district authorities reported that only a fifth of the animals from the pre-War period had survived 'because starvation forced people to kill off many animals for food, a part

[221] HR-DASI-Šumarstvo 19.-20.st. 26th November 1955. Zaštita šuma. N. 5019/55.

was given for the nutrition of the army, while a part was taken by the invaders'.[222] Declines in the number of cattle and pigs were the greatest with the number of pigs falling by 95% and cattle by 65%. The number of sheep also dropped, and although the figures for Šibenik are not known it is likely to have been significant as in neighbouring Vodice district a drop of 80% was reported.[223] Such a dramatic fall in the number of animals was beneficial for the recovery of the woodlands as the pressure from grazing decreased.

In order to boost the recovery of pastoralism, the authorities not only started importing sheep and pigs from other parts of the state but also implemented a ban on the killing of all females, except goats, capable for reproduction and their offspring.[224] This helped in the recovery of sheep, so the numbers in the Šibenik district quickly grew to 70,812 in 1951. Despite their culling being allowed, the number of goats was also high with 4,311 goats counted, which was two times higher than the number of goats in 1904 (Šibenski list, 1953). However, unlike in the aftermath of World War I when goat keeping limitations were largely abandoned, new government of Yugoslavia started to implement a full ban on keeping goats in 1948. Since the country was still recovering from the war and many people continued to live in poverty, the decision was met with fierce resistance so in some areas it was delayed, but not abandoned (Knebl, 1978).

In the Federal Republic of Croatia instead of implementing the ban, the government introduced a regulation which limited the number of goats according to the number of people in the household. However, authorities of Šibenik district described this as inefficient since some households could keep between 40 and 50 goats. The situation was worst in the hinterland villages of Lepenica, Grabovci and Čista Mala, and among coastal villages particularly in Grebaštica. Some neighbouring districts of Šibenik decided to prohibit the keeping of goats altogether, so people

[222] HR-DAŠI-28 ONOŠ 5.1.1.-5.1.5. number 8. 1st August 1944. N. 12/44.
[223] HR-DAŠI-28 ONOŠ 5.1.1.-5.1.5. number 8. 4th December 1944. N.618/44.
[224] HR-DAŠI-28 ONOŠ 5.1.7. 5008/14871. number 10. 19th July 1945. N.7282/45; HR-DAŠI-28 ONOŠ 5.1.7. 5008/14871. number 10. 19th July 1945. N. 3049/45; HR –DAŠI-28 ONOŠ 5.1.6.-5.1.7. number 9. 14th December 1945. N.293.

from those districts started to bring their goats on the territory of Šibenik because goats were still allowed there.[225] Finally, the state-wide ban on the keeping of goats was also implemented in Croatia in 1954, six years after the ban was first adopted in Macedonia and Bosnia and Herzegovina.

The ban had the full backing of the central government, and it was strongly supported by the president and prime minister of SFR Yugoslavia Josip Broz. He linked the ban with the renewal of woodlands, and in a speech he gave in Trebinje in Bosnia and Herzegovina in 1954, he praised the positive effects of the six years' old ban:

'I have to say I am happy that you have destroyed the goats because now I see your hills are green. I wish it was done wherever they have not done so. In 10 years' time, our people will feel what the goat meant for him, and what for the woodlands. It is necessary to breed the sheep for they provide both milk and wool.

Breed the sheep; they will not destroy the woodlands! And you know that woodlands repair the climate. When these hills are covered with woodlands, then you will not have the same dry climate here, as you have during the summer, that unbearable heat. The climate will change, and this will produce more opportunities for more the intensive use of the land you have here' (Broz Tito, 1959).

Although Kneb (1978) argued that the ban on goats was not as strict in Croatia as in other Federal Republics as some of the poorest people were allowed to keep goats in stables and on a leash, the overall number did show a significant drop. Their number in Croatia peaked in 1952 when there were 354,000 goats but started to fall in 1953 when a drop of 30% was observed (Figure 6.14). During the first two years of the ban, the number fell by a further 70% and continued to slowly decrease for the next decade (Ziani, 1964).

According to the local people, the ban was explicitly implemented because of woodland damage:

G12: There used to be a ban immediately after World War II. They [municipality and foresters] apparently determined that goats do a lot of damage to woodlands, bushes, gaj areas. Goats were

[225] HR-DASI-Šumarstvo 19.-20.st. 5th May 1953. *Čuvanje i uzgajanje šuma-primjedbe.* N. 280/53.

killed, and it was not allowed to breed them. That was in my time when I was born. My ancestors used to have goats, but they and everybody else had to remove the goats.

(G12: 70s, Grebaštica, F, retired/civil servant)

G17: Allegedly goats would horribly browse everything, and there was no development of bushes, so they banned them [goats] unless somebody kept them in their enclosures.

(G17: 70s, Konoba, F, retired/farmer)

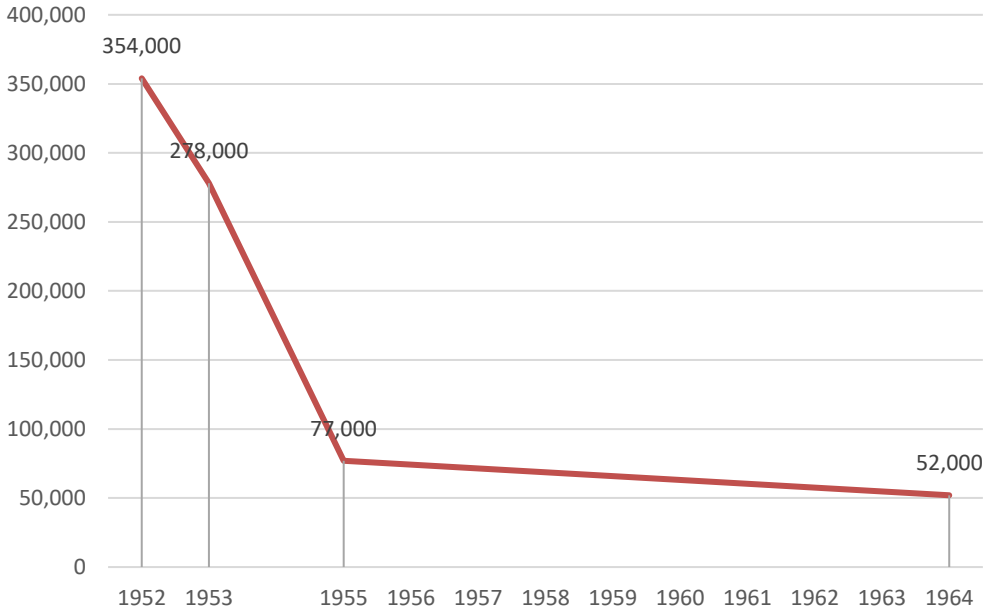


Figure 6.14. Number of goats on the territory of the Federal Republic of Croatia from 1952 to 1964 (Source: Ziani, 1964).

The remaining goats in Croatia were mainly concentrated in karst areas of northern Dalmatia. By 1964 there were three goats per 100 people in Dalmatia, but in north Dalmatia, that number was seven times higher (Ziani, 1964). It is likely that in more remote areas where supervision was difficult some goats continued to browse freely, but in more populated areas such as the Šibenik district, the ban probably brought such browsing to a full stop. The district's ten-year plan for the development of agriculture (Šibenski list, 1953) listed all domestic animals and the numbers that were intended to be reached by 1962. Goats were the only domestic animals that were not listed. The number of sheep, however, was supposed to be increased from approximately 70,000 in 1952 to 120,000 1962 which corresponded

to Josip Broz's desire, expressed in his Trebinje speech, to replace the goat with the sheep as the basis of pastoralism.

The ban on goats solved one of the main Dalmatian forestry problems that the different administrations since the Venetian period had attempted to tackle. It was also the strictest regulation on the goats in the whole Mediterranean at that time, despite all of those countries having a problem with browsing of the goats. Twenty years after the ban, during the UNESCO's Man and the Biosphere conference in 1975, Yugoslavia was credited for being the only country that had managed to solve the problem of goats (Knebl, 1978).

Soon after, the authorities decided to try and finally put an end to illegal exploitation of woodlands. Up until 1950, the custom of cutting in woodlands included villagers cutting under the supervision of the forest guard:

B1: Sometime in spring, the forest guard would call the people and then we would go cut in the gaj. You would not choose what to cut yourself, but he would tell you where and what to cut. It used to be masses of people.

(B1: 80s, Boraja, F, retired/housewife/farmer)

Such cutting was carried out during rotational coppicing of trees for firewood, clear-cutting of degraded and damaged trees near the ground, or when foresters carried out singling, that is, removal of all but the best stems in order to aid the conversion of low-growth woodland to a high forest. In any case, the cutting provided villagers with firewood.[226] However, in 1956 the Croatian Parliament decided to terminate regulations concerning the mandatory provision of firewood and construction wood to people after the economic analysis of villages determined it was possible to replace such provision with the selling of wood through beneficial prices. The purpose was to decrease consumption of firewood in general and to free larger amounts of wood for industry and export, increase production of wood in private woodlands and boost the yields of national woodlands through better management. To achieve this, already in 1954 some Forestry Offices across the state

[226] HR-DASI-Šumarstvo 19.-20.st. 25th November 1950. *Stanje šumarstva na području kotare.* N.26253/50.

began the experimental production of high volumes of wood for the provision of people and produced large quantities of wood for tannin and cellulose, as well as mining wood, railway sleepers and sawmill boards.[227]

In 1956 the regulations were changed in a way that all cutting was supposed to be carried out exclusively by Forestry Offices or forestry-industrial companies, while the cutting by villagers was completely abandoned. Forestry Offices were required to develop cutting plans and follow them through while also taking care of young stands that were regenerating. It was effectively decided that 'bringing forestry to a higher-level demands exclusion of villagers as direct consumers of wood, therefore, industrially made wood will be sold outside the woodland'. Only firewood of low quality was allowed to be collected near the stumps and later sold to the villagers.[228]

With the new regulation, traditional woodland management practices that had existed for centuries were stopped and the management of traditional woodlands was to be exclusively carried out by the Forestry Office staff. This transition was helped with the abandonment of rural areas and rise of industry and tourism, so it was met with no opposition from the people.

Despite the initial success of the woodland management system through Forestry Offices supervised by Forestry Enterprise Dalmatia, the Enterprise itself was abolished in 1954. It was replaced by the Forestry Inspectorate, while individual Forestry Offices became independent, self-funded institutions. The Inspectorate was then abolished in 1956, and Forestry Offices became tied to the political districts. Therefore, in 1956 forestry administration in Dalmatia became decentralized down to the individual districts or sometimes even municipalities (Vrdoljak and Jedlowski, 1965). According to Petak (2006), in the 1950s the first phase of decentralisation of Yugoslavia commenced, when the central government increased the financial

[227] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 21st February 1956. *Opsrkba pučanstva ogrjevnim drvom.* N. 5344.
[228] *Ibid.*

independence of districts and municipalities. The system of woodland management was just one of the administrative branches that was affected.

This decentralisation in woodland management led to the loss of government funds which proved very disruptive for Dalmatian forestry. The efforts to unify once again the work of Forestry Offices failed in 1963, and further disintegration followed as nine more separate Districts were created (Vrdoljak, 1965). The process of disintegration continued and by 1977 there were 14 small Forestry Offices (Vrdoljak, 1977). The financial weakening of forestry institutions was followed by a reduction in the number of forestry professionals. These administrative changes were strongly linked to the distancing of Yugoslavia from the Soviet model of socialism, increased federalisation of the state, increased autonomy in businesses and the implementation of market-led principles of business (Gligorov, 2004).

Vrdoljak (1965) argued that proper management of Dalmatian woodlands in this new context was not possible because so much was made up of small, degraded, patches which could not provide any financial yields. Because of this, foresters had to gain revenues from activities in services and tourism. Rajić (1964) explained that the staff had been reduced, so the Forestry Offices at Šibenik, Knin and Drniš were each left with only one forester and one technician, compared to two foresters and several technicians before 1960. The main revenues continued to be taxes from pasture and selling wood, but these were only just enough to cover the costs of salaries. After 1970 revenues were obtained primarily from work associated with tourism and horticulture (Šumarski list, 1975). At a meeting of Dalmatian municipalities in 1975 it was concluded that 'ever since forestry was developed as an organised activity in karst areas, never has it been in such a weak position and so disorganised', that is 'never has society cared less about karst woodlands' (Šumarski list, 1975, p. 240).

The forestry situation began to improve with the new Law on Forests in 1977. The new Law considered karst woodlands within a specific context that differentiated them from the continental woodlands and mandated that 'management will be carried out according to the specific conditions, relations and needs of the karst area'

(Vrdoljak, 1977). More importantly, the new Law solved the financial aspect of the forestry in karst in 1980 through 'Public agreement on procurement of means for natural regeneration and protection of woodlands from forest fires on karst areas of Federal Republic of Croatia'. This was enabled through the political strengthening of individual Republics and weakening of federalism (Petak, 2012). Once implemented, it determined that management, and regeneration of woodlands was of particular state interest, and a large number of public and business enterprises became committed to support woodland management (Ivančević, 1983). However, never again did the forestry administration in Dalmatia reach the levels of financial prosperity and productivity as in the first half of the 1950s when the Forestry Offices were joined up in Dalmatia Forestry Enterprise.

6.3.2. Pine woodlands and reforestation in the second half of the 20th century

The reforestation in the Šibenik district continued immediately after the fighting stopped. As a part of the district's strategy of renewal of woodlands by the end of 1944, it was ordered that organized collection of pine and oak seeds was to be initiated by foresters, villagers and even schoolchildren in order to restore nurseries.[229] In 1946 the first reforestation attempts after the War had been carried out by citizens who volunteered. Seedlings of only two species were used – Aleppo pine in almost three-quarters of the reforested area and a mix of Aleppo pine and Cypress seedlings in the rest.[230] In the spring of 1946, the authorities in Dalmatia ordered that 'everybody should contribute to the collection of seeds' and that 'each village must make a stash of seeds for the reforestation of its area'. The idea was to collect the seeds of various types of trees, such as holm oak, lime, laurel, stone pine, ash, pomegranate, the mahaleb cherry, hornbeam, mock privet and oak which would then be used to reforest an area of 600,000 hectares of Dalmatian barren karst during the period of 20 years. In addition to seed collection, every local National Liberation Council was instructed to call a meeting of villagers to explain the importance of

[229] HR-DAŠI- Šumarstvo 19.-20.st. 14th September 1944. N. 797.
[230] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 6th February 1946. N. 2835.

establishing woodlands so that they would cooperate more willingly.[231] However, despite the instruction to collect seeds of previously listed various species, reforestation in Šibenik district in 1947 was entirely carried out by Aleppo pine and false acacia (*Robinia pseudoacacia).*[232] Additionally, subsequent reforestation records never again mentioned the unrealistic plan of reforesting an area as large as 600,000 ha.

From 1947 onwards, reforestation had started to rapidly expand, primarily because of the push that was given by the government in Zagreb. In Autumn 1947 a Central Action Committee for reforestation had been established within the Ministry of Agriculture and Forestry. Its task was to coordinate the work of government agencies and the reforestation initiatives that were carried out by people, mostly volunteers, and to deliver propaganda to the population in order to meet the reforestation goals.[233]

The Ministry of Education and schools had a vital role in this propaganda.[234] The Ministry mandated that 'teachers of science modules in every school had to teach the students about the aesthetic, economical, hygienic and cultural value of reforestation'. All pupils also had to write an essay on the topic of reforestation of karst. In addition, they had to physically assist in reforestation works – elementary school pupils for one whole non-working day and high school pupils for one working and one non-working day.[235]

Such propaganda was needed because according to the first five-year management plan the government of the Federal Republic of Croatia had plans to reforest 7,000 ha of karst areas. By the scope and intensity of works, this was considered the most extensive reforestation in the history of karst reforestation. However, the works exceeded the planned scope of reforestation and area that was covered was 373% larger than initially planned. Not all of it was successful, and out of 26,157 ha reforested in whole Croatia, only 10,949 ha were successful. In

[231] HR-DASI- Poljoprivreda i Šumarstvo. 12th April 1946. N.3632/46.
[232] HR-DASI-Šumarstvo 19.-20.st. 1947. P*lan jesenskog pošumljavanja u 1947. godini.* N.
[233] HR-DASI-Šumarstvo 19.-20.st. 15th October 1947. N. 18332.
[234] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 8th November 1947. N. 205.
[235] HR-DASI-Šumarstvo 19.-20.st. 13th November 1947. N. 20541.

comparison, however, the first Yugoslav government managed to reforest only an area of 7,000 ha in Croatia between 1920 and 1940 (Horvat, 1954). The 1947-1951 reforestation in Dalmatia was completed on 9,447 ha, but the success was achieved on 34.7% of the area or 3,280 ha (Horvat, 1954). Out of that area, 401 ha was reforested in Šibenik district but with the success rate of only 29 %.

Horvat (1954) explained that a high percentage of reforestation failure was due to the lack of organisation. He wrote that sometimes work had been carried out at 100 locations within one Forestry Office. Since men had to work in other activities, a lot of workforces consisted of women and children which is why they planted near the settlements where there was a higher risk of animal intrusion. In Šibenik district authorities also reported that work of such a large number of volunteers was ineffective because of the inability to supervise everybody including an especially large number of children.[236] Because of this the whole process became more regulated and managed, especially after the Forestry Office had been established in 1951, and people began to be paid for their work:

G1: Forestry Office planted them [pines]. My mother worked there; she would plant them.
G2: They gathered people from the village to plant them by hand.
G1: But it was paid. It was in 1952 or 1953 when reforestation took place [near Konoba]. And they gave us sweets, to us workers. Who had sweets then!

(G1: 60s, Grebaštica, M, retired/electrician; G2: 60s, Grebaštica, F, retired/saleswoman)

B2: Nobody would complain. You see, it was in people's interest to earn some dinar for that, so they went up and planted those pines.

(B2: 80s, Boraja, M, retired/farmer)

By transforming reforestation into a paid work, the foresters softened the resistance people showed towards it, but the problem of claiming municipal pastures from the people still persisted. The Šibenik district's commissioner for agriculture and forestry reported in 1950 that it was difficult to designate any areas for reforestation

[236] HR-DASI-Šumarstvo 19.-20.st. 25th November 1950. *Stanje šumarstva na području kotare.* N.26253/50.

because conflicts often arose with pastoralists or farmers.[237] Numerous reports of animals damaging young pine stands were reported across the district in 1951 and even of people deliberately cutting the trees.[238]

Reforestation picked up in intensity from 1951. According to Vajda (1955), initiatives started by citizens and their voluntary work brought about a rapprochement between people and woodlands. However, the most significant boost to reforestation occurred when in 1951 all woodlands were entrusted to Forestry Enterprise Dalmatia, and the government started to subsidize reforestation through Fund for forestry development.

The importance of this fund for forestry in Dalmatia is visible from the data on revenues and expenditures of Forestry Office Šibenik in 1953. According to the head of the Forestry Office total revenues from selling of wood, pasture tax, secondary woodland products and fines for woodland crimes amounted to 2,026,000 dinars. The expenditures included salaries for foresters and people working on reforestation, works in a nursery, reforestation and management of woodlands amounted to 9,762,600 dinars. This means that the government had to provide for almost 80% of the financial costs of the Forestry Office.[239] The heavy subsidy allowed reforestation to reach its peak. In Šibenik district from 1952 to 1955, an area of 582 ha was reforested, up from 399 ha in the preceding five years. And while before 1952 only approximately 30% of reforestation turned out to be successful, with better-organised management of workers and improvement of reforestation techniques the reforestation from 1952 to 1955 was successful on 92% of areas (Figure 6.15).[240]

[237] HR-DASI-Šumarstvo 19.-20.st. 25th November 1950. *Stanje šumarstva na području kotare.* N.26253/50.
[238] HR-DASI-Šumarstvo 19.-20.st. 19th January 1951. N. 1158/57.
[239] HR-DASI-Šumarstvo 19.-20.st. 5th May 1953. *Čuvanje i uzgajanje šuma - primjedbe*. N.280/53.
[240] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 29th August 1956. *Obim i dinamika radova u poslijeratnom razdoblju.* N. 1116.

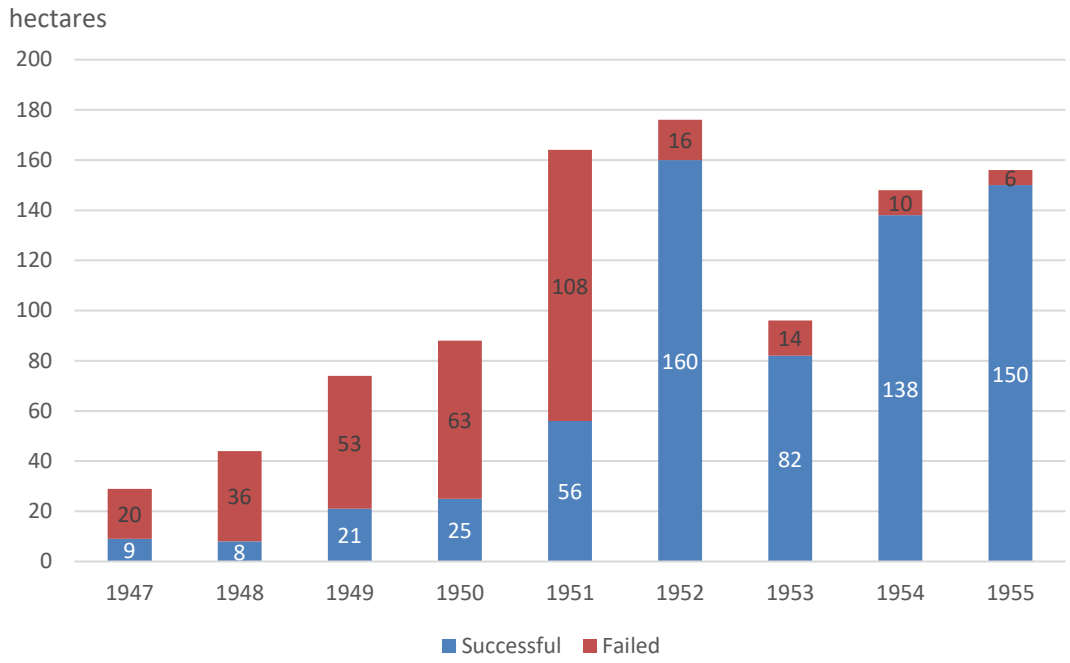


Figure 6.15. The extent and success of reforestation activities in Šibenik district from 1947 to 1955 (Source: HR-DASI-Šibenik 19-20.st. Šumarstvo. 29th August 1956. *Obim i dinamika radova u poslijeratnom razdoblju.* N. 1116).

However, in 1954 the government decided to reform the Forestry Enterprise Dalmatia into a Forestry Inspectorate, while Forestry Offices became independent, self-funded institutions. The Inspectorate was then abolished in 1956, and Forestry Offices became tied to the political districts. Therefore, in 1956 forestry administration in Dalmatia became decentralized down to the individual districts or sometimes even municipalities (Vrdoljak and Jedlowski, 1965). A severe blow to the forestry was delivered in 1955 when the Fund for Forestry Development was abolished by the government. With the loss of financial funds forestry in Dalmatia became increasingly disorganized and disintegrated and the effect on reforestation was immediate (Šumarski list, 1975).

While an average 1,680 ha were reforested annually in Croatia from 1947 to 1955, in the period from 1956 to 1964 only 250 ha were (Figure 6.16) and the trend continued until the mid-1970s (Vrdoljak and Jedlowski, 1965; Šumarski list, 1975). The number of forestry staff declined as well. In 1955 Dalmatia had 37 professional foresters and 37 forestry technicians. By 1963 the number of foresters dropped to 21 and of technicians to 28, while by 1971 only 13 foresters remained with 22

technicians. This was also followed by the abolition of numerous scientific institutions or schools dedicated to the development of forestry on karst (Šumarski list, 1975).

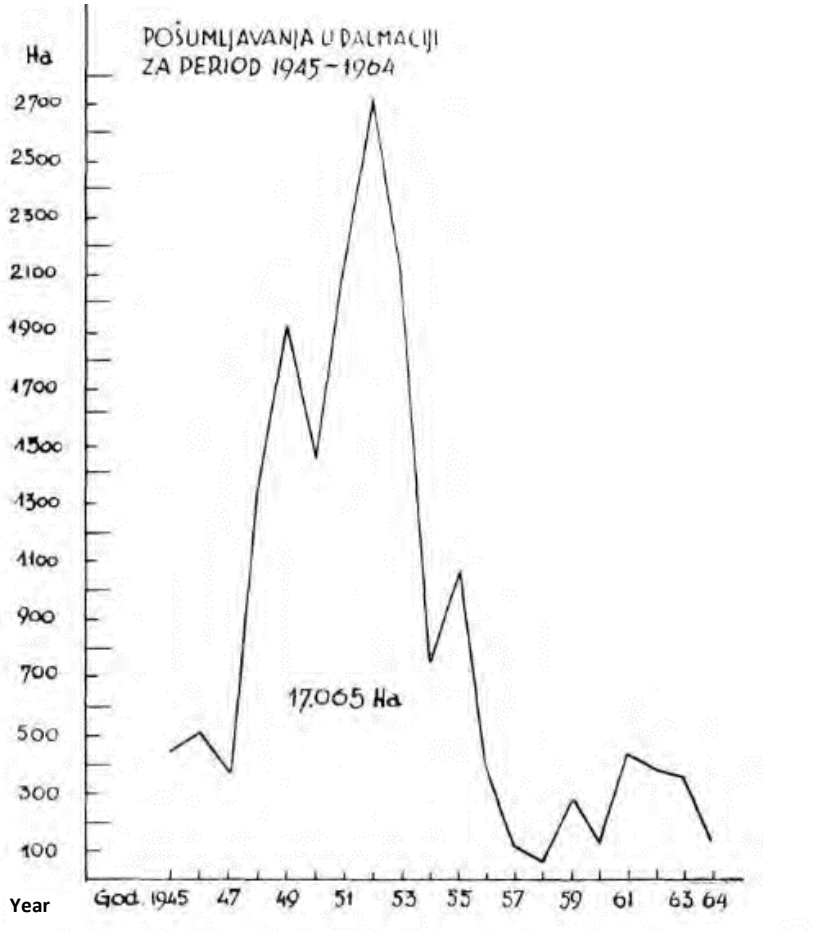


Figure 6.16. The scope of reforestation in the Federal Republic of Croatia from 1947 to 1964 (Source: Vrdoljak and Jedlowski, 1965).

