THESIS ON CIVIL ENGINEERING F64

The Restoration of Nationally Protected Estonian Manor Parks in the Light of the Florence Charter

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This dissertation was accepted for the defence of the degree of Doctor of Philosophy in Civil Engineering on 7th April 2017.

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Defence of the thesis: 12th June 2017, Tallinn

Declaration:

Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for any academic degree.

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ISSN 1406-4766
ISBN 978-9949-83-095-4 (publication)
ISBN 978-9949-83-094-7 (PDF)

EHITUS F64

Riiklikult kaitstavate Eesti mõisaparkide restaureerimisest Firenze harta valguses

NELE NUTT

TTÜ KIRJASTUS

Contents

List of publications

This chapter consists of the summary of publications that make up the body of this work. It also notes which research question is answered and the author's role in each publication.

Publication 1. Talking ruins: The legacy of Baroque garden design in Manor Parks of Estonia

Nurme, Sulev; Nutt, Nele; Hiob, Mart; Hess, Daniel Baldwin. 2012. Talking ruins: The legacy of baroque garden design in Manor Parks of Estonia. In: Amsterdam University Press, 115−125.

The late 19th-century and early 20th-century 'grand era' of manor parks in Estonia coincides with the period when English gardening ideas dominated Europe. What is less recognised, however, is that manors in Estonia possess formal French-inspired gardens dating from the mid-18th century (the introduction of Baroque design in Estonia was delayed). Today, about 600 complete manor ensembles remain, retaining distinctive structural characteristics which date from the 18th-19th centuries. It is quite typical that in old parks of Estonia Baroque and English garden styles have merged, giving them a unique and original character.

This research reports on archival study, field investigation and map analyses of 45 protected manor parks in Estonia. The analysis suggests that, despite the relatively short period (ca. 1730-1770), formal Baroque gardening was the dominant style practised in Estonia. The movement had a significant influence on local garden design, and on landscape planning more broadly. The Baroque elements in manor lands include formal geometric spaces, axial connections between landscape and buildings, orchestrated vistas and tree-lined roadways. Within the Baroque garden, formal plantings, pathways and water features were arranged in classical configurations. Finding physical traces of Baroque artefacts today is difficult because many manor parks were destroyed during the Soviet era in the latter half of the 20th century.

Nevertheless, archival materials and present-day visits to garden ruins in manor parks suggest that formal Baroque gardens dating from mid-18th-century manor lands were vivid and sophisticated ensembles of formal terrain, tree allées, sculptural elements and finely orchestrated water elements.

The author of this thesis helped to compose this article and presented it at the 1st Landscape Archaeology Conference: LAC2010 in 26th to 28th January 2010 at VU University Amsterdam, the Netherlands. The article was published in the conference proceedings.

Note: This article addresses research question 1.

Publication 2. Baroque manorial cores and the landscape

Nurme, Sulev; Kotval, Zenia; Nutt, Nele; Hiob, Mart; Salmistu, Sirle. 2014. Baroque manorial cores and the landscape. Journal of Cultural Heritage Management and Sustainable Development, 4 (2), 166−183.

This paper seeks to provide guidelines that can be articulated to protect cultural landscapes. These guidelines are based on a manorial core study that was carried out in 2010 to analyse the changes in road networks and spatial systems of manors over the past 150 years. This study is part of a larger research effort on different aspects of Estonian Baroque manor gardens. Many landscapes may contain historicly relevant objects and phenomena not protected by law, which, nevertheless form the basis of a unique local landscape. The altering of such a landscape not only changes its natural form, but may directly impact the cultural identity and milieu of the area, thereby affecting how its inhabitants relate to their environment. The preservation of historic buildings and landscapes plays an important role particularly in relation to manor landscapes. This network has remained well preserved, and the rural landscape based on this Baltic-German manor culture is still strongly reflected in the current landscape through the existing historic landscape elements like housing, viewsheds, roads, etc. Without landscape analysis, it can be challenging for an outsider to understand the spatial context, especially when it has changed and evolved through the years.