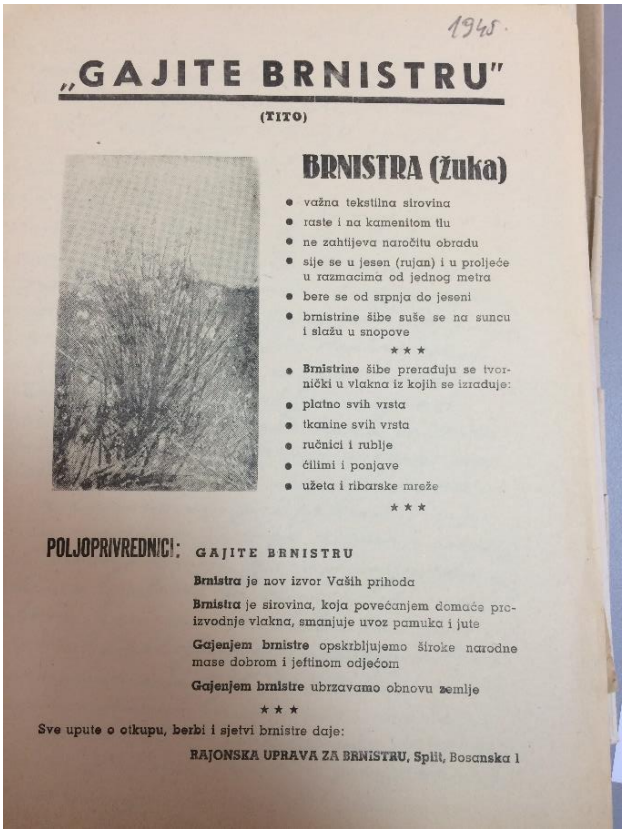
In Šibenik district the effect of financial problems was felt already in 1954 when the Forestry Office Šibenik reported that it needed approximately 7,000,000 dinars to finish the planned reforestation on 240ha. However, they only received 2,570,000 dinars from the government, so they had to restrict the scope of reforestation.[241] When the Fund for Forestry Development was abolished the Forestry Office lost 90% of its revenues. The Forestry Office's annual report for 1956 stated that 'funds available to the Forestry Office were not known to us, but we began

[241] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 14th December 1954. *Vodni objekti i pošumljavanje na području N.O. Kotara Šibenik – podaci.* N. 16597.

to implement the work plan for that year. There were no salaries for three months… We could not carry out fieldwork as all the efforts were concentrated on where to obtain dinars … Some money started to arrive in October'.[242] In 1957 it was impossible to carry out reforestation without the funds so the planned scope of reforestation included only 10 ha.[243] People could no longer be paid to sow seeds, so in 1957 officials from Council of Agriculture of People's Committee instructed Forestry Offices to avoid the decay of stored seeds by organising reforestation on a voluntary basis.[244]

While the decline of reforestation after 1955 is unambiguously tied to the cessation of funding, the sudden boom in reforestation before 1955 and the reasons it became so subsidized in the first place had several reasons. The new Yugoslav government was particularly committed to work on what Marinković (1946, p.89) described as 'socio-economic goal of improvement of people's wellbeing' so in reforestation they saw benefits for various economic sectors, particularly in underdeveloped areas of karst. Ziani (1947) argued that the primary function of reforestation was the economic one while Horvat (1951) stated that rising productivity of karst areas was one of the main tasks of government. The government was indeed very interested in various ways how rural areas could be alleviated from poverty, and at first, they saw planned planting of Spanish broom (*Spartium junceum*) as one of the ways. Forester Premužić (1948) promoted this plant as a valuable plant for textile industry that was easy to manage and brought larger revenues than pastoralism. The government implemented propaganda for the planting of Spanish broom and leaflets describing its benefits were dispatched across districts with the heading quoting Tito 'Plant Spanish broom' (Figure 6.17).

[242] HR-DASI- Poljoprivreda i Šumarstvo. 21st January 1957. N.14492/56.
[243] HR-DASI- Poljoprivreda i Šumarstvo. 25th October 1957. N. 2785/57.
[244] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 25th September 1957. *Jesensko pošumljavanje na dobrovoljnoj bazi*. N.9530/57.



1945.

„GAJITE BRNISTRU"

(TITO)

BRNISTRA (žuka)

- važna tekstilna sirovina
- raste i na kamenitom tlu
- ne zahtijeva naročitu obradu
- sije se u jesen (rujan) i u proljeće u razmacima od jednog metra
- bere se od srpnja do jeseni
- brnistrine šibe suše se na suncu i slažu u snopove

* * *

- **Brnistrine** šibe prerađuju se tvornički u vlakna iz kojih se izrađuje:
- platno svih vrsta
- tkanine svih vrsta
- ručnici i rublje
- ćilimi i ponjave
- užeta i ribarske mreže

* * *

POLJOPRIVREDNICI! GAJITE BRNISTRU

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Brnistra je sirovina, koja povećanjem domaće proizvodnje vlakna, smanjuje uvoz pamuka i jute

Gajenjem brnistre opskrbljujemo široke narodne mase dobrom i jeftinom odjećom

Gajenjem brnistre ubrzavamo obnovu zemlje

* * *

Sve upute o otkupu, berbi i sjetvi brnistre daje:

RAJONSKA UPRAVA ZA BRNISTRU, Split, Bosanska 1

Figure 6.17. Propaganda leaflet with a description of Spanish broom's characteristics and use. Some of the arguments that promoted planting were: 'the new source of your revenues; a resource whose national production will lead to less import of cotton and jute; supply masses of people with proper, cheap clothes; speed the recovery of the state' (Source: HR-DASI- Poljoprivreda i Šumarstvo. 1945. *Gajite brnistru leaflet*).

Resin production followed soon after. The resin industry started to develop just before World War II, and it started to gain momentum after 1947. The government saw its potential for replacing the expensively imported resin and turpentine products with those nationally produced. In addition, high-quality etheric oils and balsams could also be produced. While black pine was already established as a good resin producing tree, Aleppo pine was gaining more attention as research started to show it had higher yields (Marković, 1950; Pejoski, 1950). Pejoski (1950, p.257) argued that 'in order to free the state from the import of these products [resin and turpentine] it is crucially needed to manage and exploit our pine woodlands in a way that will secure enough seeds to expand the area of pine woodlands'. Radimir (1953) urged foresters to plant Aleppo pine in all coastal zones because it grew faster, quickly and easily naturally regenerated and also generated substantially more better-quality resin.

Foresters further promoted the planting of pines for resin production by elaborately writing about the financial benefits this industry could yield. Meštrović (1954) argued that private owners of small Aleppo stands in coastal areas could be paid by the Forestry Office for each kilogram of resin their stand had produced. Since all the work would be done by the foresters, the owners would have a free source of revenues, while the Forestry Office would also earn money from the government. Bičanić (1955) calculated that 1ha of Aleppo pine woodland designated for resin production gave eight times more revenues than 1ha Aleppo pine woodland that was used for the production of timber. When comparing them to oak woodlands, he concluded that resin extraction gave 70% more revenue and, in comparison to beech forests, this number went up as much as 100%. With 60% of Croatian pine woodlands located in Dalmatia, he urged for resin production to be the new path in Dalmatian forestry. The government also saw the possible benefits, so the construction of a resin distillery was commenced in 1954 on Hvar island.

Between 1947 and 1952 resin production in Croatia increased five-fold (Radimir, 1953). However, as quickly as it developed, the resin industry also deteriorated. The peak in resin production was achieved in 1956, after which it started to collapse because the prices of turpentine and rosin significantly fell due to cheaper imports (Bičanić, 1959). The collapse was so significant that in 1960s resin production became an insignificant secondary woodland product (Golubović and Meštrović, 1966).

The plans for resin extraction in Šibenik district began to develop in 1951, and 7,000 pine trees were exploited. Only six workers were so employed for this, and there was no inclusion of the local population in production. Production decreased in the 1960s when only 2,500 trees were exploited due to decreasing prices of resin products. In 1970 resin production was abandoned entirely in the district (Management programme, 1980). None of the elderly villagers that were interviewed could recall resin collection in the area.

Tourism had an essential role in reforestation between the World Wars and after 1945 Croatian and Dalmatian authorities quickly began to work on its renewal

and did their best to promote the land for the tourists. In 1947 the NL Council of Dalmatia warned Šibenik district about reports that pine woodland in Rogoznica was being felled in front of the few who tourists who 'admired the scenery but were disgusted when they saw that woodland was cut'. The county authorities felt so strongly about this that they threatened to sue the district if felling was not stopped.[245]

That same year the Federal committee for tourism assessed the Adriatic coast and visited settlements to assess possibilities of tourism development and concluded that such conditions existed in Primošten village, south of Šibenik (Figure 6.18). This encouraged the local authorities to reforest the Raduča peninsula which was described as covered with vineyards abandoned for almost 30 years. Reforestation was carried out by volunteers from the village on two-thirds of the peninsula, but ten families that had properties there refused to reforest their land. When volunteers reforested the area despite their protest, the families destroyed the trees. Because of this the district authority requested the Croatian Committee for tourism to force those families to give their land for reforestation as 'it would benefit the whole community'. These benefits included 'health of the settlement… protection from northern wind… tourism because both sides of the peninsula have two convenient bays for swimming with fine sand'.[246]

[245] HR-DASI-Šumarstvo 19.-20.st. 3rd October 1947. N. 3470.
[246] HR-DASI-Šumarstvo 19.-20.st. 30th May 1950. N. 13041/50.

Figure 6.18. Aerial view of Raduča peninsula in Primošten village in 1962 (Source: Private archives).

The aesthetic appeal of the land had started to become one of the major factors in choosing areas for reforestation. The Šibenik district authorities reported that 'the immediate vicinity and surroundings of the city were characterised by bareness and karst, which has a negative impact from touristic, aesthetic as well as hygienic point of view. It is necessary to carry out reforestation in order to mitigate this problem'. They also expressed the intention to legally compel owners of the factory in Crnica area to reforest the land around the factory as 'one of the ugliest barren areas in the area of the city'.[247] In 1953 the Forestry Office reported that reforestation was focused mostly around the Adriatic or 'Tourist road', the newly built main road that runs along the whole coast of Dalmatia, and that for the following few years reforestation would concentrate on touristic settlements.[248] A plan was also developed to reforest large section of river Krka banks over a period of ten years. The Forestry Office explained that 'this way this area with its natural beauties of Krka canyon, Roški waterfall and Visovac, along with woodland belt near Krka, would be very attractive for tourists' (Šibenski list, 1955b).

[247] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 8th November 1954. *Pošumljavanje užeš i šireg područja grada.* N. 916.
[248] HR-DASI-Šumarstvo 19.-20.st. 5th May 1953. *Čuvanje i uzgajanje šuma-primjedbe.* N.280/53.

This period also corresponds with the establishment of numerous tourist boards across the coastal settlements in the district. These tourist boards became prominent initiators of reforestation of their areas. For instance, Murter tourist board organised reforestation of 5,000 pine trees around the settlement in 1955 (Šibenski list, 1955a) and a year later Tisno tourist board planted 10,000 pine trees in their area (Šibenski list, 1956). The importance of these initiatives was that they were undertaken on a voluntary basis by local people and did not depend on state subsidies to Forestry Office, so they continued even after the 1956 decline in organised reforestation. However, they were helped by the Forestry Office in terms of the procurement of seeds. What is more, in 1955, it became legally mandatory for the Forestry Offices to develop plans for establishing green belts or woodland parks for at least one touristic settlement in its area, in collaboration with urban and tourism experts.[249]

The broader forestry community started to pay attention to tourism from 1955 when the first articles of this topic appeared in the *Forestry Journal*. Marčić (1955) pointed out that tourism was the answer to the economic problem of coastal karst areas and islands as it was one of the most critical sectors of the state's economy and the primary source of income in the coastal region. He argued for more intensive planting of conifers 'especially in coastal tourist settlements for their aesthetic-decorative and climate point of view, and because reforested areas attract the largest number of tourists' (p.31). Šafar (1962) went as far as suggesting that areas overgrown with maquis should be reduced and replaced with pines since 'nurturing maquis is not aesthetically pleasing. In some places, it is so thick that visitor cannot walk into it nor can he see through it'. Discussions on the importance of reforestation for tourism particularly became prominent in the 1960s.

Horvat (1951) was one of the rare foresters from this period who promoted what could now be called a traditional view on reforestation where the primary purpose was seen as the protection of the soil from erosion and improvement of environmental conditions of habitats. He also supported the view that pines could

[249] HR-DASI-Šibenik 19.-20.st. Šumarstvo. *Podsjetnik o zadacima šumarija iz 1955. godina za 1956*. N.798-1956.

best resist harsh conditions of karst and after environmental conditions under their canopy have been improved, a stand was supposed to be replaced with a more suitable and resilient species.

Resin production and tourism also promoted the planting of pines rather than other species. Additionally, as reforestation was carried out more and more through sowing of seeds instead of planting seedlings, exclusive planting of pines started to dominate. This was primarily the case of Aleppo pine in the coastal areas (Beltram, 1950). Horvat (1954) claimed that the selection of species was dictated by the availability of seedlings in the nursery and the possibility of harvesting seeds from trees. For instance, Giberborejski (1951) explained that planting of native lime tree and elm could not have been done primarily because of the lack of seedlings or difficulty in collecting collect seeds. However, seeds from coastal pines were easy to obtain and plentiful:

S2: In summer months, during intense heat, the pine cone breaks and open and seeds fall out from it. You shake it a bit and using a bag collect the seeds. Seeds can be used to grow new plants in containers, or you can collect so many seeds that you sow it like wheat. You take the bags with you and disperse the seed by hand on areas where there is no vegetation.

(S2: 60s, Lozovac, M, retired/forester)

Some foresters, though, argued against the dominant use of pines. For instance, P.F. (1947) argued that 'more focus should be put on phytosociology' and that rather than 'pointless monocultures… we should aim to implement a natural state through the creation of mixed stands where in addition to tall trees specific species of bushes also have an important role. This would lead to valuable stands that are more resistant to disease and other damage' (p.397). Horvat (1954) explained that conifers were much easier to establish than broadleaves and this is why reforestation between 1947 and 1952 was dominated by pines. Only seven species were used in reforestation of Dalmatia by Dalmatia Forestry Enterprise, compared to 15 by Kapela and 33 by Viševica Forestry Offices in the mountainous karst areas of Croatia (Figure 6.19). Out of these, Aleppo pine and black pine were planted on 31% of the reforested area each, with Aleppo pine dominating in coastal areas and black pine in the hinterland.

Giberborejski (1951) confirmed that the survival rate of planted seedlings was crucial for selection of species which is why he believed most foresters decided to plant pines in their supervision area. He elaborated that in his area in the south of Dalmatia the survival of black pine never dropped below 50-60% and it was considered as a 'reliable ally of the foresters which safeguarded their honour and prestige by concealing their failures in other works of their service'. Because of this, the ratio of planting pines over broadleaves only increased in the following periods.

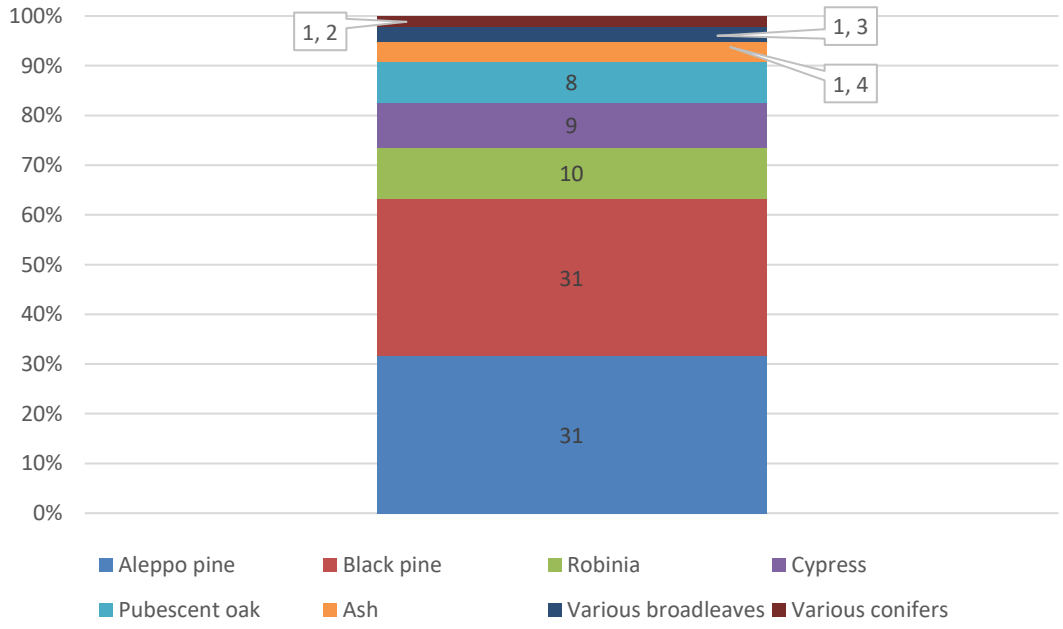


Figure 6.19. Species used in 1947-1952 reforestation of Dalmatia and percentage of reforested area on which they were planted (Source: Horvat, 1954).

In Šibenik district, reforestation had been carried out almost entirely with Aleppo pines. A report published by the Forestry Office Šibenik in 1960 listed all the reforested woodland areas within the district, both recently reforested and those with already well-developed stands. The description of the planted species reveals that all the reforested woodlands classified as 'mature' were, in fact, pine woodlands (Table 6.1). The areas that underwent reforestation in the previous years were dominantly planted with Aleppo pine, except only two locations in the hinterland. In addition to Aleppo pine, maritime pine was used on Obonjan and Velika Sestra islands (Table 6.1; Table 6.2). As in the 1920s and the 1930s, these pine woodlands were

designated as having a protective purpose, which is why they could not have been exploited for any economic purpose. This was also determined by the management plan for the period from 1956 to 1971.[250]

Table 6.1. Area and tree species in reforested 'mature woodlands' in each section of Šibenik district, 1960 (Source: HR-DAŠI-Hortikultura. 16th September 1960. *Perspektivni plan pošumljavanja za 1960. godinu i stanje postojećih šuma za Šumariju Šibenik.* N. 06-5433/1-1960).

Section	Area (ha)	Tree species
Krapanj	322	Pines
Grebaštica	76	Pines
Boraja	47	Pines
Jadrtovac	26	Pines
Vrpolje	157	Pines
Slivno	54	Pines
Konjevrate	26	Pines
Lozovac	179	Pines
Zaton	14	Pines
Zlarin	47	Pines
Bratiškovci	21	Pines
Bribir	119	Pines
Dubravice	210	Pines
Ostrovica	44	Pines
Rupe	114	Pines
Skradin	174	Pines
Velika Glava	105	Pines
Smrdelje	34	Pines
Pirovac	18	Pines
Tisno	34	Pines

[250] HR-DAŠI-Hortikultura. 1957. N. 166/57.

Table 6.2. Woodland areas classified as 'newly reforested' in the Forestry Office Šibenik report from 1960. [251]

Location	Section	Area size (ha)	Tree species planted
Konjička Draga	Boraja	60	Aleppo pine
Petrinovica	Vrpolje	42	Aleppo pine
Tanka Draga	Sonkovići	25	Aleppo pine
Rimljača	Skradin	37	Aleppo pine
Prigrada	Jadrtovac	4	Aleppo pine
Brinčuša	Bratiškovci	40	Aleppo pine
Korita	Piramatovci	70	Aleppo pine
Jelinjak	Grebaštica	150	Aleppo pine
Konoba	Grebaštica	75	Aleppo pine
Plančinik	Đevrske	50	Aleppo pine
Debeljak	Rupe	66	Aleppo pine
Čulišića Brdo	Skradin	75	Aleppo pine
Zablaće	Bribir	10	Aleppo pine
Ošljak	Perković	28	Aleppo pine and *Celtis Australis*
Ostrovačko Brdo	Ostrovica	43	Ailanthus and Mahaleb cherry
Torak	Konjevrate	20	Cypress and False acacia
Obonjan island	Zlarin	57	Aleppo pine and maritime pine
Velika Sestra island	Zlarin	21	Aleppo pine and maritime pine

[251] Source: HR-DAŠI-Hortikultura. 16th September 1960. *Perspektivni plan pošumljavanja za 1960. godinu i stanje postojećih šuma za Šumariju Šibenik.* N. 06-5433/1-1960.

6.4. Effects of migration and tourism on woodlands in Dalmatia and Šibenik area from the 1950s to 1990

The emigration trends that started to intensify during the 1920s and the 1930s gained momentum after World War II. The islands underwent an intense process of depopulation, with population growth barely maintaining positive levels (Figure 6.20). The hinterland area also became affected by emigration; however, because of the substantial natural increase, the effects were not as visible as on the islands. The effect was even less visible in the coastal areas where emigration was mitigated by the development of tourism which provided a source of income outside agriculture (Friganović, 1962).

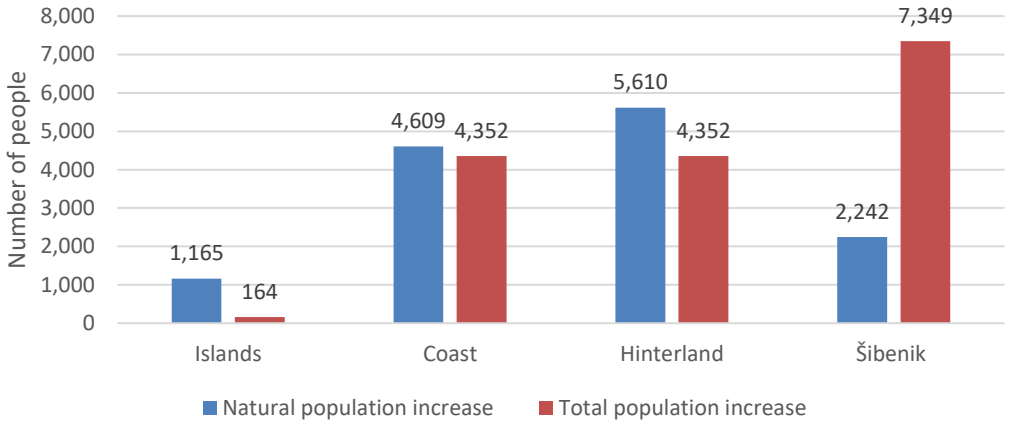


Figure 6.20. Statistical data on observed natural and total population change in different areas of Šibenik municipality between 1948 and 1958 (Friganović, 1962).

While many people emigrated abroad or to other larger settlements in Dalmatia or elsewhere in the state, Šibenik also experienced a large intake of people and continued to grow in size mainly because of immigration. After the war, Šibenik intensively started to develop its industry and port related services so that in the 1960s it produced 80% of the municipality's total GDP while 75% of that GDP was generated from secondary economic sector. The development of mainly port and industrial activities attracted particularly male population, while women and elderly were left behind in the villages. While in the city in 1958 49% of the population were men, on islands 57% of the population were women (Friganović, 1962; 1966).

With the rapid development of jobs outside of agriculture and emigration from rural areas, agriculture continued to decline. Potočić (1962) noted that viticulture in the 1960s was still employing 60% of the rural Dalmatian population, but the area under vineyards had decreased by almost 50% from the start of the century. The same was true with olive oil production, with only 5,000,000 olive trees counted in 1960, which was a quarter of the number in 1900. Because of such drastic land abandonment, vineyards moved down slope to more valuable land in the lowlands where they replaced wheat. As a consequence, slopes became used as pastures or were comletely abandoned leading to natural regeneration of shrub and tree species.

Emigration and land abandonment consequently led to the regeneration of woodland cover, but these areas were not officially listed as woodland. Statistical data on land use categories from 1956 show a considerable increase in woodland area when compared to the land survey of 1846. However, this increase in the hinterland was primarily due to changes in administrative borders as large sections of hinterland areas were later included in Šibenik district, so the area of woodland also increased along with the total area. But when comparing the percentage of area covered with woodlands, considerable differences are evident only on islands where woodland cover had increased by almost 15% and where emigration was prevalent already for several decades (Figure 6.21, Figure 6.22).

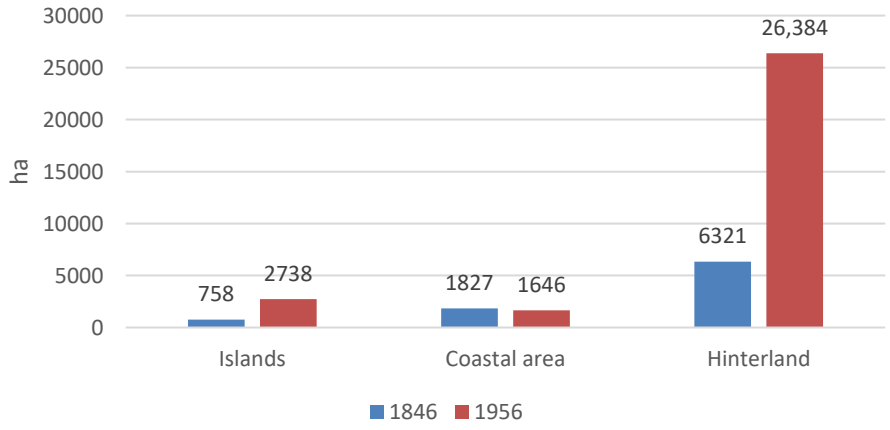


Figure 6.21. The area under woodlands in Šibenik district in 1846 and 1956 (Source: Friganović, 1966).