Nutt was the co-author of this article.

Note: This article addresses research question 1.

Publication 3. Simple, but Therefore a Clever Idea - an Effective Dendrological Inventory Process for Landscape Architecture and Design Projects

Kalberg, Heiki; Nutt, Nele; Nurme, Sulev; Hiob, Mart. 2013. Simple, but Therefore Clever Idea - an Effective Dendrological Inventory Process for Landscape Architecture and Design Projects. In: Buhmann, Ervin; Ervin, Stephen M.; Pietsch, Matthias. Ed. Buhmann, Ervin; Ervin, Stephen M.; Pietsch, Matthias. Berlin: Wichmann, pp 48−54.

This article introduces a simple way to improve the economic efficiency of the digitalization of dendrological inventory data. The application developed in this study makes it possible to effectively link drawing and database programmes so that data can be utilized in both CAD (computer-aided design) and GIS (geographic information system) systems. Furthermore, no additional investments in training or technology are necessary, as this application uses software already featured in most plan design offices.

In Estonia, more than four hundred parks are protected areas (Sinijärv, 2008), but there are many more historic parks. After Estonia regained independence (1991), people became more passionate about restoring and rebuilding historic parks, which explains why landscape architects deal with compiling restoration projects on a daily basis. Compiling park design projects involves the inventory of park trees (Eesti standardid, 2010), and provides a much needed overview of park conditions along with the data needed to choose the best restoration methods that promote sustainable design (Nurme, 2008). Dendrological inventory is a time-consuming process due to the extensive fieldwork involved and the detailed data digitalizing and systemizing processes that follow.

Nutt coordinated the writing of this article by organizing the cooperation of writing the content and arranging the final draft. She is also a co-author of this article.

Note: This article addresses research question 1.

Publication 4. Restoring Manor Parks: Exploring and Specifying Original Design and Character through the Study of Dendrologous Plants in Estonian Historic Manor Parks

Nutt, Nele; Hiob, Mart; Nurme, Sulev; Salmistu, Sirle; Kotval, Zenia. 2014. Restoring Manor Parks: Exploring and Specifying Original Design and Character Through the Study of Dendrologous Plants in Estonian Historic Manor Parks. Baltic Forestry, 19 (2), 280−288.

Manor parks are an integral part of the Estonian landscape, given that we have about 1,000 manors with smaller and larger parks of which about 400 are under nature protection or declared as national heritage objects. Manor park restoration is an important national goal for the country. However, restoration techniques and expertise is not readily available. While there is great interest in cataloguing and inventorying the plant species in the Estonian Landscape, particularly in Manor Parks, knowing the types of different species is far from adequate to understand the original composition and design of the parks for true restoration. While historic documents, maps, writings, poetry and paintings give us useful background information regarding the overall scheme, such as spatial orientation and road patterns, little is understood about detailed plantings, tree species etc. Under specific circumstances the old trees in the park may yield valuable information for restoration decisions. The most important question in restoration is which woody plants and on what conditions are part of the original design concept. That is the key question posed by the researchers of this paper. Due to the fact that the development of manors and manor parks in the Baltic countries is similar the topic is equally interesting for all Baltic States. Moreover, the addressed problems of restoration of parks are similar in every place with the lack of primary data.

The researchers contend that in addition to the inventories performed by many foresters and naturalists, it is equally relevant to know the actual count of each type of tree to begin composing the original landscape. Furthermore, one needs to understand that these parks have evolved over many years and the current structure might be very different than the original plan. To make it even more complicated, it is difficult to really say what era was "original" or what were the glory days of the Mansions. One of the ways to deal with this issue is to identify the really old trees from the new or subsequent growth, and focus attention on those. The authors have begun the tedious task of identifying, inventorying (types and number of species) and understanding this footprint in each of the 16 parks in 2003 - 2009.

This paper addresses the methods and significance of focusing on the identification and composition of old trees and their influence/significance in understanding the original intent of the park design and the amount of original matter in today's historic parks, thereby aiding in better restoration efforts.