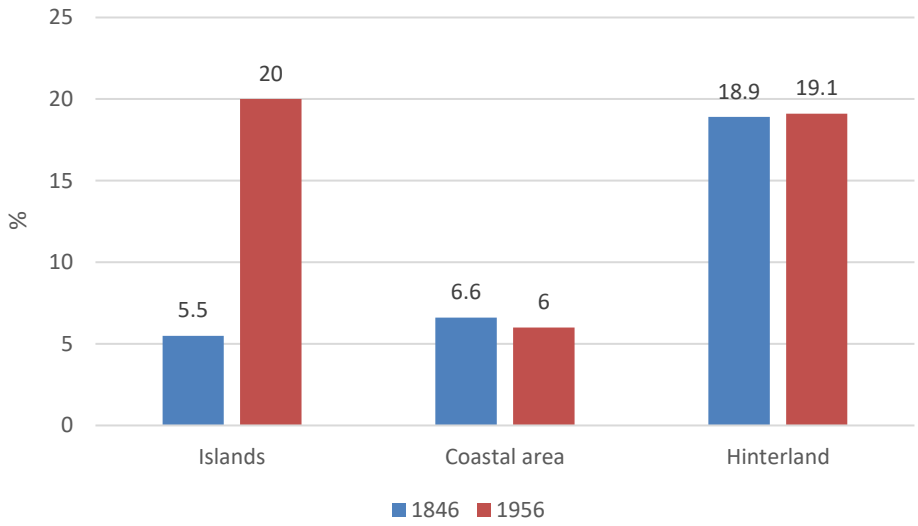
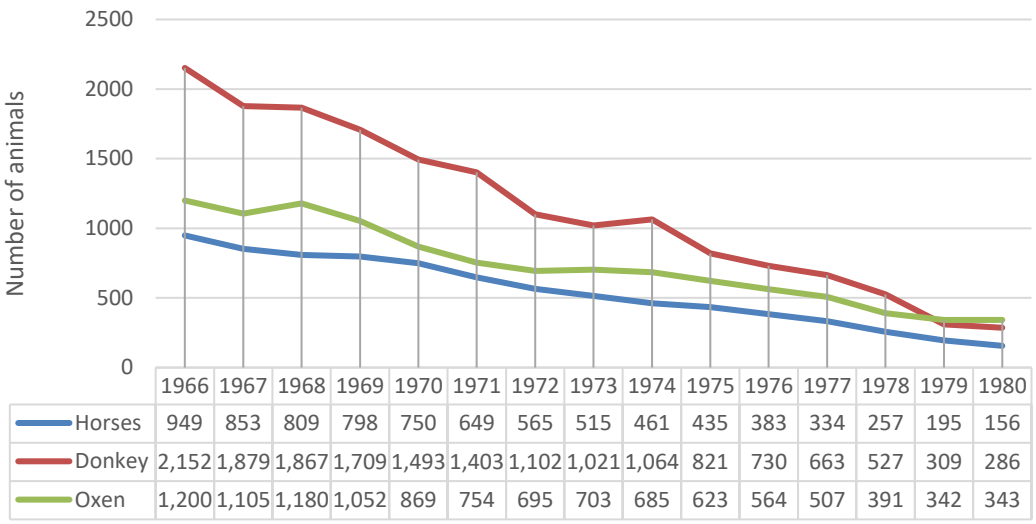


Figure 6.22. Percentage of area under woodlands in Šibenik district in 1846 and 1956 (Source: Friganović, 1966).

With the intensification of emigration in the 1970s, especially in the hinterland area, pressure on woodlands continued to diminish, especially when it is considered that the practice of cutting by local people had also stopped. In addition, a significant decrease in consumption of firewood was reported in Dalmatia because of the introduction of electrification and other sources of heating. Pastoralism was also on the decline as the number of some animals such as donkeys fell by almost 90% in just 14 years (Figure 6.23). The number of sheep decreased by 50% in the same period (Figure 6.24). The reason was that more and more people moved away or became employed in industry (Šumarski list, 1975):

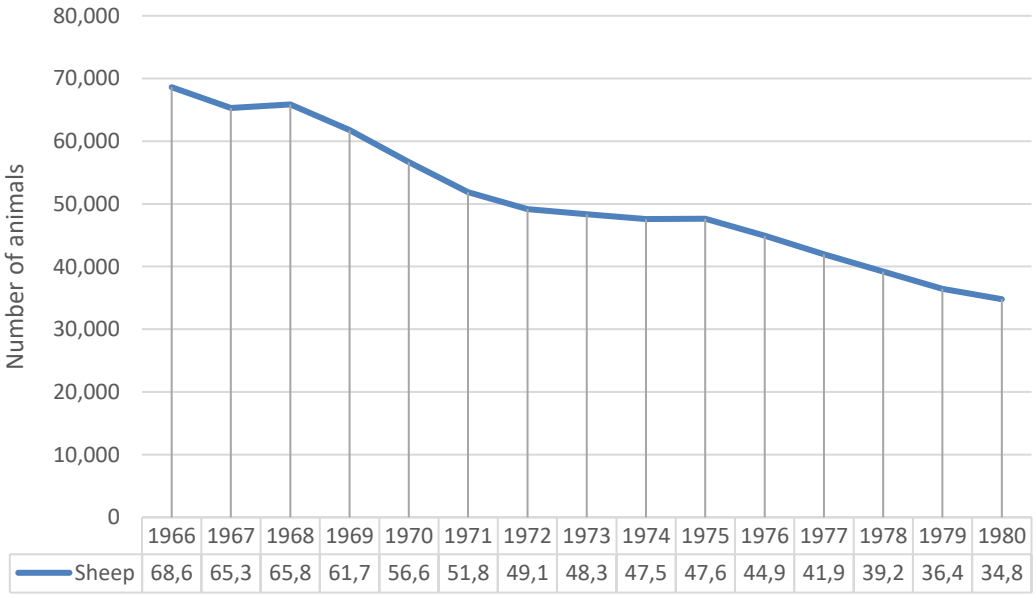
G12: When factories opened up, then the number of cattle per household started to drop. And that was from the 70s, or 1967. I do not know exactly. When factories opened, people went to work there, so there was nobody left at home to manage the animals. This is when their numbers reduced to a number that families could support. Now there is none.

(G12: 70s, Grebaštica, F, retired/civil servant)



	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Horses	949	853	809	798	750	649	565	515	461	435	383	334	257	195	156
Donkey	2,152	1,879	1,867	1,709	1,493	1,403	1,102	1,021	1,064	821	730	663	527	309	286
Oxen	1,200	1,105	1,180	1,052	869	754	695	703	685	623	564	507	391	342	343

Figure 6.23. Number of domestic animals in Šibenik district from 1966 to 1980 (Source: Management programme, 1980).



	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Sheep	68,6	65,3	65,8	61,7	56,6	51,8	49,1	48,3	47,5	47,6	44,9	41,9	39,2	36,4	34,8

Figure 6.24. Number of sheep in Šibenik district from 1966 to 1980 (Source: Management programme, 1980).

By the 1970s lime kilns in the municipality had also ceased to be used:

S2: In my time, when I worked in the Forestry Office, that is from the 70s, there were none. Or nobody told me that it was going on. It was left in the past I think. Only the more elderly could remember this.

(S2: 60s, Lozovac, M, retired/forester)

With the decreasing pressure on woodlands, the total volume of available wood in Dalmatia had increased considerably from the 1950s. In 1956 it was estimated that woodlands in national property, excluding privately owned ones, contained a volume of 3,631,400m^3 of wood or 12,6m^3 per 1ha. This increased almost three times by 1985 when the volume of wood was estimated to be 10,515,000m^3 or 31,43m^3 per 1 ha in 1985 (Vrdoljak and Topić, 1990).

The process of woodland regeneration was so prevalent in Dalmatia in the 1970s that Böhm (1978) concluded that the profound social-economic changes that led to social stratification in villages and abandonment of traditional agriculture became the fundamental precondition for regeneration of vegetation in the karst region. He argued that vegetation was undergoing a 'period of Renaissance' that was initiated by cessation of thousands of years of anthropogenic influence over vast areas in a very short period. He concluded that the vegetation regeneration was happening primarily through species that produced light seeds which were easily carried by the wind. Because of this, in Dalmatia, in open areas that used to be used as pastures and abandoned agricultural parcels, Aleppo pine experienced the most intensive spread. In coastal areas holm oak, as the main species of the maquis, failed to compete with faster growing species such as Aleppo pine and did not spread as much. In the hinterland, pastures and rocky areas were overtaken by juniper, ash, hornbeam, and especially black pine, while pubescent oak expanded more slower. Böhm (1978) concluded that Aleppo pine and black pine dominated the initial phase of woodlands regeneration as they conquered open areas and abandoned agricultural parcels, but he argued that their role and significance would have decreased over time which is why he characterised them as pioneering species. This is because pines did not regenerate well under established canopy, where broad-leaved trees outperformed the growth of young pines in the conditions of decreased light.

However, according to Böhm (1978), this regeneration of woodland dominated with pines was not something positive as he argued that 'from the point of view of protection and conservation of landscapes, the spread of Aleppo pine in abandoned agricultural areas in the coastal zone is certainly undesirable. Once

preserved and managed through hard labour, the most valuable component of our Mediterranean landscape is disappearing before our very eyes'. The same process had also begun in the hinterland, but because of the existence of pastoralism, it was much less intensive, whereas in the coastal areas, replacement of agriculture with tourism or employment in an industry rapidly led to increased land abandonment.

The process of emigration and land abandonment was not, however, set off only by the development of industry. As most of the interviewees confirmed, the building of roads had a crucial role. For the southern part of Šibenik municipality, this was of crucial importance:

G13: Only after the Adriatic Road, then it all started to develop - life became easier as people went to factories, and people were educated, and transportation developed - buses, cars. I remember in the 1960s, in Belgrade a decision was made where Highway will pass - through Upper Primošten, or Lower Primošten. Both fought in Belgrade for the road to pass through their village. And the Lower one got it, because of the sea and because of tourism. And from 1963, or 1965, since then, life began to develop. And then began a bigger boom, people leaving, factories opened… So, the Adriatic Road and factories were the two main factors that started the change. Factory and Highway gave us abandonment of villages.

(G13: 70s, Grebaštica, F, retired/housekeeper)

For others, however, the building of road meant the advent of tourism:

G2: 'It all changed when tourism arrived. The young turned to more modern life. When the Adriatic Road was built, people started to meet at fairs; cars came, people went to work in the factory in Ražine. And foreign people started to visit our village'.

G2: 60s, Grebaštica, F, retired/saleswoman)

Tourism became an increasingly important factor of the Yugoslav economy especially after 1960, but in Croatia, it was the second highest-grossing economy after shipbuilding. Through the whole period of Yugoslavia, around two-thirds of all tourists visited coastal areas (Figure 6.25) (Žukina, 1964; Gosar, 1989). The revenues from tourism expanded rapidly in the 1960s and in a period of just 20 years, from 1963 to 1986 they increased by 19 times, or from 70 million dollars in 1963 to 1,337 million dollars in 1986 (Figure 6.26).

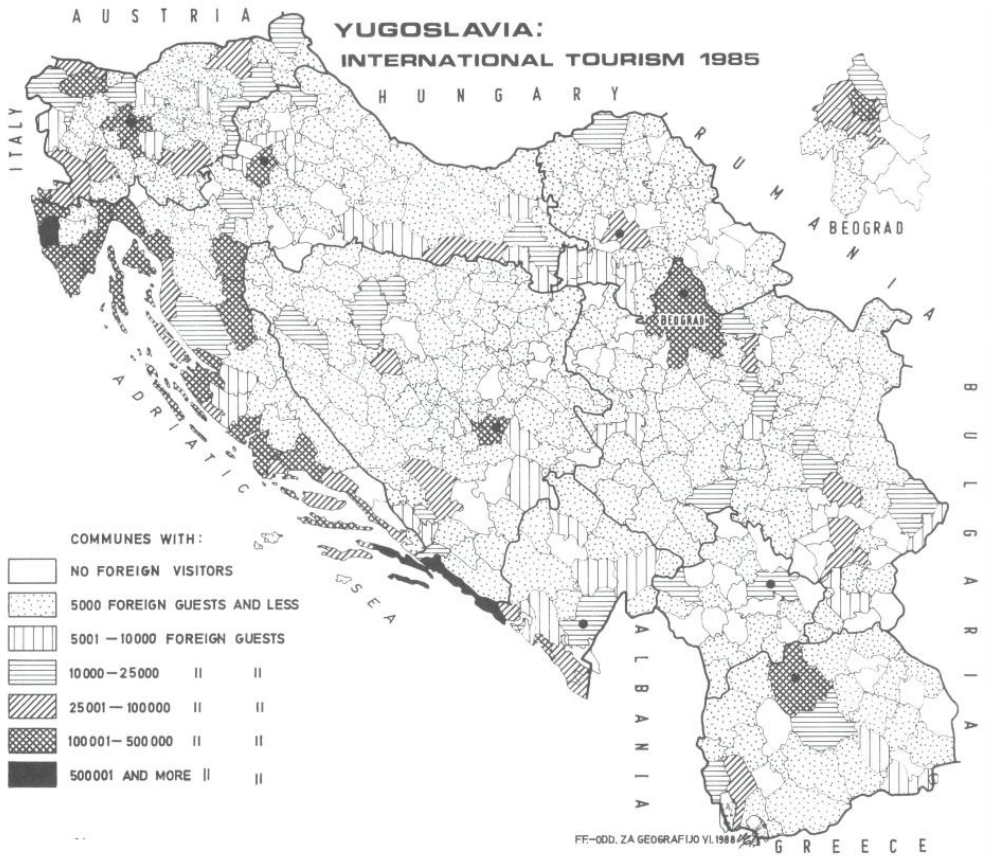


Figure 6.25. Distribution of visits by international tourists in Yugoslavia in 1985 (Source: Gosar, 1989).

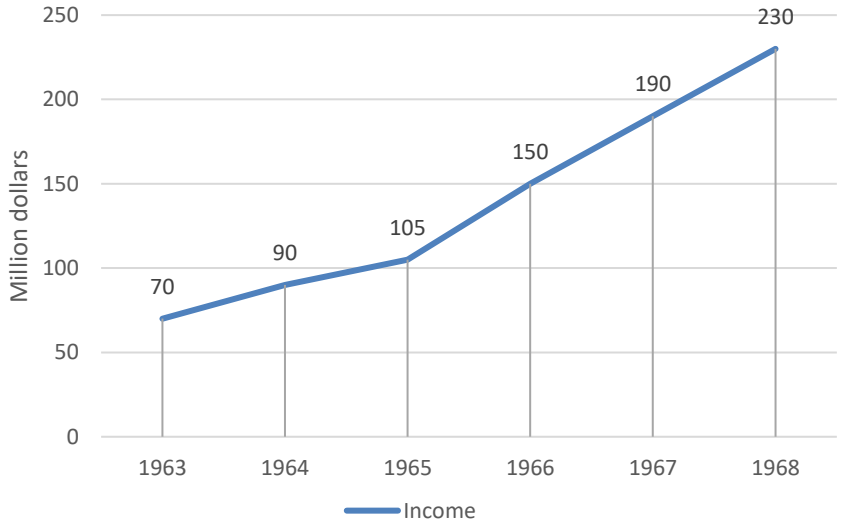


Figure 6.26. Income from tourism in SFR Yugoslavia from 1963 to 1968 (Golubović, 1970).

Tourism already had a significant influence on reforestation in the coastal areas, but with its further development, this became more prominent. As the resin industry collapsed by the end of the 1950s, the management of pine stands began to shift towards exploitation for tourism and recreation, and the new management plans were developed accordingly (Golubović and Meštrović, 1966). Potočić (1962) argued that the Yugoslav government was not interested in establishing woodlands in barren karst areas anymore, especially in Dalmatia, since it could import wood cheaply from other parts of the country. Instead, he claimed that 'goals of establishing woodlands come from the requirements of other economic sectors. Therefore, the improvement and reforestation of the woodlands on karst will have different goals now, and those should be defined by users of woodlands and not the forestry service. The role of forestry service is only to initiate the development of those goals'.

Since seaside tourism had specific requirements from woodlands, they became increasingly important for shade in camps or on beaches, or near viewpoints and recreational areas (Šafar, 1968) (Figure 6.27). The Yugoslav advisory centre for agriculture and forestry concluded that preservation of woodlands in coastal areas and the establishment of new ones along the Adriatic Highway were the main preconditions for the development of tourism as it was determined that in 1962 83% of overnight stays happened at places in or near woodlands. Because of this, it was stressed that further development of tourism required quick and cheap reforestation with tree species that grew very quickly (Tkalčić et al., 1965). As Tomašević (1979) pointed out, tourist organisations looked for attractive swimming areas adjoining woodland for establishment of objects for accommodation. This also brought revenues for the Forestry Offices, as Golubović and Meštrović (1966) calculated that Aleppo pine stands containing a tourist camp generated revenues 277 times higher than all the woodland products that would have otherwise been produced. They viewed this as an opportunity for Forestry Offices to lease the land with pine stands and collect a part of revenues.

Figure 6.27. Beach in Rogoznica on Raduča peninsula which was reforested at the start of the 20th century (Source: Private archives).

The importance of these revenues was also supported by the director of Forestry Office Šibenik:

S2: We made a profit from National Park Krka – the area was not a park then [in the 1960s and the 1970s], it was a natural reserve managed by enterprise Kras. From then on, we were always voted as the best managed in all of Dalmatia because we had profited from tourism and hospitality. We had a camp there and a store. It was a car camp.

(S2: 60s, Lozovac, M, retired/forester)

He also noted that revenues from that one camp were almost enough to cover the costs of all works of the Forestry Office which enabled it then to carry out more activities in the management of woodlands. After all, as he pointed out, this was a period where Forestry Offices were struggling to finance their operations:

S2: The point was to create financial gains.

(S2: 60s, Lozovac, M, retired/forester)

Because of tourism, the purpose of reforestation had begun to change even more rapidly, and this was noted by many foresters. According to Golubović and Meštrović (1966), coastal woodlands were more often viewed from the tourism-economic point of view, so the reforestation with seedlings and traditional species had started to be abandoned and so was reforestation of hills and barren areas that were located far away from coast, roads, hotels, motels and tourist settlements. Šafar (1968, p.149) acknowledged that historically reforestation had a goal of mitigating erosion and deluges but because of tourism new reforestation was 'a reflection of local aesthetic-sentimental or touristic incentives and less of a general economic and ecological-ameliorative need'.

One of the consequences of this change was that woodlands were beginning to be overloaded with bungalows, tents, car parks, camping areas and weekend-settlements (Tkalčić et al., 1965; Šafar, 1968) (Figure 6.28; Figure 6.29). Revenue from these objects was collected primarily by the tourism industry, but very little of it was reinvested into the management of stands or establishment of new ones. Because of this and increasing exploitation, it was reported that the tourist and recreational potential of coastal woodlands had started to decrease rapidly (Antoljak, 1976).

Figure 6.28. Postcard circulated in 1979 showing hotel complex in Solaris built in 1966 (Source: Private archives).

Figure 6.29. Postcard of Primošten from 1980 with a view of hotel complex on Raduča peninsula which was reforested with Aleppo pine in 1947 (Source: Private archives).

The new reality concerning coastal woodlands was recognized and legislated in the 1977 Forest Law. This determined that the goal of woodland management in karst areas was not firewood production but the provision of non-market forest functions. These were social non-market functions such as benefits they provided for tourism, health and recreation and protective non-market services such as mitigation of erosion, protection from wind and hazards, etc. (Prgin, 1979). The new reality concerning Dalmatian woodlands was summarised by Prpić (1979, p.8-9):

'Woodlands in this part of our beautiful Republic are especially important because of their non-market functions. They help us maintain a steady flow of drinking water during droughts, mitigate climate extremes, impair the effect of erosion and deluges, slow down the intensity of backfilling of accumulation lakes, increase agricultural production, protect roads and settlements from wind gusts, provide landscape with a particular aesthetic quality, clean the air that is polluted by dust and smoke from factories, produce oxygen, participate as an irreplaceable element in spatial plan, provide location for sport and recreation…'.

Tomašević (1979) agreed with the list of non-market functions provided by Prpić, but he also singled out tourism and recreational-hygienic ones as the most

important among them. This was confirmed in the 1980 Management programme for Šibenik Forestry Office which stated that pine woodlands in the coastal belt had the highest significance for tourism and should be managed accordingly, but even for naturally distributed maquis woodlands the management programme proposed improvements which will increase their value for tourism and recreation and for improvement of their landscape function' (Management programme, 1980, p.40).

The social changes that brought about land abandonment and consequently regeneration of woodland cover on previously exploited pastures and woodland parcels directly led to an increase of forest fires. This was made even worse with the planting of inflammable pine species and their wind-induced spreading over abandoned land. It was not until the late 1960s and in the 1970s that this became evident.

From 1958 to 1967 in Croatia, an average of 2,407 ha of woodland area burned each year, and this increased to 3,685 ha in 1968 and to almost 5,000ha in the 1980s (Vajda, 1970; Bertović, 1987). In Dalmatia from 1972 to 1977 a total area of 19,408 ha of woodlands burned. In the same period, only 2,558 ha of the area was reforested which means that the area that burned was 7.36 times larger than the reforested area (Tomašević, 1979). The damage from forest fires in coastal areas and on islands rapidly increased over the years, not only because of the devastation they caused in planted pine woodlands, but because they endangered tourism through deterioration of landscape appeal (Vajda, 1970). Also, they directly endangered settlements and human lives, as many pine woodlands were established close to villages and hotels (Figure 6.30).

When asked about the occurrence of forest fires in Šibenik area, elderly residents could not recollect such events, be it pine woodlands or broadleaved woodlands where firewood was procured:

Q: Where there forest fires when you were younger?

G14: No, never. This is all now with tourism; this happens now only. Never before.

(G14: 80s, Konoba, F, retired/farmer)

Q: Where there forest fires in woodland where you collected wood?

B1: No, never. There was no dry wood. There was nothing to burn. You had to go all the way to Skadrica, near Podine and Vrsno to get some dry wood.

(B1: 80s, Boraja, F, retired/housewife/farmer)

Figure 6.30. Forest fire on Šubićevac hill in the outskirts of Šibenik on 4th August 1988 (Source: Private archives).

A significant forest fire occurred on Šubićevac hill in the outskirts of Šibenik on 4th August 1988 (Figure 6.30) and destroyed the pine woodland that had been planted ever since the 1890s. Satellite images from the 1980s reveal the occurrence of several more, but these were very limited in area and did not endanger agricultural areas nor settlements. Only one more forest fire stood out in its size, and that was the one that spread from the pastures near Vrpolje and destroyed Petrinovica pine woodland in 1986 (Figure 6.31).

As depopulation and land abandonment continue to intensify in the 1990s because of general economic and social changes that were emphasised by the War of Independence (1991-1995), forest fires became the biggest problem of Dalmatian forestry.

Figure 6.31. Petrinovica pine woodland on aerial image from 1968 (top) and satellite image of Vrpolje and Grebaštica area from 1986 (bottom). The area that burned in a forest fire is clearly visible in a lighter shade of colour, while the location of the destroyed Petrinovica pine woodland is marked in red by the author (Source: MGPU-ISPU, 2018; Google Earth).

6.5. Case study analysis – woodlands in the Yugoslav period

6.5.1. Zlarin

Zlarin was the first settlement to be engulfed in the most intensive process of depopulation in Šibenik district (Friganović, 1962). Although the process was evident already at the start of the 20th century, emigration rapidly intensified in the 1920s. According to Stulli (1982) 'devastation in vineyards, collapse of sailing and the constant decline in olive oil production merged into a crisis of such scope and structure that it set in motion the process of continuous decline which hit every part of the community, without exception, and which goes on until the very day' (p.67). Between 1921 and 1960 more than half of the island's population had emigrated and by 1991 less than 21% remained (Figure 6.32). A similar process occurred in the remaining island settlements of Šibenik district, that is Krapanj, Kaprije, Žirje and Prvić, but because of the lower agricultural density, the process had begun later than in Zlarin and was more evident in the second half of the century.

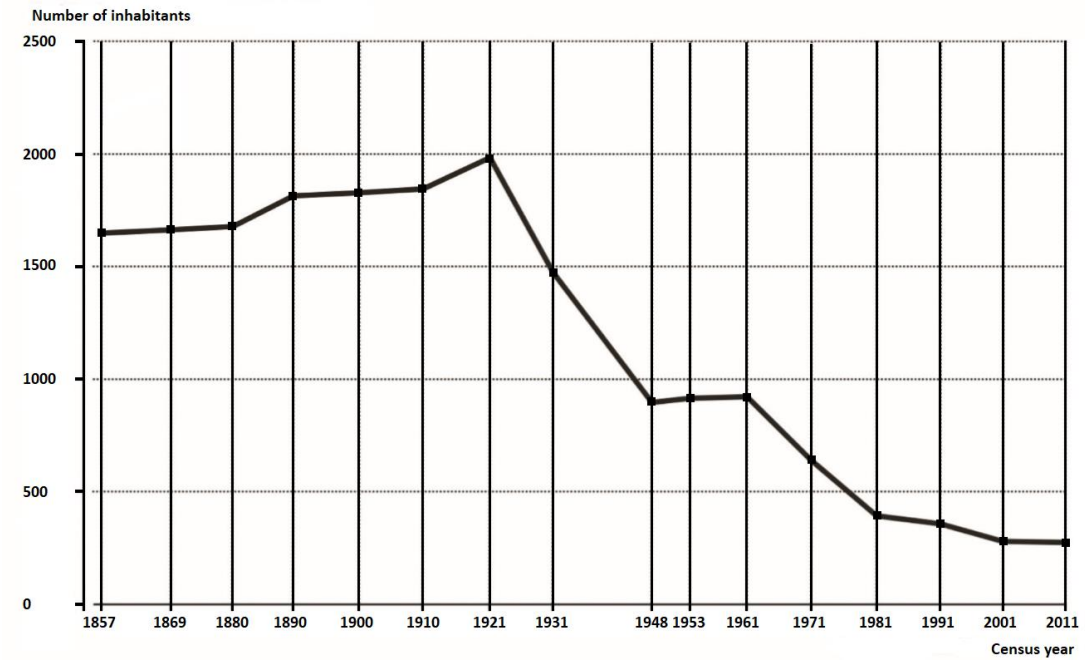


Figure 6.32. Population change of Zlarin from 1857 to 2011 (Source: Klempić Bogadi and Podgorelec, 2011).

Due to such rapid loss of population, Zlarin island also experienced rapid land abandonment. The number of vines and olive trees halved by the 1950s (Stulli, 1982). Some of the vineyards that were devastated with phylloxera were reforested with pines already at the start of the century and there is evidence that in the 1920s and the 1930s this process continued. For instance, on several occasions, pine processionary infestation was recorded.[252] In 1927 reforestation was carried out on parcels that were owned by the Church.[253] Elderly people on the island still recollect that small pine stands were established across the island before World War II. However, the most substantial reforestation activities followed immediately after World War II.

According to the local people, reforestation was carried out mainly by school-children at least until the 1970s:

Z6: It was after the War, probably between 1947 and 1950. We went to reforest with school. But it was all just for fun to us; you cannot say it was some real work'.

(Z6: 80s, Zlarin, M, retired/fisherman)

Z1: I was in 4th grade in 1964. It was the time when we would go with the school and reforest up there in the hills. We were happy to do it, and now we would give anything to get rid of those pines.

(Z1: 60s, Zlarin, M, retired/civil servant)

The aerial images of Zlarin from 1968 reveal the existence of pine stands that were scattered across the whole island, particularly in the north-western part called Marin (Figure 6.33). Pine woodlands that were planted on Church grounds at the top of Klepac hill in 1927 are also visible as covering several disjunct parcels. Some of the

[252] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 13th December 1922. N. 16378/22; HR-DASI-Šumarstvo 19.-20.st. 30th January 1933. *Oglas*. N. 3102; HR-DASI-Šibenik 19.-20.st. Šumarstvo. 11th December 1936. *Poziv za čišćenje gnjezda borovog prelca u veštačkim šumama*. 22958/36

[253] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 1927. *Iskaz zemljišta koja da se pošume u općini Zlarin*. N. 1910/27

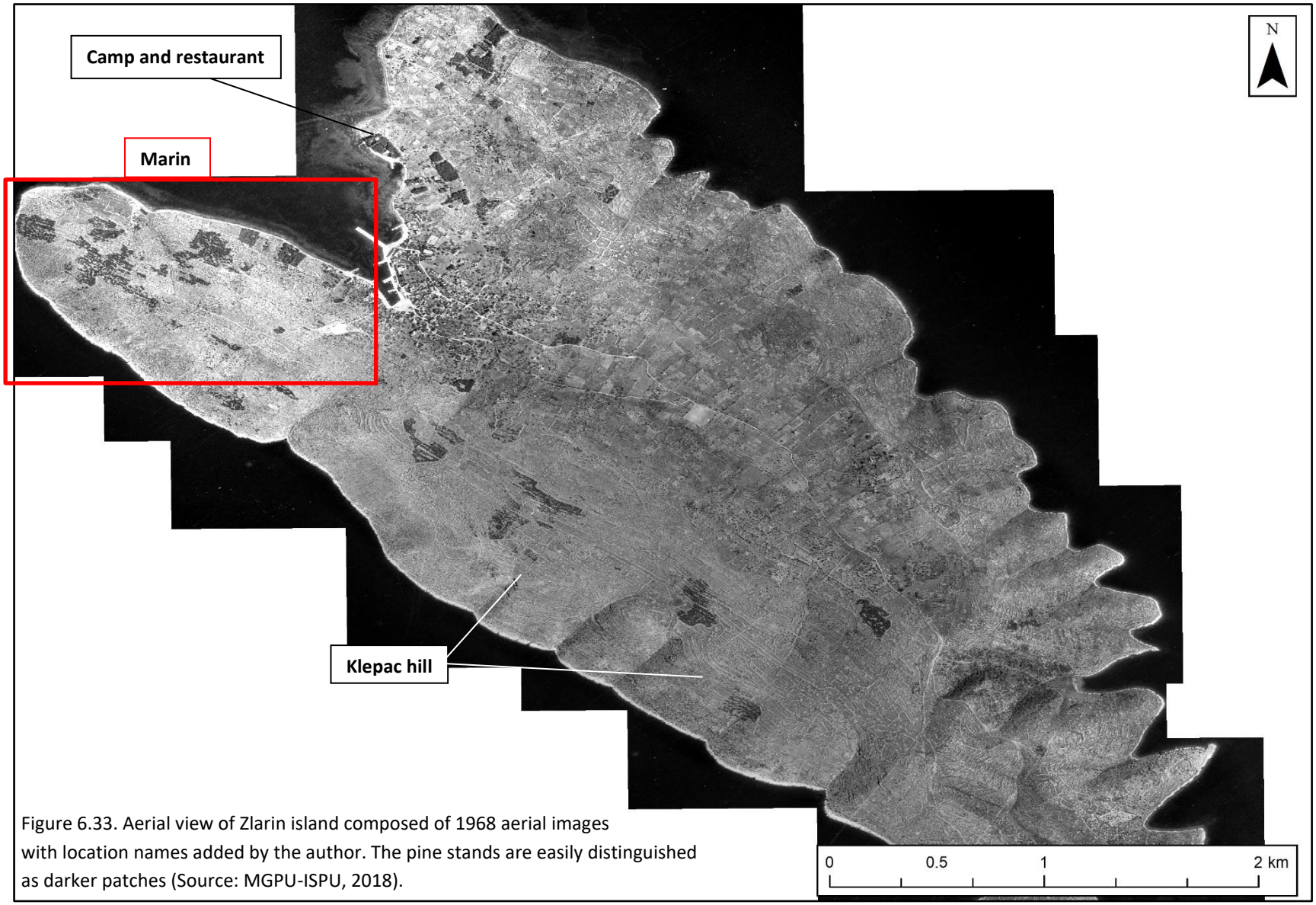


Figure 6.33. Aerial view of Zlarin island composed of 1968 aerial images with location names added by the author. The pine stands are easily distinguished as darker patches (Source: MGPU-ISPU, 2018).

older pine stands were already used for tourism in the 1960s. This was the case with a pine stand locally known as Borići (*small pines*) to the north of the settlement in which a camp and a restaurant were constructed.

The comparison of images of Marin area from 1935 and 1965 shows that the pine stands were being established quickly (Figure 6.34) and confined to specific parcels. In contrast to other areas of the district, reforestation in Zlarin was unique because it was carried out exclusively on private properties. The Marin example (Figure 6.35) emphasises that this was possible because the land use ever since the

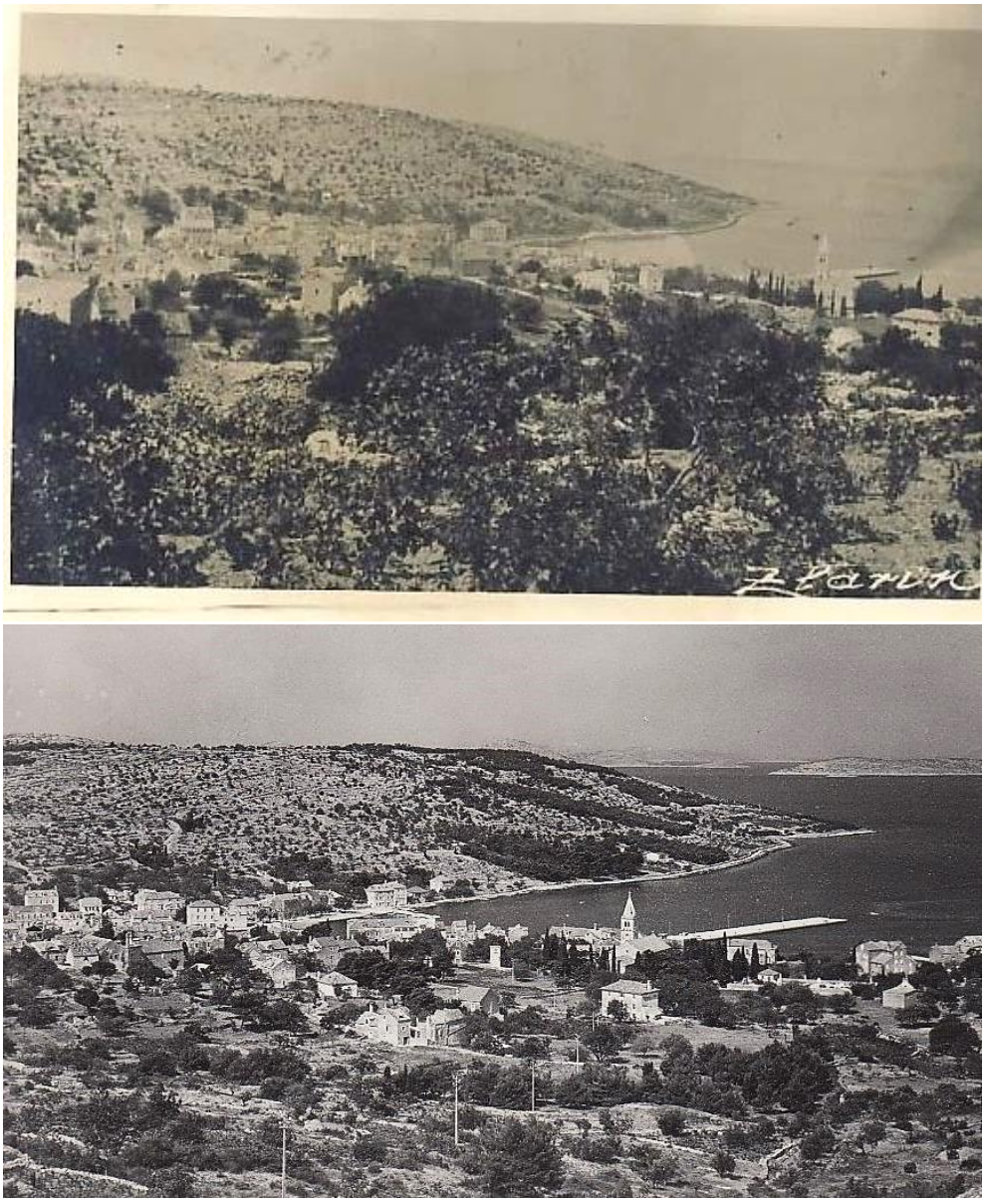


Figure 6.34. Postcards of Zlarin with a view on Marin area in 1935 (above) and 1965 (below) (Source: Private archives).

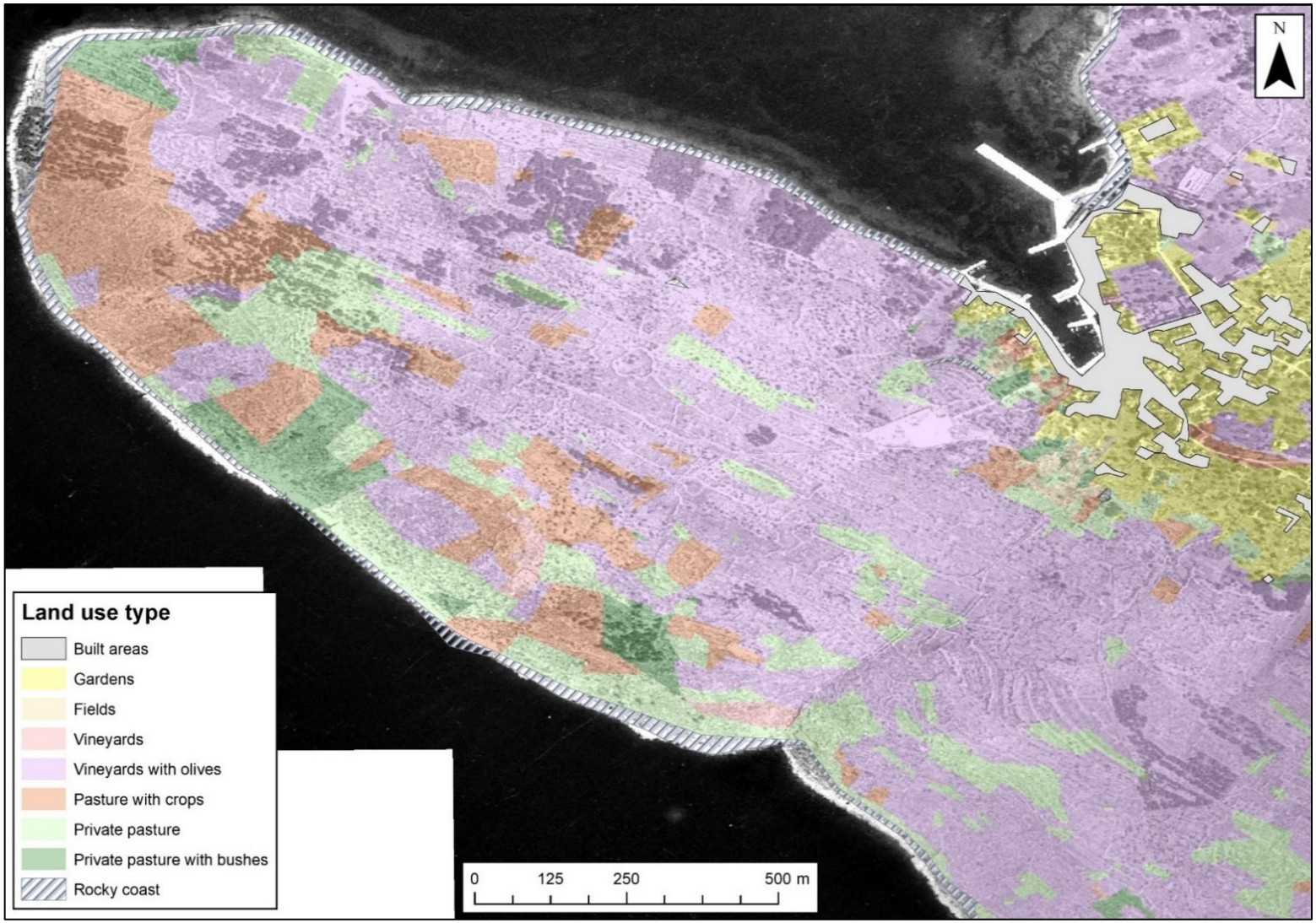


Figure 6.35. Aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map made from 1825 cadastral plans showing Marin area, Zlarin.

early 19th century was dominantly agriculture, that is viticulture and olive oil production. As people started to leave the island, these parcels ceased to be cultivated, and some owners opted for reforestation. According to the local people, it is likely that people agreed to reforest their parcels because they gained certain subsidies for this, but there are no records to support this. Others say that there was a certain gain in terms of obtaining firewood since pines were not used for anything else:

Z6: It has no other purpose but to burn it for heating. People would take what they have on their parcels.

(Z6: 80s, Zlarin, M, retired/fisherman)

Finally, some mentioned that at the time it seemed a good idea to reforest the parcel since there was nobody left to work any crop in it.

By the late 1970s, the population of the island had fallen to just 400 and agriculture had collapsed almost completely. Photographs of Zlarin settlement from 1976 reveal substantial regeneration of vegetation on previously worked hills above the village (Figure 6.36). What used to be pastures, vineyards and olive groves were now being overtaken by naturally regenerating maquis. However, according to the local residents, even though reforestation had stopped, pines continued to naturally spread across the island from planted stands (Figure 6.37).

Figure 6.36. Zlarin settlement in 1976 (Source: Private archives).

Figure 6.37. The southern part of Zlarin island on aerial images from 1968 (above) and 2011 (below). The expansion of pines had occurred particularly on the eastern coast of the island which was historically more agriculturally exploited than the steeper and rockier western coast. Survival of small-scale agriculture in fields in the central part of the island had stopped the spread of pines on the most fertile terrain (Source: MGPU-ISPU, 2018).

The barren or poorly overgrown areas of past terraced vineyards and pastures represent the most suitable habitat for young pines which developed from wind-dispersed seeds, so the expansion over the island was rapid.

Besides Zlarin island, reforestation was carried out on nearby smaller islands – Drvenik, Dvainka, Rakitan, Mumonja, Oblik, Krbela Mala and Krbela Vela. These islands all used to be municipal pastures where people took animals or collected scarce firewood, but in 1956, the ownership of the islands was given to the Forestry Office Šibenik. Reforestation was carried out immediately on Krbela Mala and Krbela Vela, and later on, the rest and Aleppo and maritime pine woodland started to spread (Figure 6.38).[254] According to forester Prgin (1995), the reforestation was entirely carried out for aesthetic reasons.

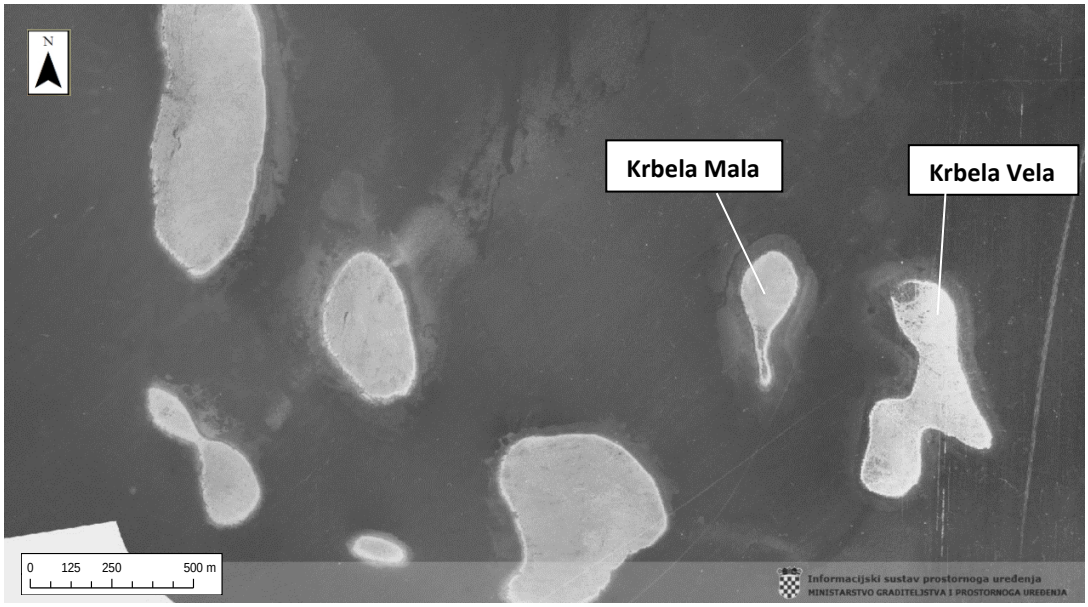


Figure 6.38. Aerial image of Drvenik, Dvainka, Rakitan, Mumonja, Oblik, Krbela Mala and Krbela Vela islands south-west of Zlarin from 1968 (Source: MPGU-ISPU, 2018).

Among the uninhabited islands around Zlarin, Obonjan island is probably the best example of the change in land use that occurred after reforestation. Until the 1950s Obonjan was predominantly a barren island on which several vineyards were worked by villagers of neighbouring Prvić island. In 1954 Šibenik Forestry Office decided that Aleppo pine woodland would be established as a part of the decision to

[254] HR-DASI-Šumarstvo 19.-20.st. 4th April 1956. *Rješenje.* N. 6612/56.

improve the aesthetic appeal of Šibenik archipelago. The aerial image from 1968 shows the prevalent bareness of the island, while small pine trees that were planted since 1954 can be seen growing on most of it (Figure 6.39). After the trees had grown from the 1970s to the 1990s, the island was designated as a tourist-recreational area, and in total 17 pavilions, a restaurant, ambulance, administrative building, pool with sea water, playgrounds and sports facilities were built, while a beach and a swimming area also established. Each year, the island was visited by thousands of domestic tourists, primarily young people and 'scouts', which is why the island became known as the Island of Youth (Prgin, 2003; 2005). Without the shade of tall pine trees, such infrastructure would never have been built (Figure 6.40; Figure 6.41).

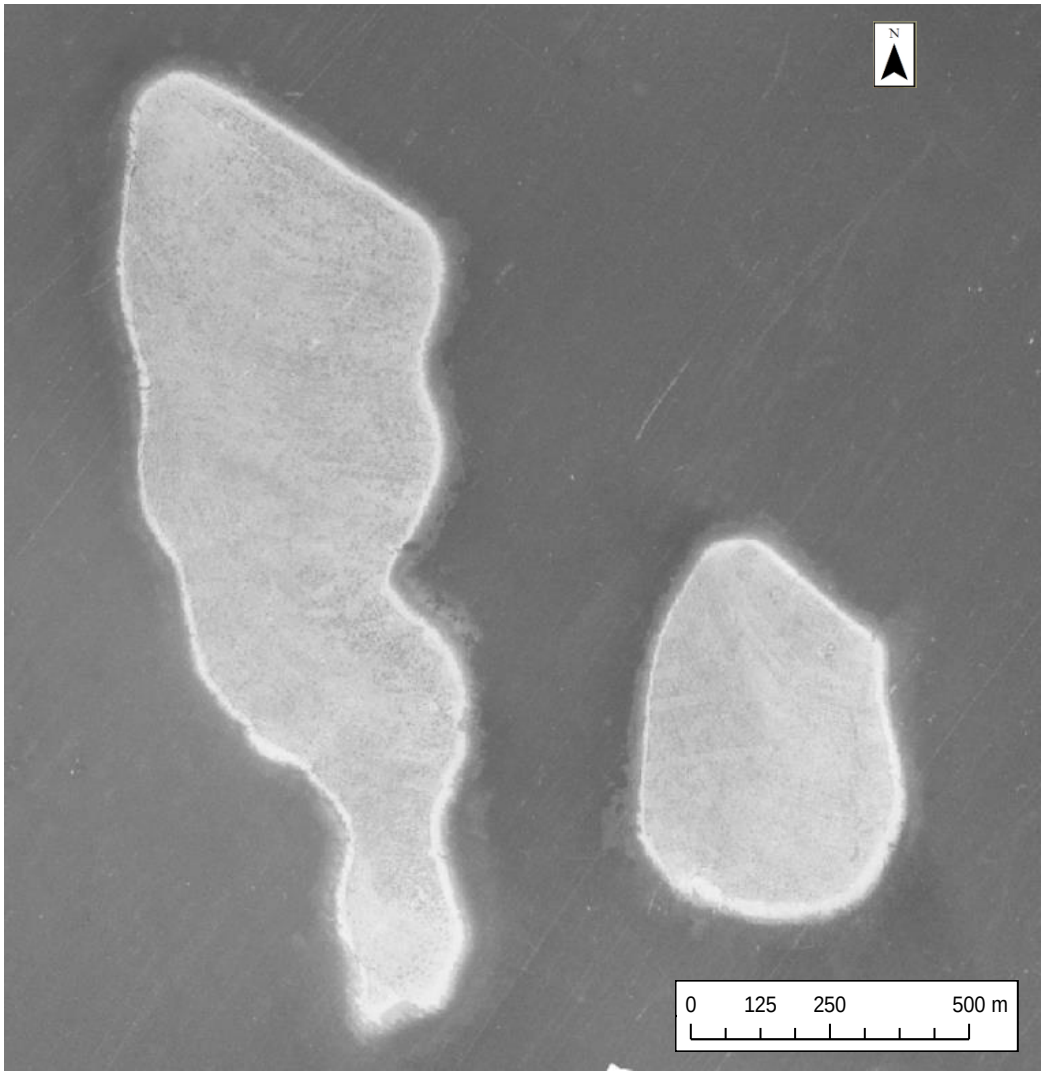


Figure 6.39. Obonjan island on aerial image from 1968 (Source: MGU-ISPU, 2018).

Figure 6.40. Obonjan island as seen from neighbouring Zmajan island in the late 1970s. In the background, the hilltop of Sestrica Vela island can be seen which was not yet reforested and represents the type of landscape that characterised Obonjan before reforestation (Source: Private archives).

Figure 6.41. Obonjan and Sestrica Vela islands on Google Earth images from 2019 (Source: Google Earth).

6.5.2. Krapanj / Grebaštica

Unlike Zlarin, Krapanj island and Grebaštica experienced a different process of population change in the 20th century. In Grebaštica, like other coastal settlements, the population grew well into the second half of the 20th century. But in the 1960s, the population of Grebaštica area decreased by more than 10% although this was reversed in the mid-1980s and recovery of the population followed. In contrast, Krapanj island-settlement, where emigration in the first part of the 20th century was largely avoided due to its close proximity to the mainland and agricultural areas, lost more than 50% of its population in a period from 1953 and 1981. The statistical change in 1981 partially occurred because of administrative changes (Figure 6.42).