Nele Nutt presented and developed the idea, worked out the initial methodology, is fully responsible for the conclusions and partly responsible for the data collection.

Note: This article addresses research questions 2.

Publication 5. Mõisaparkide dendroloogiline autentsus

Nutt, Nele. 2013. Mõisaparkide dendroloogiline autentsus [The Dendrological Authenticity of Manorial Parks]. Acta Architecturae Naturalis, 3, 93−103 (In Estonian).

Most Estonian parks are historic parks that are already 150 years old and regarding which issues related to restoration are increasingly topical. One of these issues is the requirement based on Article 12 of the Florence Charter – that the species of trees, shrubs, plants and flowers to be replaced periodically must be selected with regard for established and recognised practice in each botanical and horticultural region, and with the aim to determine the species initially grown and to preserve them. Interest in parks and their dendrological flora has been apparent in Estonia for a long time. This is proven by the large number of dendrological inventories that have been compiled. However, a survey of the relative proportions of species in the arboreta is still not available, although this could be of help in drawing up the selection of species for restoration projects. This article introduces a project initiated in 2009 by the Department of Landscape Architecture at the Tallinn University of Technology, which deals with researching the species-based compositions of the stands of trees in historic parks.

The author of this thesis is the sole author, is responsible for the research concept, worked out the initial methodology, is responsible for composing the study design and data collection.

Note: This article addresses research questions 2.

Introduction

On May 21st, 1981, ICOMOS-IFLA (International Council on Monuments and Sites - International Federation of Landscape Architects) Committee for Historic Gardens gathered in Florence and created a charter on the preservation of historic gardens. The charter was named after the meeting town Florence and it was registered by ICOMOS on December 15th, 1982, as an addendum to the Venice Charter. The necessity of this dissertation is directly derived from the Florence Charter, article No 15, which states that no reconstruction work on an historic garden shall be undertaken without thorough prior research to ensure that such work is scientifically executed (article No 15, ICOMOS, 1981). The charter also emphasises that before any practical work starts, a project must be prepared on the basis of said research (article No 15, ICOMOS, 1981) and article No 9 which states that the preservation of historic gardens depends on their identification and listing (article No 9, ICOMOS, 1981). It is important to pay equal attention to all park components in the research (plan and topography; vegetation, including species, proportions, colour schemes, spacing and respective heights; structural and decorative features; water, running or still, reflecting the sky) because all maintenance, preservation, restoration or reconstruction work in a historic park or its parts has to consider the completeness of the design elements. It is important to study the unusual and typical qualities of each park as preservation is among other things. Since the principal material is vegetal, the preservation of the garden in an unchanged condition requires both prompt replacements when required and a long-term programme of periodic renewal (article No 11, ICOMOS, 1981). These programmes are derived from the species of trees, shrubs, plants and flowers which need to be replaced periodically and must be selected with regard to established and recognized practice in each botanical and horticultural region, an with the aim to determine the species initially grown and to preserve them (article No 12, ICOMOS, 1981).

The Florence Charter defines historic parks as architectural and horticultural compositions whose attributes are primarily vegetation, therefore living, which means that they are perishable and renewable. A park is an original work of a creative artist. It represents a specific culture, style, era, and expresses the connections between the culture and nature making it a suitable place for peaceful rest. Architectural design techniques that are used to create diverse spaces are important in park architecture. A space contains aesthetic, functional, recreational, social, cultural, natural elements values and connections and thus is a multi-layered and multi-faceted object of study in landscape architecture. Landscape architects as researchers are interested in the outside surroundings, structure and function of the park a its relations with a person, and the social processes taking place in that space (Hiob et al., 2012; Hiob and Nutt, 2016; Nutt et al., 2013a). The same principles that are used for architecture apply for designing a space. A room painted dark appears smaller than a room painted light which feels more spacious (Tammert, 2002). Park as an architectural piece is created by combining brightness with darkness and open space with closed.