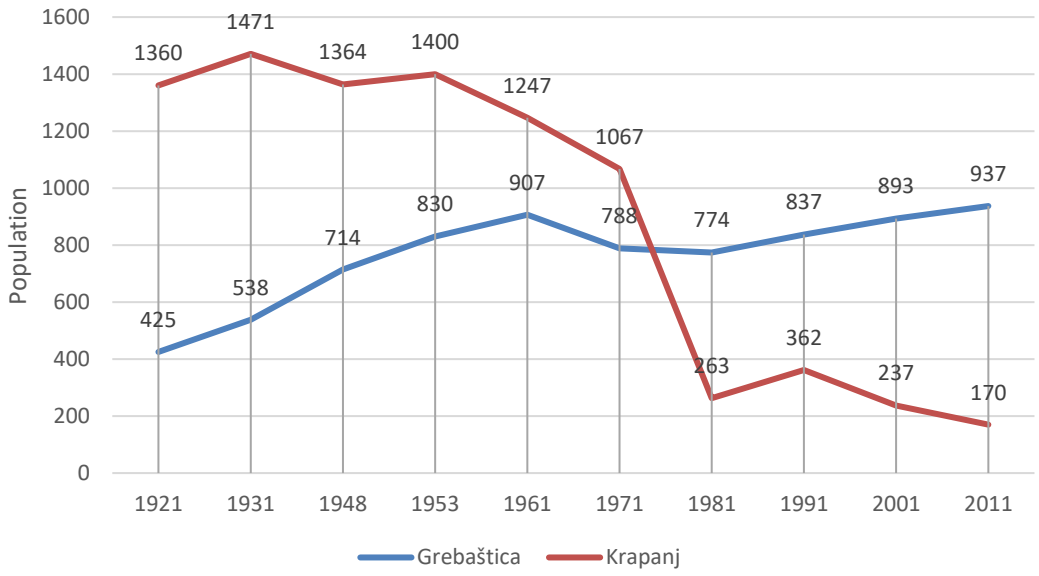


Figure 6.42. Population change of Grebaštica and Krapanj settlements from 1921 to 2011. The data for Krapanj in 1921 and 1931 includes parts of Jadrtovac settlement. Because of administrative changes, from 1981 settlement Žaborić (population of 130 in 1981) was counted separately from Krapanj, and some parts were adjoined to Brodarica settlement (DZS, 2018).

Until the 1970s, agriculture was the main and almost the only activity in Grebaštica. Because of the growing population, much of the landscape was cultivated:

G1: When you look at the landscape today, there is a big difference compared to today.

G2: It all used to be dug up, cultivated. People worked in the fields everywhere, day and night. They dug vineyards, planted wheat where they could. They would cultivate olive and fig trees.

G1: There were more than 10,000 sheep here, roaming the hills. Now, not even 50.

G2: And so many people. They all lived in huge families. The family of Joso, the instructor - there were 40 in their house. That is what they were telling us at least.

(G1: 60s, Grebaštica, M, retired/electrician; G2: 60s, Grebaštica, F, retired/saleswoman)

The agricultural areas had expanded onto areas that were in the 19th century designated as municipal pastures (Figure 6.43). Most of the expansion occurred in the 20th century as revisions of land parcels from 1876 and 1882 still show the areas as a municipal pasture.[255] As the population of Krapanj declined, its people sold most of its land to villagers of Grebaštica who then continued to cultivate them.

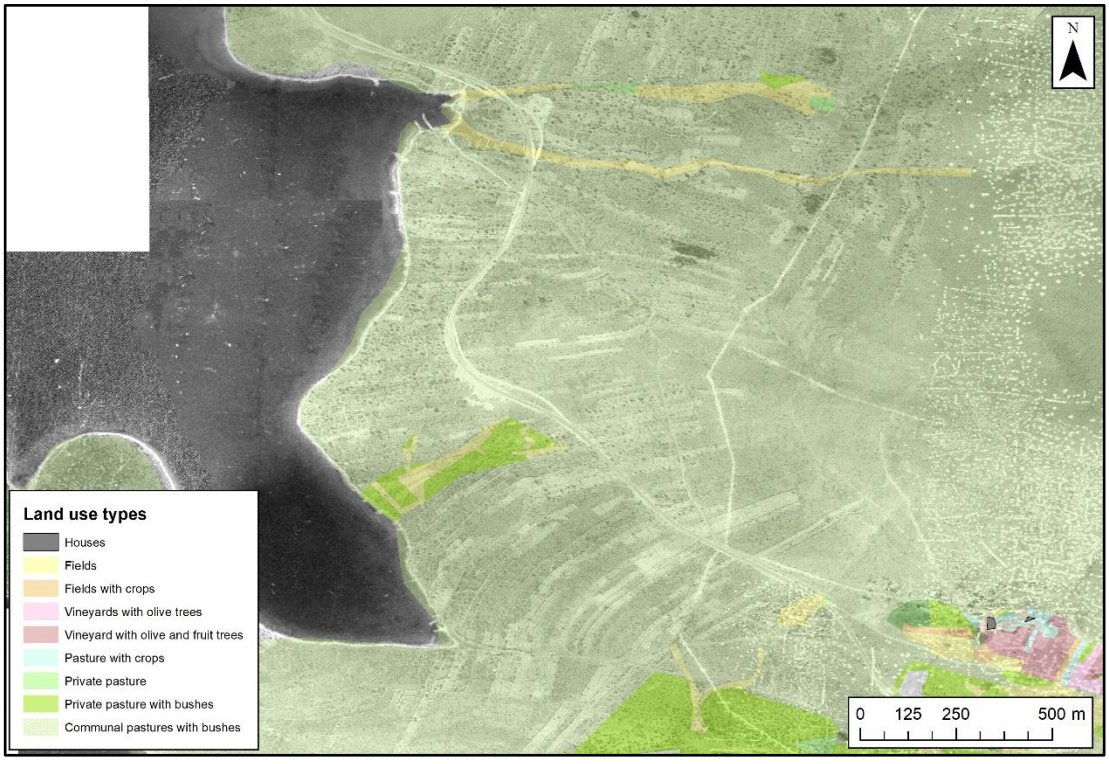


Figure 6.43. Aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map made from 1825 cadastral plans showing Mrzle Vale in Krapanj/Grebaštica area.

Pastoralism was a significant component of livelihood in Grebaštica for the most of the 20th century. The animals were taken for pasture on the hills in the hinterland of Grebaštica and Konoba settlements (Figure 6.44), toward Vrpolje, where

[255] HR-DAST-152 Arhiv mapa za Istru i Dalmacij, KO. 279 Krapanj. *Protocollo delle particelle dei terreni*, 1825/1882

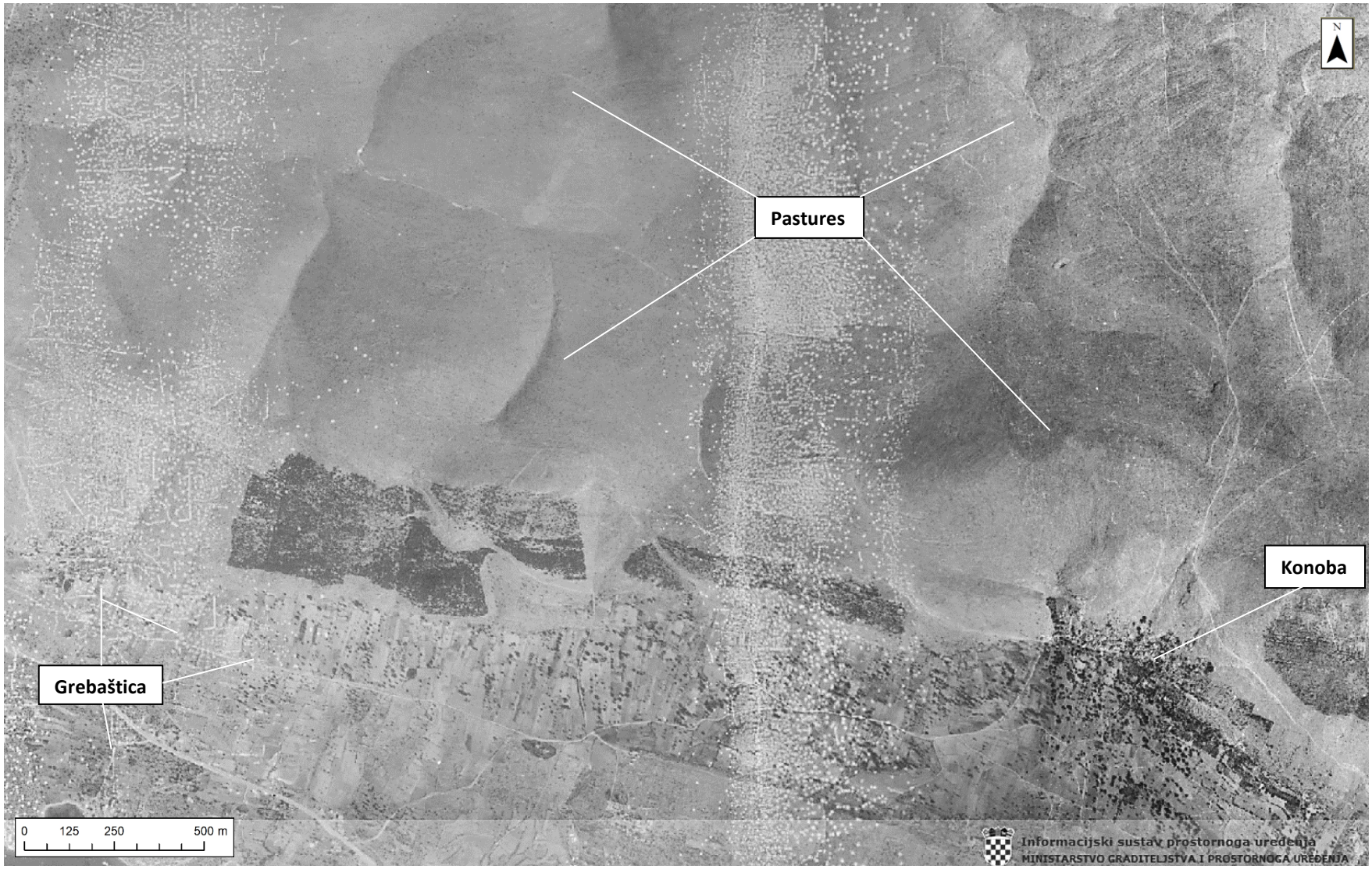


Figure 6.44. Aerial image of Grebaštica area from 1968 with the location of pastures in the hinterland of the village (Source: MPG-ISPU, 2018).

they grazed grass and herbaceous plants and browsed scattered bushes. The terrain was harsh and without any significant development of vegetation (Figure 6.45). According to local residents, the landscape looked the same even during the lives of their predecessors and very little changed because of the continuing pasturing. Whatever bushes developed, mostly juniper, the locals cut for firewood. Since the 1825 cadastral plans show that the area was designated as a municipal pasture even then, it is likely that the same type of land use had existed here for centuries.

Figure 6.45. Pastures between Grebaštica and Vrpolje villages. The scattered trees are mainly young pine trees which spread only in the last two decades, whereas the landscape in 1968 was without any trees (Ivan Tekić, April 2017).

There was no limit as to the number of animals that could pasture here, and the pastures supported not only animals from Grebaštica but of neighbouring villages as well:

G14: We took them there, behind the hills, it was all free for pasture. In the morning you let them loose alone and, in the evening, you went to find them. If somebody could afford a shepherd, he would follow them for the whole day. I would send mine alone, and they would come back in the evening, you could keep as many as you wanted that way. Each house had at least 20 sheep. Some had more than 50.

(G14: 80s, Konoba, F, retired/farmer)

G7: We would meet with the villagers of Podine and Vrsno and Jadrtovac. We would all meet - shepherds, us, children, and everybody would guard their own flock. If an animal escaped, you had to go and look for it.

(G7: 70s, Grebaštica, M, retired/farmer)

During the summer months, it was different because of the heat. Then the custom was to bring the animals home during the day and set them loose during the evening and night. There was no vegetation that could shield them from the sun. The centuries-long custom of transhumance, sending flocks of animals to the mountains of the hinterland, also survived at least until the 1980s:

G5: It was when the summer starts. They would take them to mountain pastures. There was one, we called him *planinar* (*mountaineer*), who would collect all the animals – from Grebaštica, Jadrtovac, everywhere! You would pay a certain amount for each animal, and they would be taken to Drniš (a town in the hinterland). Then, somebody would take them from Drniš to pastures on Dinara and Promina mountains and keep them until summer was over.

(G5: 50s, Grebaštica, M, fisherman)

G12: Sheep would go in those three summer months into mountains. We called it mountains, and it was a part of Bosnian territory. It was rainy there, and there were forests and food for them. Here there was no food for those animals, over summer. And even during winter, we would have to walk all day with them to feed them, from above the hill and down, and back again. The pastures were very scanty.

(G12: 70s, Grebaštica, F, retired/civil servant)

According to the local people, this practice stopped in the 1980s, when agriculture, in general, had started to decline, and people stopped keeping animals.

Along with sheep, people also kept goats. Many of them remember the ban on goats that existed immediately after the War, and some recollected stories from their ancestors that a ban was enforced before World War II. According to the archival records, a ban was enforced in Grebaštica and neighbouring Vrpolje areas in the 1930s to encourage the establishment of low-growth woodland of ash, hornbeam and oak in Vrpolje gaj. The then existing municipal woodland was supposed to be cleared of juniper and other stunted trees, while protection was enforced by the

prohibition of all exploitation and killing or selling of all goats in the area.[256] After the war, the ban was enforced as a part of the nation-wide agenda of extermination of goats. However, in the 1960s and 1970s, people again started to keep goats as the regulation was eased. To most, the goat was more valuable for a household than the sheep was, but sheep were easier to keep since restrictions were placed on the keeping of goats:

G13: You couldn't go to the field because of a goat. They would browse plants, destroy olives and figs. You could not let goats loose in Forestry Office owned woodland. Only where other woodland was, those bushes around, you could let them roam.

(G13: 70s, Grebaštica, F, retired/housekeeper)

G2: We would tie our goats on a chain while we worked in fields. We always tied them. Then children or grandfather or one of us guarded them after we came back from the field so that they did not do damage.

(G2: 60s, Grebaštica, F, retired/saleswoman)

Unlike goats, sheep were allowed to enter woodlands, even after ownership of municipal woodlands was overtaken by the state, that is the Forestry Office Šibenik. According to the document which confirms transferal of ownership, all of the municipal woodlands identified on 19th century cadastral plans and topographic maps became the property of the Forestry Office. Among these, Vrpolje gaj was most abundant with trees:

G13: It was all barren except one woodland – Vrpolje gaj. There was ash there and some oak trees. It was guarded by a forest guard.

(G13: 70s, Grebaštica, F, retired/housekeeper)

Although cutting was supposed to be supervised, all interviewees confirmed they would illegally steal wood:

G14: Nobody gave you wood, you had to take it from the woodland, if you did not have your enclosures. You walked five kilometres, and that is where you would find it - where Vrpoljac is, and Vrpolje gaj. That is where we took the woodland from.

Q: Was that allowed?

[256] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 30th October 1933. N.26579

G14: You were not allowed. You would have to steal it, and if the forest guard caught you, you would be fined. Now people steal money. Before they stole firewood.

(G14: 80s, Konoba, F, retired/farmer)

G17: We usually collected wood from our enclosures where you would cut figs, bushes, even vines. We also went to the woodlands. When sheep were taken to pasture in woodlands, then women would always bring back some wood on their backs.

(G17: 70s, Konoba, F, retired/farmer)

According to the 1968 aerial images, Vrpolje gaj was comprised mostly of shrubby vegetation as the ground is visible (Figure 6.46). These were coppiced trees of various deciduous species, including pubescent oak, ash, hornbeam and evergreen species of the maquis and juniper. The border of the wooded section clearly corresponded with the woodland border from 1825 which points to century-long traditional management that preserved this wooded patch from turning into a barren landscape that marked the pastures to the south.

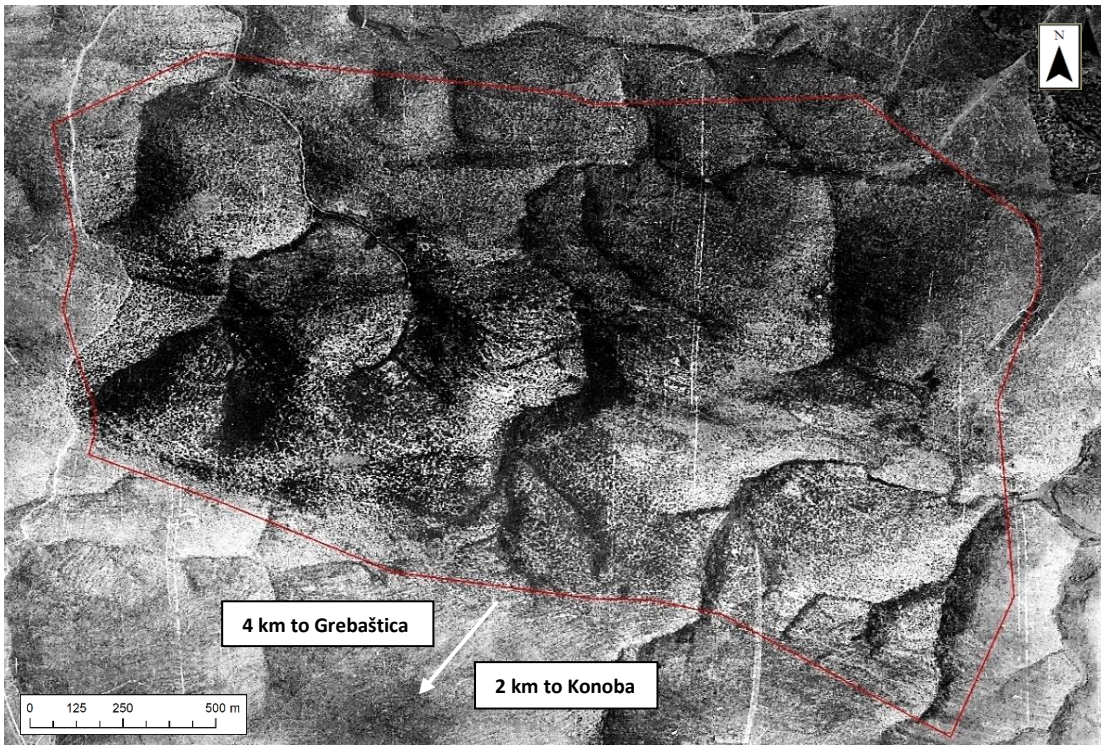


Figure 6.46. Vrpolje gaj on aerial image from 1968. The border of woodland Vrpolje gaj from 1825 cadastral plan is added in ArcGIS in the red line (Source: MGPU-ISPU, 2018).

The more wooded sections were located in ravines and corresponded with the borders of woodland parcels that were seen on the third military survey (1869-

1887) topographic map (Figure 5.17, p.155). Although records from 1939 reveal that county authorities intended to nurture an ash woodland predominately in order to procure specifically ash-wood for making agricultural and household tools, none on the interviewees could confirm they used wood for any other purpose than as firewood.[257]

Firewood was also collected from wooded areas in the south-eastern part of Grebaštica section. These areas, municipal pastures in the early 19th century, were designated as woodland in the late 19th century. The aerial images from 1968 reveal that the landscape there was indeed much more wooded than the south-facing slopes of hills above Konoba and Brnjača settlements, which were also municipal pastures in the early 19th century (Figure 6.47). A forest guard was tasked with the protection of Ciser and Stari gaj-Raduča woodlands after the Forestry Offices Šibenik took over ownership. Pasturing of sheep was allowed, and people regularly collected firewood here, with or without approval.

Finally, a large tract of woodland was located on Oštrica peninsula which administratively belonged to Krapanj (Figure 6.48). According to villagers from Krapanj, the eastern-most part of the peninsula was mostly privately owned by the villagers, and many had their dry-wall enclosures there. Most enclosures were vineyards and olive groves, but some supported trees for firewood collection. The rest of the peninsula was woodland and exploitation was managed by a forest guard, at least after 1956 when the ownership was taken by the Forestry Office:

G22: There was a forest guard. The villagers would go to him, they would get a ticket, pay for it, and this gave them the right to cut. How much they could cut in that day, they would take home. It was cutting per day. I do not remember that it was organised. Instead, whoever cut first the wood was his.

(G22: 60s, Krapanj, F, retired/civil servant)

[257] HR-DASI-Šibenik 19.-20.st. Šumarstvo. 20th October 1939. N. 19139/39.

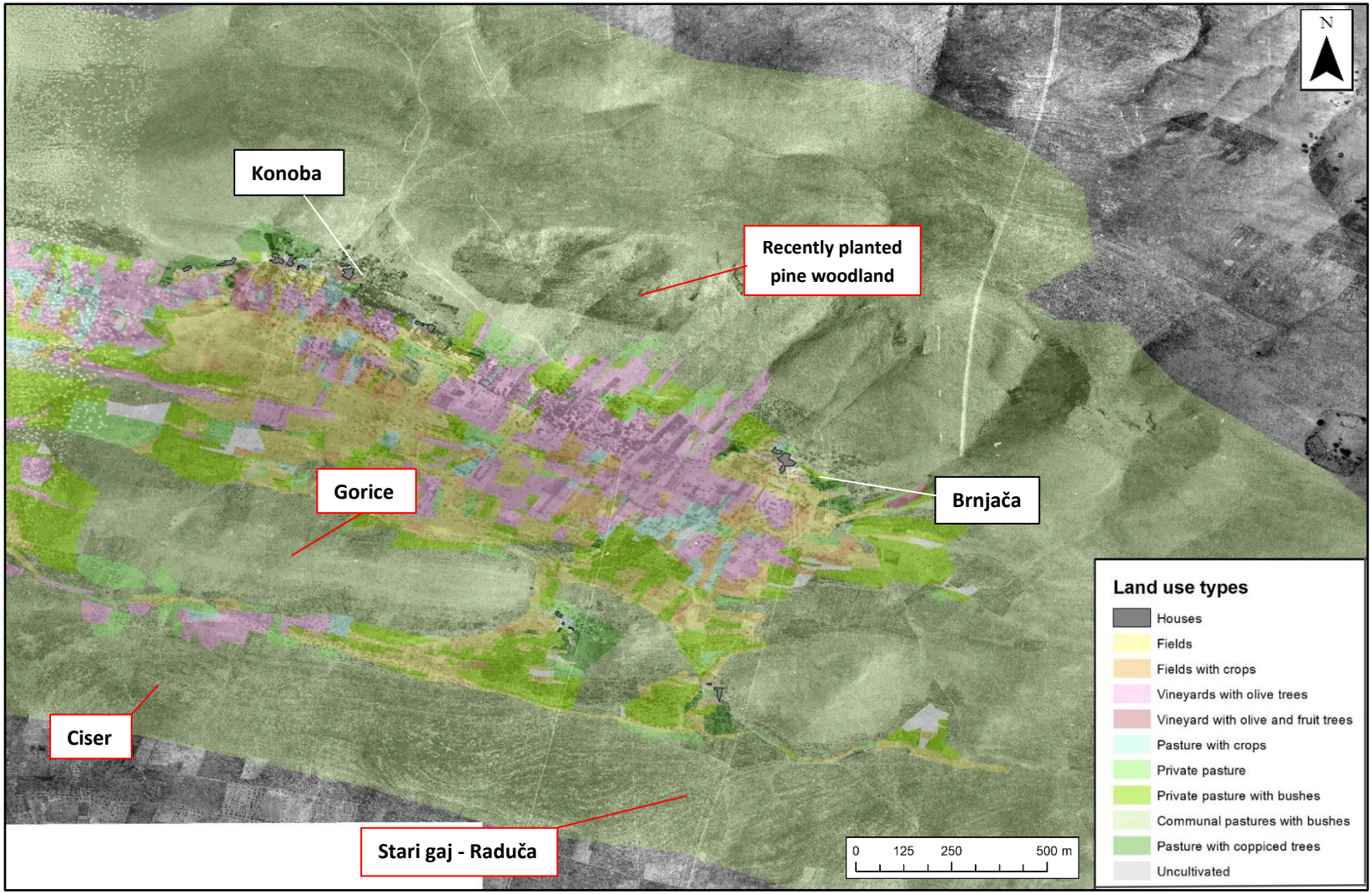


Figure 6.47. Woodland areas in the south-eastern section of Grebaštica on aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map made from 1825 cadastral plans.