The building material in park architecture is vegetation, primarily woody plant which is a plant that produces wood as its structural tissue (trees, shrubs, lianas). The specific biological quality of species is not most important in the selection criteria because the parks are not dendrological arboretum. The historic park is an architectural composition. The general restoration principles which are stated in the Venice Charter can be applied for all architectural pieces. However, the Florence Charter, which is a document concentrating on the issues on garden and park protection and also an addendum to the Florence Charter, states that parks as living monument need specific rules to be applied for that protection.

After defending her Master's thesis in 2004 "The Inventory Methodology of Tartumaa Manor Ensembles" (Nutt, 2004) the author's interest in manor ensembles as a phenomena has grown and developed in many different directions. The results of studying time, space and semiosphere in manor networks have been published in articles, such as "The Time and Space of Manorial Landscape" (Nutt, 2009a), "The Manor and the Landscape" (Nutt, 2009b), "Tartumaa Manorial Landscape in Time and Space" (Nutt, 2005), "No Park Is Ever Ready. Park Maintenance and Maintenance Plans" (Nutt, 2007), „Simple, but Therefore Clever Idea - an Effective Dendrological Inventory Process for Landscape Architecture and Design Projects" (Kalberg et al., 2013), „Baroque Manorial Cores and the Landscape" (Nurme et al., 2014), „Talking Ruins: The Legacy of Baroque Garden Design in Manor Parks of Estonia" (Nurme et al., 2015) and books, such as "Alatskivi Castle and Park" (*Alatskivi loss ja park: kahe meistriklassi materjale [Alatskivi Palace and Park: Material From Two Master Classes]*, 2003), "Manors of Tartu County" (Maiste and Nutt, 2005), "Park Lexicon" (Nurme and Nutt, 2012). The problems in park architecture have been studied for more than 10 years. The research involved topics, such as the roles of parks in manor ensembles (Nutt, 2004), location in the landscape (Nutt, 2009b, 2004), the reach of views, the style and the history of park formation (Nutt, 2008a), the issues of protected objects (Nutt, 2008b), the design and archival material of historic parks (Nutt, 2008a), suitable materials for research (Nutt, 2008c), maintenance issues (Nutt, 2011, 2008d) and the problems of field work in parks (Nutt, 2008e).

The outcomes of this study include a textbook "Restoration of Parks" (Nutt et al., 2008) and a methodology "A Guide to Compiling a Park Maintenance Plan" (Nutt, 2011) ordered by The Environmental Board of Estonia. The latter serves as a basis for planning and managing the maintenance of historic parks. The most significant works about the results of the research of historic park material include an international conference presentation „The Dendroflora of Estonian Nature Protected Parks" (Nutt et al., 2010) and scientific publications, such as „Restoring Manor Parks: Exploring and Specifying Original Design and Character Through the Study of Dendrologous Plants in Estonian Historic Manor Parks" (Nutt et al., 2013b) and "The Dendrological Authenticity of Manor Parks" (Nutt, 2013). In this work the author examines the issues involving the plant material in a park, studies the substance that creates the main volume of historic park and defines the typicalness of Estonian historic parks.

1. Literature review

Manors and their parks as a legacy have been an interest of Estonian researchers and restorers since the 1970s when an extensive inventory of manors was carried out (Maiste, 1978; Maiste and Nutt, 2005; Üprus, 1978, 1975). A lot of scientific research has been done on parks, including theses. There have been studies on the structure, style and plant material of parks (Bassova, 2012; Heringas, 2009; Kupper, 2012; Mihkelson, 2010; Nurme et al., 2009; Paalo, 2013; Ratas, 2011; Saarepuu, 2015, 2011; Tarkin, 2011; Uustal, 2003; Vaine, 2009), the iconography of parks, its meanings and aesthetics (Karro, 2009; Maiste, 2011, 2008, 2005, 2004, 2003; Sipelgas, 2009a, 2009b). The problems of invasive tree species have been pointed out (Purik, 2013, 2011; Purik and Ööpik, 2013) botanical composition of parks has been dealt with (Liira et al., 2012; Lõhmus et al., 2014; Lõhmus and Liira, 2013; Tuisk, 2009) and issues concerning biodiversity and restoration have been dealt with (Sinijärv, 2012, 2009). The studies have also included research into large-scale trees, diversity of species and alien species (Kanger and Sander, 2004; Kull, 2009; Paivel and Sander, 2004; Sander, 2009, 2008a, 2008b, 2006, 1996; Sander et al., 2008, 2006, 2003; Sander and Elliku, 2007; Sander and Meikar, 2009, 2007, 2004). The researchers have described manors' and manorial parks' history (Hein, 2003a, 2003b, 1996a, 1996b; Maiste, 2014, 1996; Maiste and Nutt, 2005; Rosenberg, 1994; Sinijärv, 2012) paid attention to the national protection of parks (Sinijärv, 2008) and put together encyclopedic overviews (Abner et al., 2012, 2007). In addition suggestions for park restorations have been compiled and they include lists of recommended species (Palm, 2013, 2009).

Historians, especially art and architectural historians, everywhere have always had a great interest in historic parks. Many reviews with an emphasis on history have been compiled about Estonian manors and parks (Maiste, 1996) and Latvian manor parks (Janelis, 2010), which belong to the same establishment period. Importance of one central object has been published for the most representative Latvian ensemble Rundale (Lancmanis, 2009) as well as one of the the most famous parks, Versailles, the birth place of Baroque (Baraton, 2014; Baridon, 2008; Lablaude, 1995; Thompson, 2006). English landscape parks have recieved equally as much attention by the researches (Mowl, 2000; Robinson, 1990; Smith, 1997). The topics of park design, style, philosophy and history, (Hobhouse, 2004; Rogers, 2001; Turner, 2005) and the topic of historical park restoration (Halbrooks, 2005) have also been popular. Many historical parks, especially urban parks, are evaluated by their cultural, ecosystem services', aesthetic and social values (Bolund and Hunhammar, 1999; Chiesura, 2004). The connections between the design style and today's values (Kümmerling and Müller, 2012) and the use of parks all the way to small urban parks (Nordh and Østby, 2013; Peschardt et al., 2016, 2012; Peschardt and Stigsdotter, 2013) have been studied.

Manor gardens may serve as local hotspots of biodiversity and provide cultural ecosystem services (Bolund and Hunhammar, 1999) Different authors have studied biodiversity (Uhrin and Supuka, 2016), both in national parks (Sulieman and Mohammed, 2014) and urban parks, and recreational values of parks (Šantrůčková, 2016). Different methods for macrofossil analysis (Alanko et al., 2015), research in garden archaeology (Frost et al., 2004; Moe et al., 2006) and horticulture as a major source of plant species invasions (Dehnen-Schmutz et al., 2007; Mack and Erneberg, 2002; Reichard and White, 2001) have been researched. But they have not studied the park as an architectural piece whose architectural character is primarily created by the stand of trees.

Estonian parks' dendroflora has been studied for a long time. The inventories have been carried out by Paivel in 1952-1973 and by Ellik and Roht in 1983-1989 (Sander et al., 2006). Since 1961 inventories of tree-stands have been done under Tallinn Botanic Garden (Abner et al., 2002). The species or its lower ranking taxon was recorded and larger trees were measured during field work. The character of woody plants turned wild was determined and the renewal of species by seeds or stolons was evaluated (Sander et al., 2006). Reviews of parks and woody plant collections (arboretums, dendrological garden) dendrofloras based on inventory data have been published (Viru County (Elliku and Sander, 1996), Saare County (Elliku et al., 1997), Pärnu County (Sander, 1996), Lääne County 2000, Jõgeva County (Elliku and Paivel, 1988a, 1988b), Tartu County (Elliku and Paivel, 1989), Järva County (Elliku and Paivel, 1991), Põlva County (Elliku and Paivel, 1987).