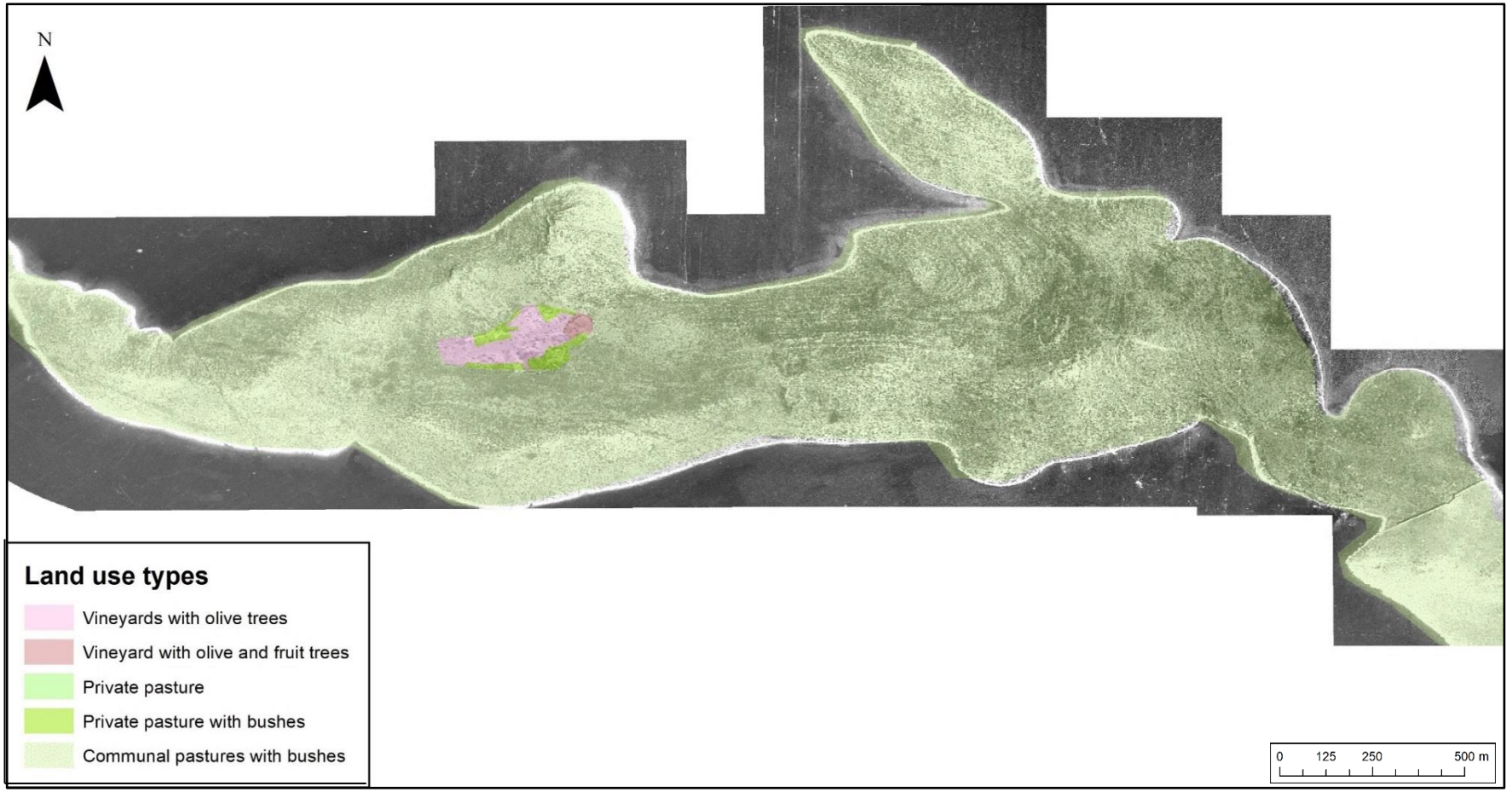


Figure 6.48. Peninsula and woodland Oštrica on aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map derived from 1825 cadastral plan.

Unlike the other woodlands in the section, Oštrica was dominated by species commonly found in maquis, that is holm oak, mock privet (*Phillyrea latifolia*), mastic and terebinth trees, myrtle, and others, while deciduous species were absent. However, there did not seem to be a difference in the use of obtained wood, since firewood for open fires was the most regular use. Some people could remember the practice of beating the myrtle tree leaves for making dyes for fishing nets. Just like other woodlands, vegetation in Oštrica was dominated by shrubs that were regularly coppiced, and large sections were sparsely wooded, as the rocky surface is visible on 1968 aerial image. Vegetation was denser in the central part of the peninsula, where access was most difficult.

The pine woodlands were established in several locations in Krapanj and Grebaštica area. Stands that were established by the Austrians at the start of the century in Bilo and Gradina area had been nurtured by the Yugoslav foresters and later on considerably expanded. Above Grebaštica, the woodland from Gradina was expanded across south-facing slopes along hills between Grebaštica and Konoba (Figure 6.49). From Bilo, the pine woodland was expanded across the whole north-facing slopes of Jelinjak hill, which established the largest patch of pine woodland in Šibenik area, and one of the largest in Dalmatia (Figure 6.50; Figure 6.51; Figure 6.52). Further reforestation of Orlice hill in the vicinity of Konoba occurred in the 1950s and early 1960s, and by the late 1980s, a dense pine woodland had been established (Figure 6.53).

The reforestation was carried out by the local people who were paid for their work. Once reforested, the area was prohibited from exploitation, which caused resentment:

G2: They opposed the pine stands because people were starving, and everybody was poor. The agriculture was in lousy condition, and people wanted to plant more cultivated plants, for instance, wheat, broad beans, potato, peas, onions so that they could provide for families.

G1: They used to send oxen, horses, donkeys and sheep in those hills, for pasture. After pines were planted you could not go there anymore; it was forbidden. You could not go for pasture; you could not do anything!

(G1: 60s, Grebaštica, M, retired/electrician; G2: 60s, Grebaštica, F, retired/saleswoman)

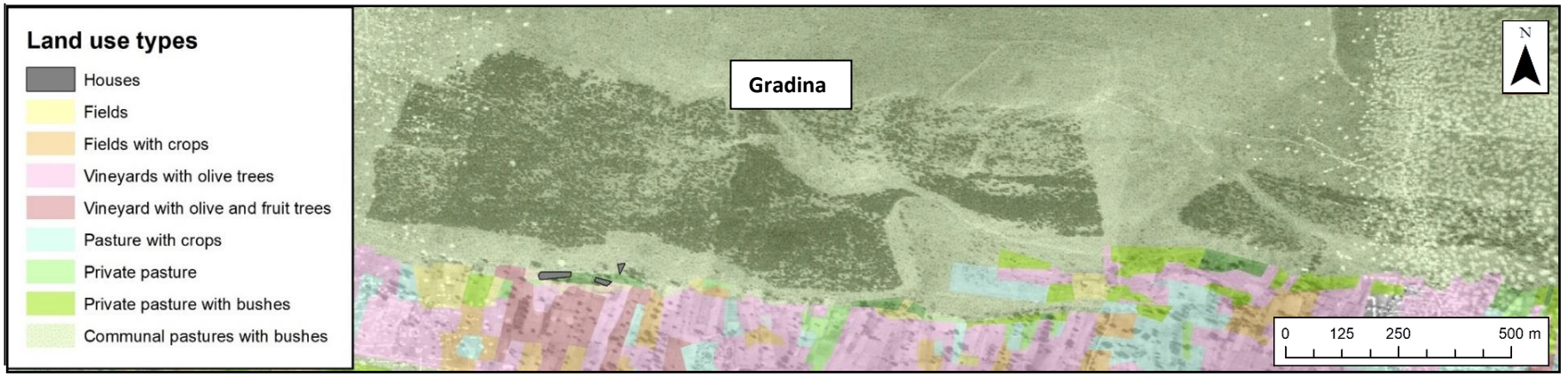


Figure 6.49. Pine woodland Gradina on aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map derived from 1825 cadastral plan.

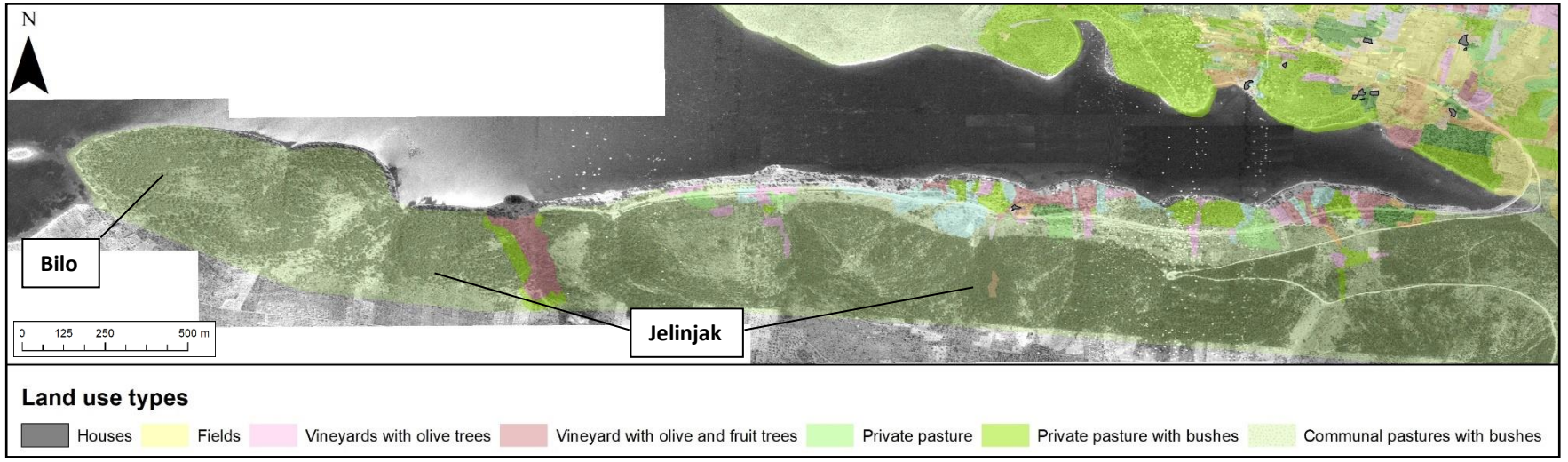


Figure 6.50. Pine woodland Jelinjak on aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map derived from 1825 cadastral plan.

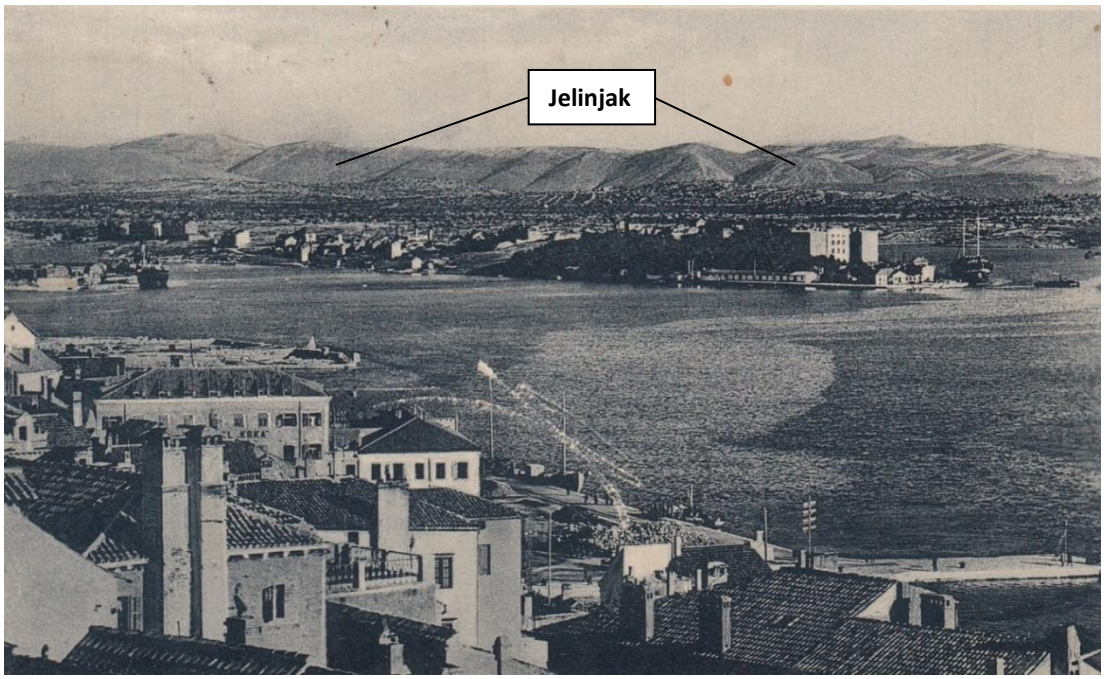


Figure 6.51. Postcard of Šibenik from 1935 with a view on Mandalina peninsula and Jelinjak hill in the background (Source: Private archives).

Figure 6.52. Photo of Jelinjak pine woodland from 1989 as viewed from Oštrica peninsula (Source: Private archives).

Figure 6.53. Photo from Grebaštica with a view towards Gradina and Orlice hills from the late 1980s (Source: Private archives).

According to the locals, everybody respected the prohibition on the exploitation of pines. To them, pine wood had no use, and some said they did not even use it for burning because they had to pay for some dry pine wood, while they could collect other types of firewood for free. They do not recollect the deliberate destruction of pine trees.

Most people had no understanding as to why pines were planted, and to them, it was just a decision that was made by the Forestry Office and it was for them to obey it. Some, however, could recollect stories on why reforestation was needed:

G16: There was a lot said. They said it would attract rain because where the forest grows, there is more moisture.

(G16: 70s, Konoba, M, retired/factory worker)

G14: It was for cellulose or for a paper that was made of it. That is what was being said. That's why they wanted to plant forests.

(G14: 80s, Konoba, F, retired/farmer)

The traditional way of life in Grebaštica had started to rapidly change in the 1960s. In the mid-1950s the Light Metals Factory was constructed in the eastern outskirts of Šibenik, while the Electrodes and Ferroalloys Factory was renovated and modernised in the western outskirts which paved the way for rapid industrialisation of the city (Poljičak, 2015). This attracted population from the nearby rural areas, including Grebaštica:

G16: People went to work in the factory in Ražine. Most of the people were saved by Ražine. Grebaštica, Boraja, Vrsno, surrounding villages of the county, Danilo, all of them. They built houses there, only for workers. Those who went to live in Šibenik did not return.

(G16: 70s, Konoba, M, retired/factory worker)

Further respondents confirmed that as people started to find work in Šibenik, the process of emigration was intensified with the construction of the Adriatic Road in 1964 and 1965. Before that people had to walk for several hours on goat-paths across hills and pastures to reach the train station and then board the train for the city. With the road, however, access to Šibenik improved, and young people were attracted away from agriculture. The wages in the city were higher than those from agriculture; there was less time to work the fields and to guard the animals, so the basis of the economy had shifted away from agriculture.

The need for firewood had also decreased considerably not only because of land abandonment but because of electric stoves. Additionally, firewood bundles could have been bought from the Forestry Office. This led to a slow regeneration of woodlands in abandoned enclosures and on pastures, but also led to the spread of pine trees from established plantations.

Finally, tourism started to become more important in the village which was not possible before the road was constructed. This brought about a rapid change in the value of the land:

G13: When somebody died, and the land was divided between progeny, those parcels that were near the sea, mostly rocky pastures, were left to the women. They had the least value; you could not even sell them. After tourism, the owners of such parcels could become rich by just selling them.

(G13: 70s, Grebaštica, F, retired/housekeeper)

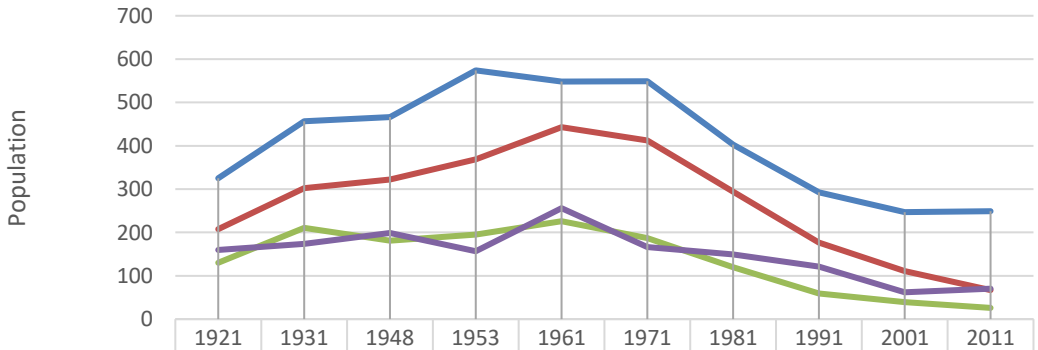
Because of the road, people left villages in the hills and built new houses on properties that were near the road. As the road was close to the sea, the houses also became used as apartments that were rented to tourists. It was very popular for the citizens of Šibenik to buy land here and build a weekend-house. The trend increased in the late 1970s, and the 1980s and a lot of vacation houses or weekend-houses were built in the vicinity of already existing coastal settlements which led to the creation of exclusively weekend-settlements (Figure 6.54). The land in the vicinity of pine plantations was particularly popular. After the 1970s in Grebaštica and Krapanj areas settlements Bilo and Šparadići were established at the foothills of Jelinjak, and Žaborić in Mrzle Vale. The houses there were used mainly during summer, and at first, were exclusively weekend-houses. Soon after, they were converted to apartments for tourists (Poljičak, 2015).

Figure 6.54. Mrzle Vale area on aerial image from 1968 (above) and 2011 (below) (Source: MGPU-ISPU, 2018).

The so-called process of *apartmentisation* of the coastal area and the possibility of earning income from tourism reversed the emigration trend and the population in Grebaštica started to expand again in the 1980s. In Krapanj this did not happen, but in Brodarica, a settlement on the mainland across the island, the population expanded three-fold by 1990. In this context, the role of pine woodlands became the promotion of tourism through the increase of landscape appeal and availability of recreation and swimming zones, which was later reflected in the prices of accommodation (Marušić et al., 2010).

6.5.3. Boraja section

The four settlements that developed in the Austrian period in Boraja section began to consolidate further in the Yugoslav period. The expansion of the population reached its peak in 1953 in Boraja settlement and in 1961 in Vrsno, Podine and Mravnice (Figure 6.55). The emigration of people from Boraja section after 1961 was mainly caused by the excess of the labour force in an area that could support very little expansion of agriculture because of karst terrain, and the development of industry in Šibenik. There was a road that connected Boraja with Šibenik and Split ever since the 19th century, so the access to the city was more accessible than in the coastal area. Over time, what used to be daily, weekly or seasonal circulation of people turned into permanent resettlement (Friganović, 1966).



	1921	1931	1948	1953	1961	1971	1981	1991	2001	2011
Boraja	325	457	466	574	548	549	403	293	247	249
Vrsno	208	302	322	369	443	412	294	177	111	67
Podine	130	211	181	195	226	187	120	59	39	26
Mravnice	160	174	199	157	256	166	149	121	62	70

Figure 6.55. Population change of villages in Boraja section from 1921 to 2011 (DZS, 2018).

Because there was no prospect of the development of tourism, there was no opportunity for any other employment outside agriculture. As more and more young people left for Šibenik and Split, the community collapsed, and the elderly were left behind. Those that remained carried on with agriculture and pastoralism on their private parcels, while the overall pressure on landscape considerably decreased by 1991.

Aerial images from 1968 reveal that after the peak of population expansion, and what was likely the period in which influence on woodlands was the most profound, the landscape was used in a similar pattern as the 1825 cadastral plans recorded (Figure 6.56). Private parcels had expanded insignificantly considering more that almost a century and a half has passed, which confirms that agriculture was limited by the geomorphology of the landscape. Municipal areas too had shown similar characteristics in both periods. Areas that used to be municipal pastures with bushes in 1825 were considerably more barren in 1968 than the areas that used to be municipal pastures with coppiced trees. The most wooded area in 1968 images was Glumča woodland (Figure 6.57) whose distribution mostly corresponded to borders of the woodland from 1825, but also exceeded them. The southern part of woodland, which used to be designated as municipal pasture with coppiced trees, was characterised by bareness which implies increased pressure on areas in closest proximity to agricultural parcels in the 20th century. Another woodland was located in the vicinity of Vrsno (Figure 6.58). In this area, the four land use types prevalent for Boraja section can be most easily distinguished.

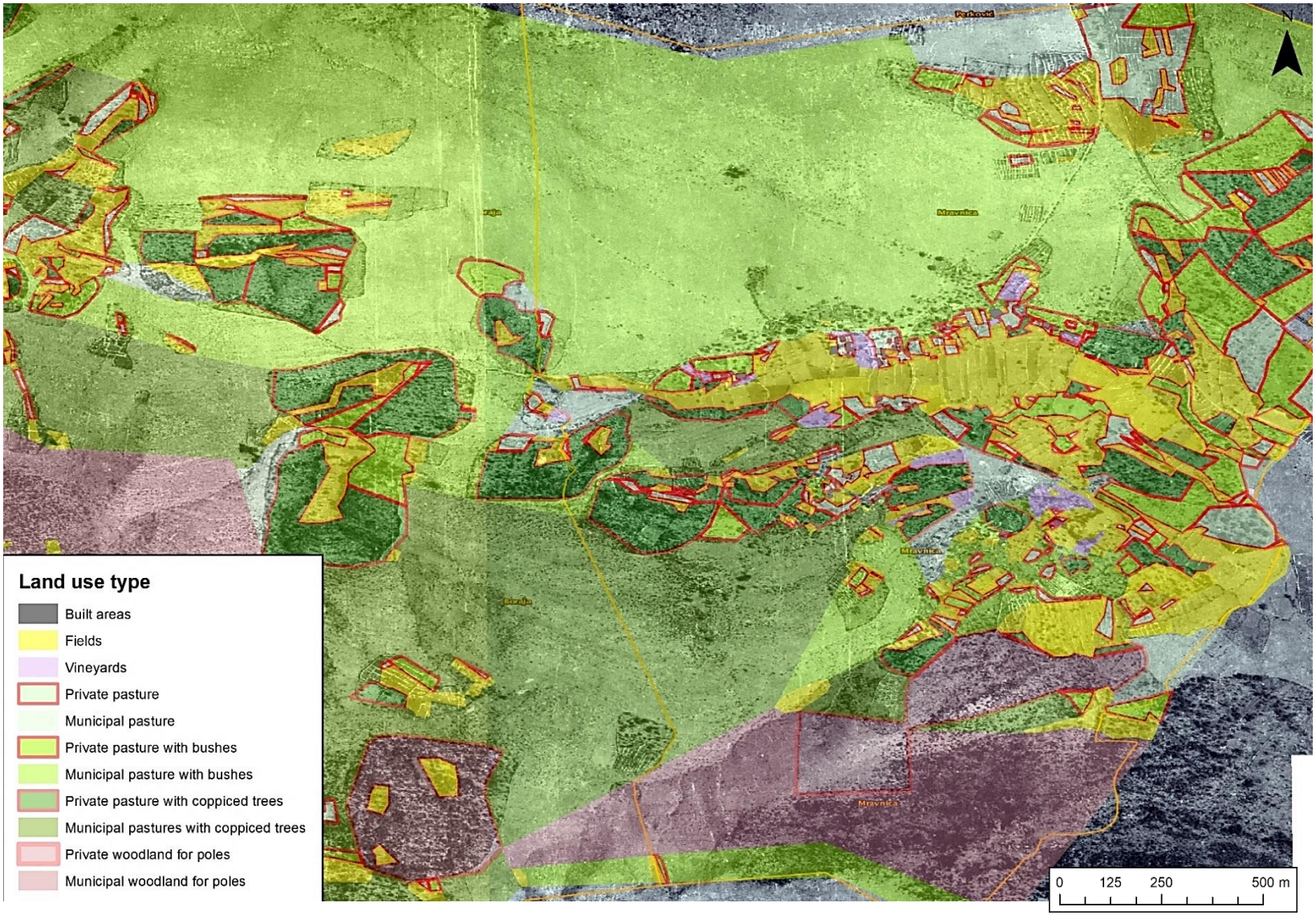


Figure 6.56. Aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map made from 1825 cadastral plans showing Mravnice area in Boraja section.

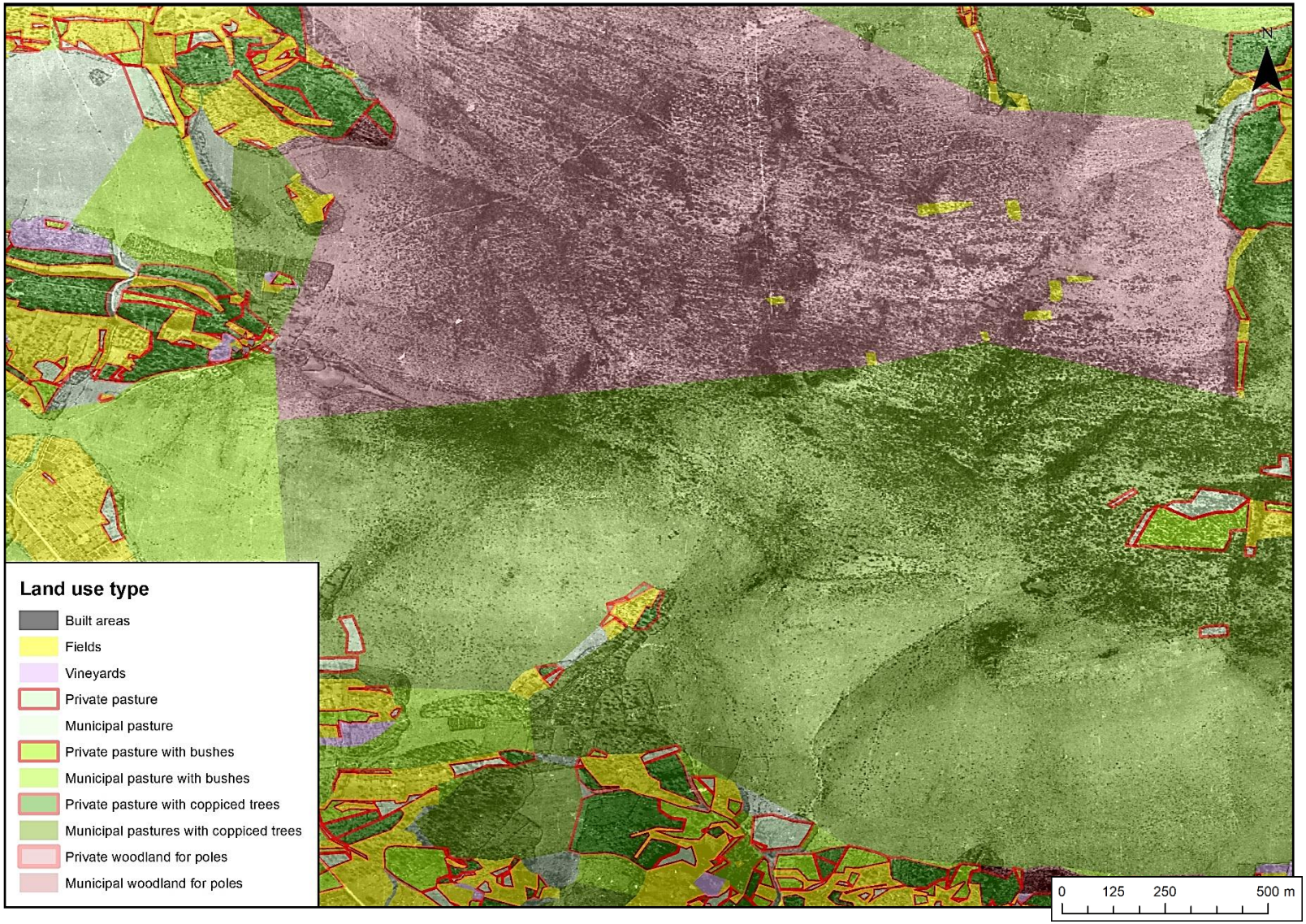


Figure 6.57. Aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map made from 1825 cadastral plans showing Glumča woodland in Boraja section.