Published articles talk about species richness, the presence of introduced species and the occurence of large specimens. Coniferous alien tree species have been discussed separately. One of the goals of species richness inventories has been the study of species richness which is the basis for dividing the parks into three groups: high, medium and low richness in species (Aaspõllu, 1984). At the same time the species richness is not a measure of value in a historic park, also in the context of the Florence Charter, because the number of species is directly linked to the architectural style of the park. When in the Baroque style it is presumed to use high number of woody plants of same species, then the diversity of species is inherent to the English park. As architectural objects Baroque and English park are equal in value. The age value of the Baroque park, which is poor in species, may be considered higher because it was established earlier. The species richness in parks has been considered valuable from the point of view of nature protection. Hereby it is interesting that exotic species form a major part of the species richness and some of them pose a potential risk for invasion. Therefore, the values in parks can be controversial as the value of biological diversity, important from the nature protection point of view, comes directly from exotic species. There are 81 indigenous woody plant species in Estonia (Kull, 2009), but in parks there have been found more than 350 different species (including exotic species, subspecies, varieties, exotic species) (Palm, 2009). The collected material gives a very throrough overview of the diversity of species in woody plant collections (including parks) but it does not portray the proportion of species, therefore it is not enough to resolve the issues related to the authenticity of the historic park.

A lot has been written about Estonian historic parks. In the context of this research it is important to name three of these works. First one was compiled in 2003 by Maire Uustal and it talked about the use of plants in Estonian manor gardens (Uustal, 2003). Second work was written in 2009 by Piret Palm who studied the woody plants of 19th-20th century Estonian manor parks protected by the Nature Conservation Act (Palm, 2009). The third research was conducted in 2012 by Urve Sinijärv (Sinijärv, 2012) and it focused on the possibilities for connecting the design and species protection objectives for restoration and maintenance. The main aim of Uustal's work is not to specify the time when the species were brought in, but to define the general principles for plant material usage in gardens and parks and to point out the plants characteristic (mostly used) to the time period. As a result, the author states without bringing out specific species that it is important to use design principles and plant material characteristic to the period during park restoration and reconstruction. The selection of plants can be made with the help of archival materials (which unfortunately can only be found for a few parks) or species lists of arboretums and gardening farms of that time. The material published about the 19th century is sufficient enough to be able to use it (the lists of plants) for park reconstruction or restoration.

When Uustal's results remained on a general level, the aims of Palm's work were to define the historicly and current most commonly occurring tree and shrub species in Estonian parks protected by the Nature Conservation Act and to compile a list of recommended species based on the results for the restoration of Estonian historic parks. The reason why the research was limited to protected parks was because their dendrological value has been preserved the best and also these parks are mostly richer in species than other parks, thus more inventories have been carried out about them. The author highlights that it is extremely important to know the composition of species in parks during the restoration and points out that not all the species available in arboretums today are suitable for manor parks. The research is based on the woody plants inventory data of 304 protected parks, which in addition include information about the town and farmstead parks but these are not pointed out in the results. The author says that the significance of this work lies in the overview of tree and shrub species which have been historicly and are still most commonly used in Estonian parks. The author was guided by the criterion that the species had to be represented in the park in history and is also represented there today (in the latter case in more than 5% of analysed parks). In this way a list of recommended tree and shrub species characteristic to Estonian historic parks was created. As the author notes, the trees in the park were not examined on a single specimen level and the proportion of species occurrence in parks was not analysed. When using this list, it has to be taken into consideration that it is based on the species lists of protected manor parks and to a small extent on town and farmstead parks, which contains a listing of some of the species (84 species in the listing) represented on the Dietrich list (241 species on the listing) (Dietrich, 1865) of the second half of 19th century and on the 20th century inventory lists (369 species on the listing) (Palm, 2009).