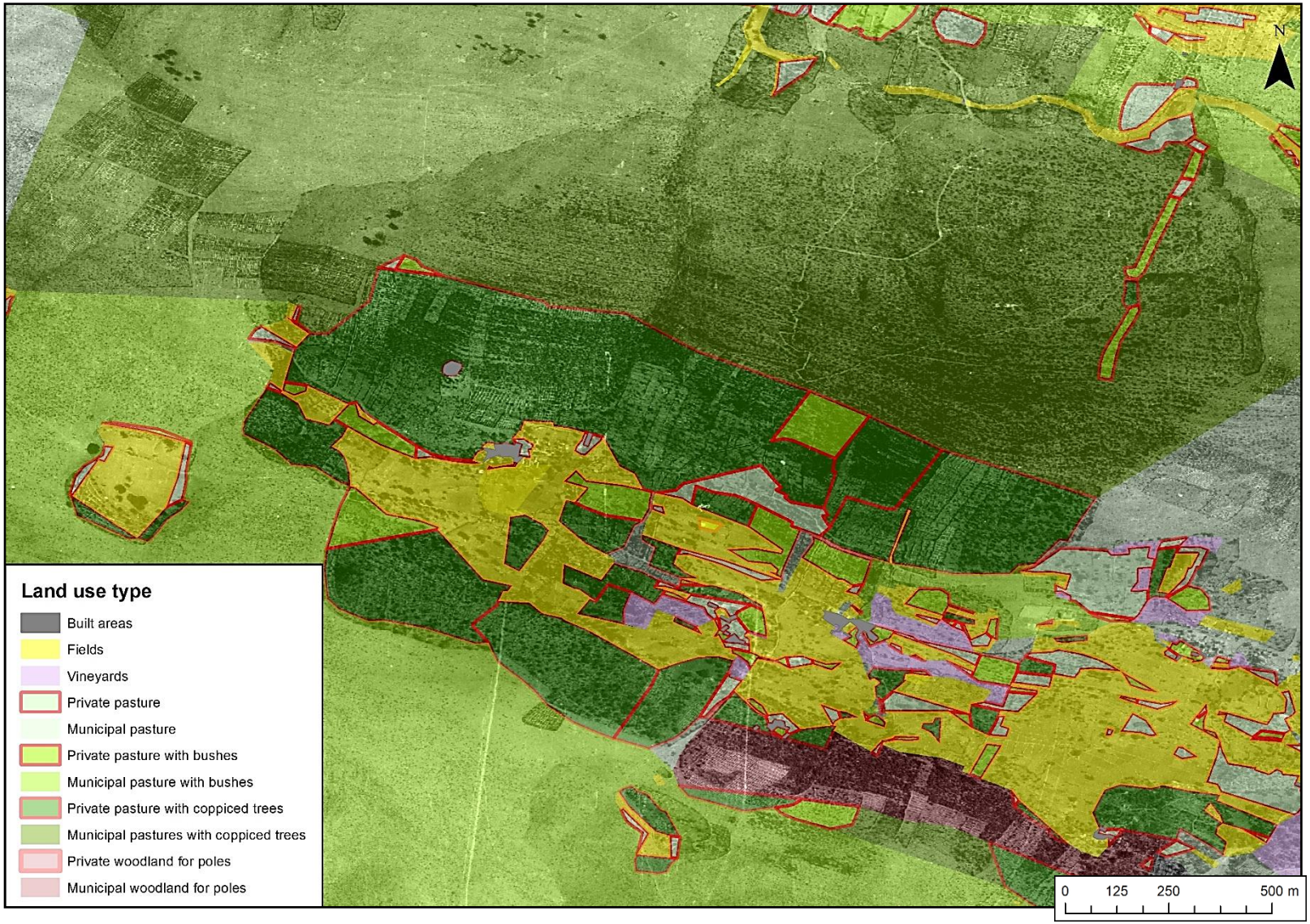


Figure 6.58. Aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map made from 1825 cadastral plans showing Vrsno area in Boraja section.

Although designated as a municipal pasture in 1825, the topographic maps from the third military survey (1869-1887) categorised this area as a proper woodland in borders that correspond to the wooded patch seen on 1968 image. According to the locals, the woodland was guarded by a forest guard who also supervised cutting for firewood. When the cutting period in spring arrived, the forest guard would issue permits for cutting and tell villagers which sections could be cut. Along with cutting, the woodland was used for grazing of sheep:

B1: With sheep, you could go anywhere you wanted. They grazed everywhere around you see, in woodlands, in pastures. Goats, however, we killed off in 1953. We received an order to kill them all, so my parents did so.

(B1: 80s, Boraja, F, retired/housewife/farmer)

After 1956 the ownership of woodland was taken by the Forestry Office Šibenik, but the same process of cutting continued until 1991. This was in contrast to what was written in the regulations that cutting in woodlands was to be carried out exclusively by the Forestry Office employers.

The second type of land use was prevalent on what used to be municipal pastures in 1825. These areas continued to be municipal pastures even in the 20th century, although some sections were taken over by the Forestry Office in 1956.[258] They were mostly barren areas with scattered bushes of mostly juniper and some pubescent oak, hornbeam and ash. Flocks of sheep freely roamed these areas, as well as goats, until the ban in 1953. Additionally, people collected firewood by cutting bushes, without any supervision, which reduced regeneration of vegetation.

The third land use type was related to private dry-wall enclosures where people nurtured their own pastures and trees for firewood collection. According to the locals, when the wood was scarce in municipal pastures, people could always rely on their walled enclosures. They did not grow any specific type of trees; rather whatever managed to grow they would cut. None of them remembers implementation of any silvicultural practices such as pollarding; instead, trees were always managed as coppice. Since enclosures were in private property, some areas

[258] HR-DASI-Šumarstvo 19.-20.st. 4th April 1956. *Rješenje.* N. 6612/56.

were converted to agriculture, mainly vineyards, but after emigration started in 1970, woodland rapidly regenerated there as enclosures were characterised by better soil than was found on pastures.

The final land use was related to privately owned agricultural areas where wheat, barley, fruit trees and occasional vineyards were grown. The edges of these parcels were usually marked with a hedge or bushes, which was often used as a source of firewood. Branches of figs and almonds, which were mostly planted among fruit trees, were also used as either firewood or fodder for sheep. After emigration in the 1970s, many of these parcels were overgrown with woodland vegetation.

Closer examination of abandoned private parcels reveals how the process of woodland regeneration unfolded over the last two centuries. For example, a privately-owned parcel near Škadrica pond was used predominately as a field in 1825 (Figure 6.59). The edges of the parcel were used as a pasture while in the southern edge trees were coppiced for firewood. In 1968 the central part was used either as a pasture where several large oak trees provided shade for animals. Estimation of age of the oaks puts them to at least a hundred and fifty years old, and at some point, they were managed as pollards (Figure 6.60).

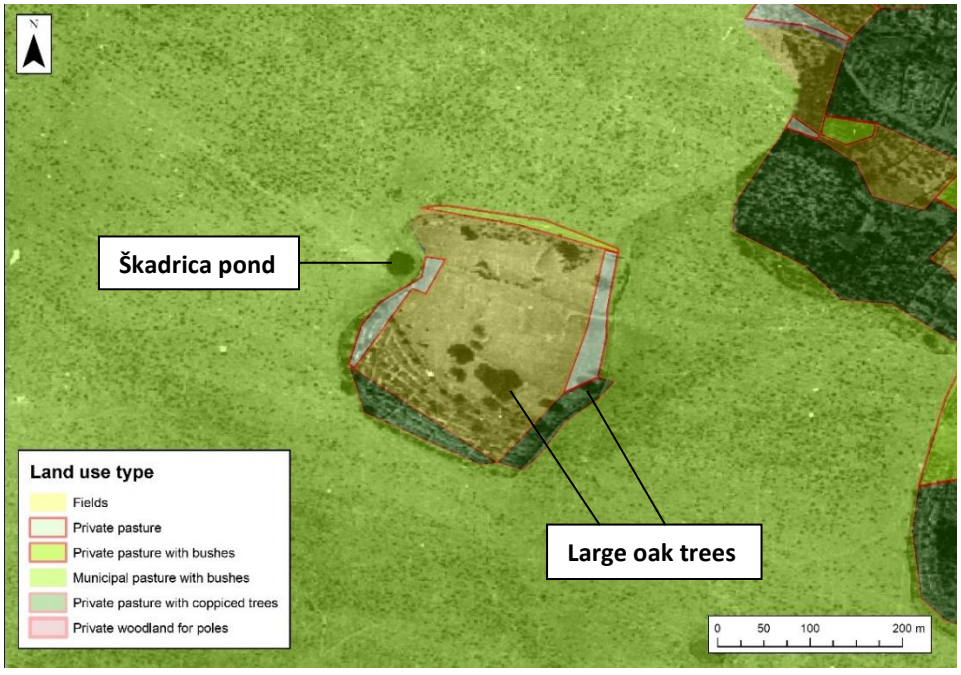


Figure 6.59. Aerial image from 1968 obtained from MGPU-ISPU (2018) overlapped in ArcGIS with land use map made from 1825 cadastral plans showing parcel near Škadrica pond in Vrsno area, Boraja section.

The southern edge of the parcel was terraced and in 1968 probably used for vineyards. Once the parcel was abandoned, natural regeneration followed first with junipers, and later with oaks from acorns from the nearby large oak trees. The young oaks are at least two decades old and show no sign of cutting, which means they probably started to grow in the late 1980s (Figure 6.61).

The central part of the parcel that used to be a field had regenerated mainly with juniper (Figure 6.62), which would indicate that in 1968 it was a pasture, not a field:

S2: Juniper is the first species that will spread on barren, open areas, where soil cannot support any proper trees. Its seeds are dispersed with birds easily. We foresters regard it as an indicator of open spaces, that is, areas that used to be open landscapes.

(S2: 60s, Lozovac, M, retired/forester)

Figure 6.60. Large pubescent oak on an abandoned parcel near Škadrica pond in Vrsno (Ivan Tekić, April 2018).

Figure 6.61. Young oaks growing on abandoned terraces with juniper as undergrowth near Škadrica pond in Vrsno (Ivan Tekić, April 2018).

Figure 6.62. Former pasture overgrown with juniper (Ivan Tekić, April 2018).

A similar process had occurred on the previously open pastures in the whole section. The difference was that along with juniper, vegetation was represented with bushes of oaks, hornbeam and ash which were regenerating from roots that had been cut for centuries by the local people. Because of the poor soil on which they grew, and repeated cutting by the people, these trees retained the form of a bush (Figure 6.63).

The newest addition in the landscape were pine trees. Without the role of tourism, there was not a lot of reforestation carried out. The black pine stand that was established in Veliki vrh near Boraja in the Austrian period was nurtured as the only black pine stand, while the new reforestation was carried out with Aleppo pine, starting from 1953 in Konjička Draga. Later on, two more small pine stands were established just south of Vrsno. According to the locals, the reason for reforestation was to regenerate woodland. As in the two other case study areas, exploitation in pine stands was forbidden, and the locals did not use pine wood for any purpose. Over time, pines have started to regenerate naturally over the landscape from established plantations.

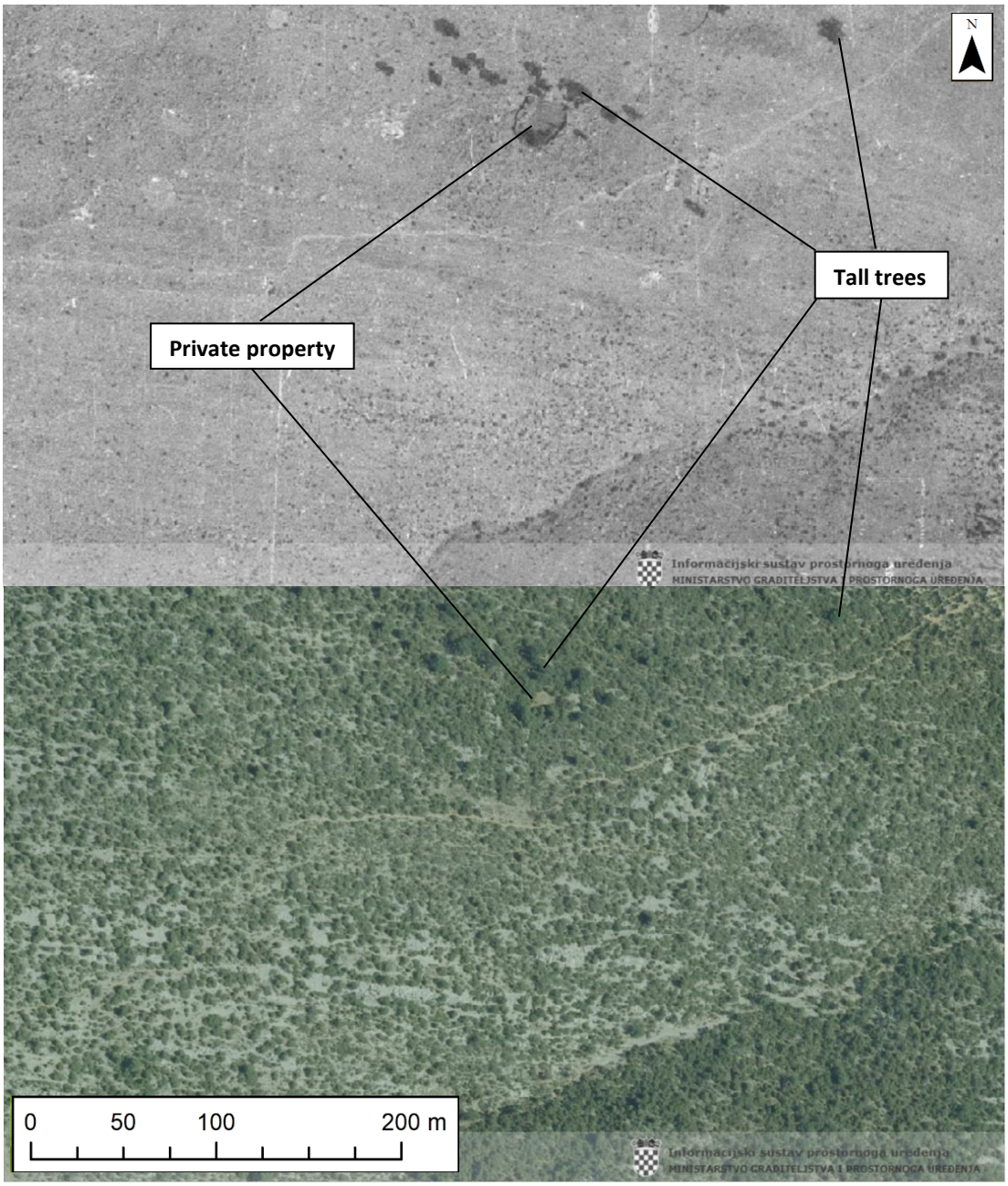


Figure 6.63. Pastures north of Vrsno settlement on aerial images from 1968 (above) and 2011 (below) with labels added by the author (Source: MGPU-ISPU, 2018).

6.6. Conclusion

In terms of management of woodlands, the Yugoslavian period of from 1918 to 1990 represents a continuation of practices that were established during the Austrian period. Traditional management of municipal woodlands was carried out through rotational cutting for the purpose of obtaining firewood, while reforestation was carried out with pine trees. With the expanding population and increasing pressure on woodlands, foresters had problems keeping the woodlands safe because of the problematic role of forest guards and this was aggravated with massive devastation of woodlands during World War II.

In the 1950s the forestry service in Dalmatia was organised into a single enterprise which in the short term solved financial problems of forestry through public subsidy and gave impetus for intensive reforestation. However, with the dissolution of this enterprise into individual Forestry Offices, forestry fell into disarray until the late 1970s. This is also a period when massive emigration started in Šibenik district which reduced pressure on woodlands and started a process of natural regeneration of woodlands in the landscape. In reforestation, tourism had started to gain more importance and further promoted the planting of pines for the creation of recreation zones.

7. Conclusion

7.1. Contributions to existing literature in historical geography and environmental history

This research represents the first comprehensive study of the history of Dalmatian woodlands. It introduces an approach to the study of environmental history and historical geography that is novel in the Croatian context in terms of methodology and emphasises the rich variety of resources available in future studies of human-woodland relations in this region. Although already well developed in western Europe (Agnoletti, 2000a; Watkins, 2015), this methodological approach stands out because of its in-depth use of diverse and numerous sources which complement each other and allow deeper understanding of woodland changes in the last 200 years. For example, understanding the development of reforestation policy would not have been possible only through the analysis of archival records, as answers to why foresters planted certain species can only be found through extensive analysis of theoretical discussions in the *Forestry Journal*. Oral histories, on the other hand, revealed details hidden from government or administrative records and, as Stewart (2016) emphasised, represent an indispensable source for the study of woodland history. Excluding some of these sources would have denied access to crucial information and the conclusions would have been partial and imprecise.

Furthermore, this research strived to visualise different types of woodland landscapes over the research period. Historical photographs, including topographical postcards and aerial photographs were especially useful for the 20th century and for the 19th century implementation of GIS was crucial. This approach, which combines historical research with the modern geographical traditions, is still under-represented in historical geography, and particularly environmental history, but allows considerable in-depth analysis of historical landscapes. It also offers a valuable method of analysing and representing historical documents such as cadastral land surveys.

There are considerable links between results of this research and the existing forest history literature. For instance, it was shown that woodland history of Dalmatia in the 19th century can be viewed as a part of an imperial narrative widely studied in countries of the Global South but very little in the context of eastern and south-eastern Europe. In Dalmatia practical forestry was entirely developed within the German forestry tradition through the Austrian forestry school and foresters who introduced scientific forestry. However, unlike in the Global South where considerable woodland resources existed and the imperial administrations developed forestry to manage it for exploitation (Guha, 1983; Gadgil and Guha, 1992), in Dalmatia exploitable woodlands first needed to be created. This took place through reforestation with fast-growing pine species. The implementation of reforestation shared all the elements of imperial forestry described by Gadgil and Guha (1992), that is, confiscation of common lands locally used for pastures and expulsion of people from reforested areas. The foresters' discussions evident in *Forestry Journal* also emphasised the stance of scientific forestry that traditional management was bad for forests and peoples' practices caused a lot of damage. However, apart from reforestation, archival records demonstrated, importantly, that at a more local level there was very little change in the management of traditional woodlands which was focused on the collection of firewood and provision of leaf fodder. The policies changed very little from the preceding periods and management and protection were left in the hands of local authorities. This relative lack of interest in the use of these woodlands as a source of timber was due to a complex mix of physical and human geographical factors. This is also emphasised by the fact that Austrians were much more directly involved in the management of forests of the Croatian Military Frontier, another Croatian region under direct Austrian rule, but where timber exploitation was of significant economic importance. Overall it can be concluded that the most evident form of imperial forestry in Dalmatia was coniferous reforestation. This also explains why few archival records show opposition of people to management of traditional woodlands, while most of them are directed at reforestation. It also explains why 19th and early 20th century discussions on forestry of Dalmatia in *Forestry Journal* are almost exclusively focused on reforestation, whereas traditional woodland management is largely ignored.

This research has also emphasised the importance of understanding the history of woodlands in order to understand contemporary processes such as forest fires. This is comparable with other Mediterranean countries which underwent considerable social and economic changes that were reflected on woodlands (Saratsi, 2003; Moreno, 2004; Cevasco et al., 2009; Arvanitis, 2011). Similar patterns of events occurred in Dalmatia with the advent of industrialisation and tourism. However, in Dalmatia, these changes occurred much later than in its west-European counterparts, with some traditional activities, such as transhumance, lasting until the 1980s. This means that the process of woodland regeneration which occurred because of the cessation of traditional practices was rather abrupt and rapid and modern woodland management needs to be considered in this context.

7.2. Traditional woodlands in the study area

Woodlands in the study area have been marked by intense exploitation and complex management until the second half of the 20th century. Today they consist of low growing trees and shrubs that have no obvious value in everyday use which conceals the fact that they were an indispensable part of the rural economy and had a vital role in the lives of the local people. Three types of woodland landscapes were identified in this study, and these constitute what can be regarded as traditional woodlands.

The first were municipal woodlands that were professionally managed by forest guards and foresters. Each settlement had jurisdiction over municipal woodlands on their territory ever since the Venetian period and until 1947 when they became national property. Exploitation in municipal woodlands was limited by regulations: all cutting was supposed to be approved and supervised by forest guards and foresters, grazing of sheep was allowed in areas that were not recovering from cutting, while browsing of goats was almost entirely prohibited ever since the Venetian period. Municipal woodlands were used and managed as a source of firewood and as pastures. The 1825 cadastral records classified them as wooded pastures, and this use carried on throughout the research period. Commercial

exploitation for timber did not exist, and numerous records confirm there were no high, well-developed trees. They were managed as a coppice with pasture being its secondary use. This implied rotational cutting of parts of the woodland and the subsequent protection of cut areas was crucial for the regeneration and conservation of woodlands. After the nationalisation of woodlands in 1947 and the establishment of Forestry Offices in 1951 the cutting of trees by the people was banned as it was seen to be inefficient and damaging; all cutting now had to be by forestry staff.

The second type of woodland landscapes were those in municipal ownership that were not legally included under the category of woodland and forestry was not the primary land use. Some of these areas nevertheless had abundant vegetation cover comprised of woody species, but the primary use, and how they were classified in the 1825 cadastral plans, was pasture. People usually referred to them as gaj. These areas can be best understood as common lands, and they were particularly important for the local people because their exploitation was less hindered by forestry regulations. Because of this, they were vital for pastoralism and firewood collection as people could send as many animals as they had on these pastures and could cut much more than in the municipal woodlands. To foresters, on the other hand, such areas represented the remnants of past woodlands, and they sought further protection for them. In the late 19th century most of gaj areas were included in the category of woodland and regulations pertaining to woodlands were implemented here. This means that statistically, the area under woodlands increased considerably, despite the fact that many of these areas were barren or with very scarce vegetation cover due to centuries of intense exploitation. Such areas can be understood as what in the 20th century became termed by foresters as forest land or forest soil, that is areas that are without substantial tree cover but which had the potential eventually to gain one through natural processes or forestry management. Most of these lands were also recognised as woodland in the Yugoslav period, and jurisdiction over them was taken over by the Forestry Offices in 1951.

The third type of woodland landscapes was represented by privately owned enclosures where tree cover existed and was used as coppice for firewood collection. Although there are few records about management of these parcels, their value for

providing a source of firewood was crucial which is why they were located in the vicinity of settlements, and sometimes even on land with better soil where agriculture could have been possible.

7.3. Continuity of traditional management

This research has highlighted that the management of traditional woodlands exhibited remarkable continuity throughout the research period, until the 1950s when significant changes were implemented. Even the changes of governments did not hamper this. Although modern foresters adopted the view of Croatian foresters from the late 19th century that the French period was beneficial for Dalmatian woodlands and that with the Austrians everything was obliterated, this study had shown the contrary. The Austrians retained all the customs of woodland management, including the conservation measures and regulations. Even the Yugoslav foresters, who publicly renounced the former practices of their Austrian counterparts, carried on without any significant changes. Only in the 1950s was the management of woodlands significantly altered after they were nationalised, and their management entrusted to the Forestry Office.

The reason for such continuity of the same practices can be explained by the fact that management of woodlands was carried out on a local level, rather than a national one. A crucial role in this was played by the municipal and district authorities, but also the village councils. Furthermore, since it was indicated that woodlands were primarily used for the provision of firewood, any significant disruption to their management could have led to devastating consequences for the rural communities. This is probably why even in the years governed by the Italian occupational armies the same regulations carried on.

Finally, the importance of village councils is evident from the findings that regulations concerning woodland management varied according to the different agreements that municipal authorities and foresters made with the village elders. If the opposition of the village elders was high, foresters were often required to change the regulations or plans regarding woodland management. In some cases, foresters were forced to abandon their plans if approval was not granted by the elders. In some

cases when they disregarded the will of the villagers, they often had to face increased deliberate cutting of trees or grazing of woodlands. With the establishment of the Forestry Offices in the 1950s, the local authorities were completely removed from the management process in woodlands.

7.4. Conservation of traditional woodlands

The established literature on forest history of Dalmatia describes the 19th and much of the 20th century as periods when the care for woodlands was neglected. However, just like the continuity of management practices, this research has demonstrated that the efforts to preserve woodlands from devastation had continued since the Venetian period. The French are praised in the forest history literature for their efforts to establish forbidden groves, but the Austrians immediately restored all regulations concerning forbidden groves once they took over Dalmatia, and evidence shows the practice lived on at least until the 1850s. In the second half of the 19th century, the Austrians proclaimed large sections of woodlands as protected areas. Because of the prohibition of exploitation, these areas were crucial for woodland regeneration, and the regulations hardly differ from those stipulated for the forbidden groves. The establishment of protected parts of woodlands also continued into the Yugoslav period.

Since traditional woodlands were managed as coppice as well as pasture at the same time, the French and the Austrian foresters implemented complex regulations to try and prevent damage to cut areas. These included specific months and predetermined areas to regulate when and where sheep could graze. Free-roaming of goats and their browsing of vegetation was denounced by foresters in all administrations. The exception was the Yugoslav administration in the inter-war period when regulations concerning goats were loosened up due to public pressure.

However, despite these complex regulations and controls, the research has found enough evidence to conclude that in this regard foresters failed. The forbidden groves the French established were reportedly devastated when the Austrians seized control and continued to be so. Numerous records emphasised that local people did considerable damage to municipal woodlands through illegal cutting and ignoring the

prohibition of grazing on cut areas. During World Wars very extensive tracts of woodlands were devastated because proper safeguarding of woodlands was impossible to implement. The illegal cutting of woodlands carried on even after the Forestry Office was established and every interviewee confirmed that stealing of wood was a common practice until 1990. It is likely then that such activity was much more widespread in the 19th century and the first part of the 20th century when villagers were more actively engaged in the exploitation of woodlands and where firewood needs were more significant.

This study had shown that much of the damage to woodlands occurred because of the way the forestry service was organised in Dalmatia, and much of it relates to the role forest guards to whom the protection of the woodlands was entrusted. First, it must be stressed that the forest administration in Dalmatia was simply not developed enough to make implementation of all regulations possible. Forest guards became employed in the service only in the second half of the 19th century, and they were too few to supervise properly every woodland. Even in much of the 20th century, there was only one forest guard in each settlement, while settlements often had patches of woodland distant from each other which took several hours to reach on foot. Secondly, there were immense problems with the service of forest guards. Namely, the forest guard for each settlement was selected from amongst the villagers and then had to protect the woodland from the community to which they belonged. Corruption and misconduct allowed many woodland felonies to go unpunished. In addition, the whole process of prosecuting woodland felonies was inefficient as municipality authorities either did not want to or did not have proper means of punishing the offenders.

7.5. Development and implementation of reforestation in Dalmatia

Reforestation was forestry practice that had the most significant effect on the history of woodlands in Dalmatia and the study area. Attempts at reforestation were recorded already in the French period, but these were mostly at a small scale and carried out on an individual basis. Reforestation as a forestry policy was

developed from the mid-19th century and this study has examined its origins and development.

Reforestation was a product of Austrian perception that karst woodlands, which included Dalmatia, were abnormal being a product of centuries of misuse and neglect and in urgent need of improvement. There was also a strong economic background to the development of reforestation as the Austrian government believed lack of woodlands was responsible for adverse climate conditions and poor soils which negatively affected agriculture and caused widespread poverty in these regions. Both of these factors were related to the fact that the Austrian and Croatian foresters believed dense, high forest was a natural state of the karst environment, a belief which dominated the forestry community of the 20th century as well. No distinction was made between the continental mountainous karst and the Mediterranean karst of Dalmatia.

According to modern studies of the history of vegetation, high forest was probably not a natural state of the landscape in many parts of the Mediterranean. Many karst areas, characterised by summer droughts and poor soil, as well as frequent forest fires, were probably characterised by open landscapes with patches of trees including many low-growing ones ever since the last ice age. However, understandings of Dalmatian Mediterranean vegetation in the 19th and much of the 20th century was limited. The first research on flora identification dates to mid-1850s, but research on vegetation began only at the start of the 20th century. Before that there was little understanding of what maquis was and how it evolved, pine species were frequently misidentified, and knowledge of the woodland history was based on several dubious historical records which were regularly repeated by foresters even in the late 20th century.

Knowledge of Dalmatian woodland history was also restricted because forestry in Dalmatia was very much under Austrian influence. There was no organised forestry in Dalmatia itself until the 1870s when the first foresters were employed, and even then, there were no schools, no universities and no professional bodies that could bolster the work of these few forestry officials and promote the development of region-specific practices. Instead, foresters were usually either Austrians or Croatians. Even if they were born in Dalmatia, they received their education in Austria

or Croatia. Furthermore, the literature on Dalmatian woodlands was almost non-existent by the start of the 20th century.

Because of all this, reforestation as a policy was developed by the Austrians on the continental karst and was merely adopted as a standard for Dalmatia as well. The institutionalisation of reforestation practice occurred already in 1878 while the bulk of reforestation in the study area started in the 1890s. By the time of the World Fair in Paris in 1900, Austrian foresters argued that the problem of reforestation of karst had been solved. This meant that by the time reforestation in Dalmatia began it was already too late to influence what had become the standardised practice.

This research has shown that reforestation was implemented in Dalmatia on the premise that it would lead to the replenishment of soils through the establishment of provisional plantations mainly of conifers. The intention was that these plantations would then be replaced with more suitable species once the quality of the soil had improved. The second justification for reforestation, the mitigation of deluges, was not recorded in the study area and was probably more common in more elevated parts of the karst. The policy of reforestation which was developed by the Austrians continued throughout Yugoslav period without significant changes, despite some criticism by foresters. Throughout the whole research period, the main species used for reforestation in the study area were pines. At least until 1990, there were no recorded attempts to do convert pine stands into a woodland composed of different species.

7.6. The problem of planting pines

This research has shown there was considerable opposition to the reforestation by the local people, especially in the period before the 1950s. There were two interconnected reasons why it was opposed: the selection of lands for reforestation and the selection of tree species for reforestation.

Reforestation was usually carried out on barren or less vegetated areas where foresters considered woodland to be most appropriate. These areas were in all recorded cases being used as municipal pastures by the local people. After land was designated for reforestation, grazing and all cutting were prohibited. In a way,

therefore, people considered reforestation a means of taking away their land. The others issue was that reforestation was almost dominantly carried out with pines – Black pine in the hinterland areas with a more continental climate, and Aleppo pine and less commonly Maritime pine in the coastal areas with a Mediterranean climate. Pines were well suited to the foresters' desire to establish high forests, but these trees did not grow in Šibenik area before and people did not have a tradition of using them as was the case in the southern Dalmatia where they grew naturally. Even if they wanted to use them, they could not because cutting was prohibited. This led to the establishment of plantations that were perceived by the people as unnatural elements of the landscape that threatened their livelihood. This is why they either destroyed the pines or refused to allow reforestation through the influence of village councils.

A few foresters argued for a different approach to reforestation and proposed the planting of broadleaved species which could have supported local pastoralism. However, there is no record that such practices were carried out in the Austrian period, while in the Yugoslav period it was not even considered. Pines were relatively cheap to grow, easily planted or sown and did not require a lot of care. Although strongly opposed by the people, pine plantations received very little criticism among the forestry community. As they became more common in the Yugoslav period, its planting became 'templated' and repeated on all types of land. It became the standard form of forestry in Dalmatia.

7.7. Importance of tourism and recreation for reforestation

This research has shown that the aesthetic appeal of trees and woodland in the landscape had a significant influence on the development of reforestation in Dalmatia. This was evident much earlier than might be expected and well before the tourism became a major branch of the economy in the mid-20th century. The first reforestations in the study area were all carried out on visually prominent locations in the vicinity of Šibenik - along the shores of its bay and channel or slopes overlooking it. It was followed with more localities along the seaside, railway or along Krka river. None of these areas had any agricultural potential, and the wording used by the

foresters and local authorities implied stands were established because woodlands made the landscape more appealing.

In the 1920s and 1930s, the role of tourism became more evident as instructions for reforestation by the authorities specifically recommended areas that could have affected the landscape perception of the tourists. After the 1950s, tourism became a major component of the economy in the coastal areas, and this was reflected in reforestation practices. Pine stands, as the only available constituents of high forest, were quickly taken up by camps, hotels, car parks, etc. They were a crucial element for the development of tourism based on sun and sea. By the 1960s, the purpose of reforestation in coastal areas had changed, and the establishment of areas for recreation and improving landscape appeal became its main drivers.

This change of focus of reforestation still fell in line with the main stipulation of the reforestation policy devised since the Austrian period – bolstering economic progress through long-term improvement of land productivity through soil improvement. Since agriculture had ceased to be such a major component of economy and tourism brought much more revenue, then reforestation served as an economic enhancer. Pines were particularly suitable for this purpose as they grew quickly and easily in areas where other species could not and could provide more shade for tourism and recreation than maquis.

7.8. The collapse of traditional management and exploitation of woodlands

Several combined factors contributed to the cessation of traditional management and exploitation of woodlands, and they all started to occur in or after the 1950s. First, with the nationalisation of woodlands and establishment of Forestry Offices, local people were left out of the woodland management process. Firewood was then produced by the foresters and sold to the people, although records showed that in some villages the practice of cutting by the people continued because forest guards did not enforce regulations. Secondly, electrification of households in the study area in the 1950s and 1960s put an end to the practice of open fireplaces. This drastically reduced firewood consumption. Thirdly, the collapse of rural communities

began after the 1960s because of relocation to the cities and emigration. Although some islands experiences this process earlier, emigration in the second half of the 20th century influenced the whole district. Emigration was emphasised by the rapid industrialisation of Šibenik and development of tourism after the main coastal road was constructed. This led to the availability of employment outside of agriculture and the collapse of pastoralism

Although some exploitation of woodlands by the local people continued until 1990, its scale was insignificant compared to the earlier period. In addition, a process of rapid vegetation recovery had started with extensive land abandonment. Because pines seed is dispersed easily in the wind, it was able to conquer open landscapes and spread naturally and quickly from established plantations.

7.9. Methodological issues and remarks

In an effort to use various types of sources in studying the woodland history of Šibenik area, this research has uncovered a rich collection of materials that can be used for this purpose. It has also reinforced the need to use a variety of different types of sources with each other to gain a better understanding of woodland changes. This is especially important because individual sources are often unable to provide enough information on their own or can provide misleading information.

Oral histories are a crucial source for exploring local practices, and this method was particularly valuable for the period after the 1930s. Because of the longevity of traditional practices, many findings from this period are relevant for preceding periods as well. However, a setback for this method was the fact that many of the local practices were abandoned in the 1950s because of the establishment of Forestry Offices and many people could not recollect how previous generations had managed the woodlands.

Forestry archives were valuable for deriving details about professional woodland management and were an indispensable part of this research. However, there are several issues relating to their use. The records are related to district and municipal authorities and the work of foresters, but they do not include local practices that were carried out by everyday people. Partial conclusions can be derived from reports on woodland crimes, but very little is recorded about how

people managed trees in their private enclosures. Finally, there are some periods with a lack of archival data. These are periods of the Austrian administration until the 1890s and the inter-war period under Yugoslav administration. In contrast, the period between 1890 and 1914 and after World War II have abundant records. Because there was no proper forestry administration until 1951 with the establishment of the Forestry Office, it is possible that more woodland related records are dispersed among archives of other sections of the district and municipal authorities, such as those on agriculture or economy.

While archives reveal how foresters and district authorities managed woodlands and woodland related issues on the ground, they reveal very little about ideas, goals and perceptions that drove their decisions. This is why the analysis of discussions and articles in the *Forestry Journal* was fundamental as it provided much-needed background and context for forestry related activities and how they have changed over time.

One of the critical sources of understanding woodlands and land use practices in the study area was the cadastral survey from 1825 and topographic maps from the 1850s and 1870s. This research has shown that Austrian surveyors carefully and thoroughly tried to record characteristics of different woodland landscapes and that there is much more complexity than is shown on cadastral plans. This is why analysis of the cadastral records which accompany the plans is very important. The implementation of ArcGIS was also valuable for understanding long term changes in patterns of land use between 1825 and 1968 as it allowed comparison on a precise and detailed level.

7.10. Impact and further research

This research has helped in understanding the evolution of woodland landscapes in coastal Croatia in the last two centuries which can contribute to contemporary landscape management. As the traditional land uses are becoming extinct in the study area and landscape becoming increasingly wooded, many of the complex and for conservation purposes, important habitats are under threat of disappearance. Similar process occurred in other Mediterranean countries, for

example in Spain where from the mid-20th century a breakdown of the traditional economy led to the abandonment of traditional dehesa management (Di Pasquale et al., 2004). In Greece several traditional woodland practices have been identified as responsible for the conservation of a cultural landscape which is also rich in biodiversity, but also under threat of disappearance after they were abandoned (Halstead; 1998; Saratsi, 2003). Cevasco and Moreno (2013) concluded that Italian cultural landscapes had entered a 'post-cultivated' condition and this had a major influence on the mosaic of plant species, soils, and animals which had been established in the preceding periods. They argue that the biodiversity of these rural landscapes can be revealed especially when their individual historical dimension is explored.

The importance of alternative knowledge and perspectives offered by indigenous groups that were based on their own locally developed practices of resource use have been recognised in recent decades (Berkes et al. 2000). Examples include the wood-pasture ecosystems in the United Kingdom which have attracted significant interest due to the survival of veteran trees in these habitats (Goldberg et al. 2007, Kirby et al. 1995, Read 2000). The concept of ancient woodland has also become a key concern in forest management and nature conservation in continental Europe (Watkins and Kirby 1998; Howard et al. 2002) and more recently similar research has spread in the Mediterranean (Mansourian et. al., 2013). All of these are closely related with the knowledge on the local forest history. According to Watkins and Kirby (1998) and Moreno (2004) the importance of recognising the history of woodland vegetation dynamics and their interaction with people is essential in historical ecology and forestry. It can help in the identification of the environmental aspects of the European rural heritage which will be used for their future conservation. This research serves as evidence of the importance of traditional management of woodlands and pastoralism in the creation of Dalmatian cultural landscapes and explores factors which were crucial for their maintenance.

This research also provides the first detailed exploration of reforestation policy and its implementation in Dalmatia. It emphasises strong connections between reforestation and economy, particularly the tourism sector, and gives the notion that this policy requires reassessment from the forestry point of view as its basic

stipulations have been replaced by economic gains. This is especially important in the wake of the devastating effects of climate change and increasing destruction from forest fires. Once coherent goals for reforestation have been decided, appropriate management can be determined and implemented. For instance, the concept of sustainable forest management in the Mediterranean has been broadened to include economic, environmental, social and cultural dimensions and the roles of the Non-Timber Values are increasingly recognized (Castañeda, 2000; Croitoru, 2007). New ways of managing established plantations to maximise nature conservation benefits are being explored (Rackham, 2006). Research is focusing on increasing the resilience of reforested landscapes to reduce their vulnerability to abiotic and biotic hazards (Chapin III et al., 2009) and on the management of old stands that have been affected by decaying processes (Sancho-Benages, 2006; Navarro-Cerrillo et al., 2013).

Finally, this research raises the question of perception that decision makers have about landscapes and woodlands, and what ideal forms of woodland landscape society should strive for.

There is considerable scope for further research on a number of topics that have been opened up by this study:

1) It was shown that traditional management of woodlands showed remarkable continuity over the last two hundred years, but it is likely such practices existed even earlier. Detailed reports from village councils from the 18th century, numerous maps and surveys carried out by the Venetians and many more records in the archives of Venice, Zadar and Split would certainly provide more insights into how these practices developed and how woodlands changed in the periods before the 19th century.

2) This research did not focus on forest fires in detail because they were not very common in the study area before 1990. However, over the past 20 years forest fires have become particularly destructive for woodlands as the process of vegetation recovery has intensified even more (Batllori et al., 2017; Turco et al., 2018). Many themes can be explored in this topic, from the influence of reforestation on the severity and frequency of forest fires to the effects of forest fires on the overall dynamics of wooded landscapes.

3) This research has shown people were included in woodland management throughout history. This was the case for both traditional woodlands and for reforestation in which people participated either as schoolchildren or as volunteers. There are prospects of further research on the attitudes of people toward local woodlands which could be important in the period where pines are drawing increasing opposition again as many people see them as a reason for the increasing number of forest fires. Research could also be carried out to discover how people can participate in future decision making related to woodlands and included in the management of woodlands through for example volunteering.

4) More research could be undertaken on the spread of pines over the last 30 years and the effects these pines are having on the local vegetation. While Grove and Rackham (2001) point out that pine monocultures have a negative effect on understory vegetation, some Croatian foresters such as Prgin (2005) and Španjol el al. (2006) disagree and praise them for their restorative influence. Research indicates that the effects of such plantations are dependent on local environmental conditions. Fernando Maestre and Jordi Cortina (2004) stress the need for more research on the influence of pine monocultures in the more arid areas of Mediterranean so that alternative forestry policies and strategies can be developed.

5) The thesis has shown that it is possible to use a variety of sources together with field survey to identify individual trees, small woods and larger areas of old woodland which are of significant importance for cultural and nature conservation. Studies could be carried out in other parts of Dalmatia to identify such sites and encourage their conservation and management.

6) More research is required on the current importance of grazing animals, especially sheep and goats. Small flocks and herds still survive, and research could be carried out to investigate their economic importance for local families and their potential for future land management to reduce the risk of fire. Although goat browsing and sheep grazing are increasingly recognised for their importance for fire mitigation in other Mediterranean countries and research on how to incorporate pastoralism into landscape management has been carried out (Mancilla Leytón and Martín Vicente, 2012; Lovreglio et al., 2014), in Dalmatia there is as yet little interest on this topic.

7) The research has shown that there are many significant features of the agricultural and pastoral landscape, such as walls, threshing floors, lime kilns, small walled coppice enclosures, and many walls and terraces which remain in the landscape. The initiative to restore and preserve this rich endangered cultural heritage was started by Kale (2010) and it has gained considerable support from local authorities. However, more research is needed if we are to understand their former purpose and function so that they can be conserved as key features of the cultural landscape.

8) The organisation of forestry has been shown to be very important in the management of traditional woodlands and in reforestation activities in the last two centuries. Further research is needed to explore examples of best practice and how they can be implemented in contemporary forestry of Croatia and Dalmatia in order to maximise benefits for society and conservation.

8. Archival sources

1. State Archive in Šibenik (HR-DASI)
    a) Forestry Records
        - Šumarstvo 19.-20.st.
        - Šibenik 19.-20.st. Šumarstvo
        - Poljoprivreda i Šumarstvo
        - Hortikultura

Records on forestry from 1797 until 1960 are separated into four different boxes and until now have not been research yet. Archival numeration of the documents was never done so they are not sorted in a concise way, although they are generally stored in the chronological order. Each document has a 'case number' which can be used for identification. Documents can be grouped into several types:

Reports from forest guards, reports from municipal foresters, correspondence between district authorities and municipal authorities on forestry issues, orders and letters from county authorities to district and municipal authorities, reports on woodland crimes, appeals and letters from villagers to authorities and correspondence between the Forestry Office and district authorities (1951-1960).

    b) Census and statistical data
        - Poljoprivreda 1918-1942
        - HR-DAŠI-28 ONOŠ: 5.1.1.-5.1.5., number 8; 5.1.6.-5.1.7. number 9; 5.1.7. 5008/14871., number 10; 15002/25399 5.1.7., number 11; 5.1.8.-5.4.6. number 12

2. State Archive in Split (HR-DAST)
    a) Arhiv mapa za Istru i Dalmaciju, KO. 52, Boraja
        - Original plans of first official survey of former region of Dalmatia from 1825 (Originalni planovi prvoga službenog premjera bivše pokrajine Dalmacije iz 1825. godine)
        - Economic description from 1844 (Ekonomski opis iz 1844. godine)

- Land parcels records from 1841 (Zapisnik čestica zemlje iz 1841. godine)
- Account of areas by land use types and classes from 1855 (Iskaz površina po kulturama i klasama iz 1855. godine)

b) Arhiv mapa za Istru i Dalmaciju, KO. 279, Krapanj
   - Original plans of first official survey of former region of Dalmatia from 1825 (Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine)
   - Description of borders from 1826 (Elaborat opisa granice iz 1826. godine)
   - Land parcels records from 1826 (Zapisnik čestica zemlje iz 1826. godine)
   - Economic description from 1844 (Ekonomski opis iz 1844. godine)
   - Account of areas by land use types and classes from 1855 (Iskaz površina po kulturama i klasama iz 1855. godine)

c) Arhiv mapa za Istru i Dalmaciju, KO. 219, Vrpolje (Verpoglie)
   - Original plans of first official survey of former region of Dalmatia from 1825 (Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine)

d) Arhiv mapa za Istru i Dalmaciju KO. 745, Zlarin
   - Original plans of first official survey of former region of Dalmatia from 1825 (Originalni planovi prvog službenog premjera bivše pokrajine Dalmacije iz 1825. godine)
   - Land parcels records from 1826 (Zapisnik čestica zemlje iz 1826. godine)
   - Economic description from 1844 (Ekonomski opis iz 1844. godine)
   - Distribution of land use types and classes from 1857 (Raspored po kulturama i klasama iz 1857. godine)

3. MAPIRE
   - Digitised versions of cadastral plans from the 1820s and 1830s accessed on MAPIRE.eu portal for analysis of land use in Dalmatia
4. Juraj Šižgorić City Library
   - Collection of periodicals and newspapers among which two newspapers were were relevant for research:
     a) Šibenski list (1952-1965)
     b) Narodna straža (1921-1928)
5. Aerial photography

- Aerial images from 1968 accessed through ISPU-MGPU (Information system for spatial planning – Ministry of construction and spatial planning: https://ispu.mgipu.hr/

6. Postcards and old photographs
    - Obtained from various individuals or received permission to use them

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Appendix 1: List of Informants

Code	Location	Date	Occupation	Age group	Gender	Type of interview*
G1	Grebaštica	10th May 2017	Retired, electrician, farmer	61-70	M	SS
G2	Grebaštica	10th May 2017	Retired, salesperson, farmer	61-70	F	SS
G3	Grebaštica	10th May 2017	Retired, farmer	71-80	M	US
G4	Grebaštica	10th May 2017	Retired, farmer	71-80	F	US
G5	Grebaštica	12th May 2017	Fisherman	51-60	M	SS
G6	Grebaštica	12th May 2017	Tourism, farmer	51-60	F	SS
G7	Grebaštica	12th May 2017	Retired, farmer	71-80	M	SS
G8	Grebaštica	12th May 2017	Retired, farmer	61-70	F	US
G9	Grebaštica	14th April 2018	Retired, factory worker	71-80	M	US
G10	Grebaštica	14th April 2018	Tourism	51-60	M	US
G11	Grebaštica	14th April 2018	Retired, housewife	61-70	F	US
G12	Grebaštica	13th May 2017	Retired, civil servant	71-80	F	SS
G13	Grebaštica	14th May 2017	Retired, housekeeper	71-80	F	SS
G14	Konoba	14th May 2017	Retired, farmer	81-90	F	SS
G15	Konoba	14th May 2017	Retired, farmer	61-70	M	US
G16	Konoba	15th May 2017	Retired, factory worker	71-80	M	SS
G17	Konoba	15th May 2017	Retired, farmer	71-80	F	SS
G18	Konoba	15th May 2017	Retired, farmer	71-80	F	US
G19	Brnjača	15th May 2017	Farmer, housewife	51-60	F	US
G20	Brnjača	15th May 2017	Retired, smallholder	71-80	M	US
G21	Brnjača	15th May 2017	Retired, smallholder	61-70	F	US
G22	Krapanj	13th April 2018	Retired, civil servant	61-70	F	SS
G23	Krapanj	13th April 2018	Retired, fisherman	71-80	M	US
G24	Krapanj	13th April 2018	Retired, smallholder	71-80	F	US

Code	Location	Date	Occupation	Age group	Gender	Type of interview*
Z1	Zlarin	15th July 2017	Retired, civil servant	60-70	M	SS
Z2	Zlarin	15th July 2017	Tourism	61-70	M	US
Z3	Zlarin	15th July 2017	Retired, electrician	71-80	M	US
Z4	Zlarin	16th July 2017	Retired, tourism	61-70	F	US
Z5	Zlarin	16th July 2017	Retired, housewife	71-80	F	US
Z6	Zlarin	11th April 2018	Retired, fisherman	81-90	M	SS
Z7	Zlarin	11th April 2018	Retired, tourism	71-80	F	SS
Z8	Zlarin	11th April 2018	Retired, smallholder	71-80	F	US

Code	Location	Date	Occupation	Age group	Gender	Type of interview*
B1	Boraja	16th April 2018	Retired, housewife, farmer	81-90	F	SS
B2	Boraja	16th April 2018	Retired, farmer	81-90	M	SS
B3	Boraja	16th April 2018	Retired, smallholder	71-80	F	US
B4	Boraja	17th April 2018	Farmer	61-70	M	US
B5	Boraja	17th April 2018	Retired, farmer	61-70	F	US
B6	Vrsno	16th April 2018	Retired, smallholder	71-80	F	US
B7	Vrsno	17th April 2018	Retired, smallholder	61-70	F	US
B8	Vrsno	17th April 2018	Retired, factory worker	71-80	M	US
B9	Podine	16th April	Retired, smallholder	71-80	M	US

Code	Location	Date	Occupation	Age group	Gender	Type of interview*
S1	Zagreb	8th May 2017	Forestry professor	41-50	M	SS
S2	Lozovac	25th August 2017	Retired, forester	61-70	M	SS
S3	Šibenik	29 August 2016	Forester	51-60	F	SS
S4	Split	23th August 2017	Forester, researcher	41-50	F	SS

*__SS__: semi-structured interview; **US:** unstructured interview