The doctoral thesis defended in 2012 by Sinijärv (Sinijärv, 2012) focuses on the park as an art piece on one side and park as an ecosystem on the other. She tries to find the answers to questions such as, is it possible and to what extent to join the design and species protective objectives for park restoration. She named the approach an ecological restoration which aims to preserve and increase the biodiversity while resolving the park design issues. The restorational solutions in the work have been presented as a text and illustrated by photomontages of park views. The main focus is on maintenance issues and on general restorational guidelines which do not replace a restoration project but this was not the objective of this work. One of the main conclusions of this work deserves recognition and it says that the design and species protective objectives of old parks generally can successfully be joined. The objectives and needs of most of the biota groups coincide with the design goals and support each other.

As seen in the above, the parks as protected objects have received a lot of attention which is due to an active interest of conservationists. The protection of parks on a national level also began from conservationism (Nutt, 2008b). Law on summer leisure and healing places (Suvitus- ja ravitsuskohtade seadus, in Estonian) adopted in 1925 was the first legislative act dealing with the protection of parks and it took 40 manor parks under its protection (Nutt, 2008b) National Heritage Board has primarily been dealing with the issues related to the park as an art piece. The Heritage Conservation Act was passed in 1974 and it was the first time park protection and everything related to it was regulated. According to this law 54 manor parks on the territory of Estonian Soviet Socialist Republic were included in the nationally protected architectural monuments of national importance list (Supreme Soviet of the ESSR and the State Gazette 1974) (Nutt, 2008b).

Today the protection of parks is managed by the National Heritage Board. The protective objective of a protected park is the preservation of the historic layout and of the tree-stand of dendrological, cultural, ecological, aesthetic and recreational value, and of the valuable design elements of park and garden architecture. The objective also includes the future use and development of the park Regulation for the Protection of Parks, Arboretums and Forest Stands. (“Kaitsealuste parkide, arboreetumite ja puistute kaitse-eeskiri [Regulation for the Protection of Parks, Arboretums and Forest Stands],” 2006). The parks under heritage protection are immovable monuments that have historic, archaeological, ethnographic, urban, architectural, artistic, scientific, religious or other type of cultural value (“Muinsuskaitseseadus [The Heritage Conservation Act],” 2002). Everything related to parks is regulated internationally (ICOMOS-IFLA Committee for Historic Gardens) by the historic park protection charter adopted in 1982 (“The Florence Charter,” 1981).

2. Research Questions and Aims

In Estonia, park restoration research deals with nationally protected parks as built monuments. The Heritage Conservation Act ("Muinsuskaitseseadus [The Heritage Conservation Act]," 2002) defines immovable monuments as built structures, monuments, cemeteries, places (areas of land) and parks that have historic value. There are 26,687 monuments under national protection in Estonia 5,265 of which are built monuments, 292 of which are parks, according to the registry of the National Heritage Board ("Muinsuskaitseamet," n.d.). Parks are often under two protections because around 300 parks are also protected by the Nature Conservation Act ("EELIS," n.d.).

Researchers have not generally focused on the built or architectural form of the park or the materials that create it. While park benches, pavilions and flowerbeds have been destroyed, the enduring tree-stands provide a good idea about the layout, built form and general historic look and feel of the park. Many manorial parks, often dating back more than 150 years, have been neglected and are in need of restoration. The remaining stand of trees, not only provide an indication of the historic built form but also help determine the authentic species composition in the park. Both these aspects are critical in renewing the plantings and restoring the parks.

The aim of this dissertation is to work out the methodological basis for the restoration of historic manor parks according to the principles for restoring the historic manor park composition that take into account the guidelines set in the Florence Charter. This is why the park is not studied as an object of biodiversity but as a built monument and an architectural piece, whose composition is mainly created by woody plants particularly trees. Creating a model for the historic park, which describes the composition of tree-stands in the park and which can be used as a basis for park renewal forms the major contribution of this dissertation.

Goal statement: When restoring historic manor parks logging and new plantings for the tree-stand need to be assigned. In order for the result of historic park's restoration to meet the requirements of the Florence Charter it is necessary to know the tree-stand composition of species from the park's founding period.

The aim of the current research was to clarify the proportion of examples of distinct tree species in manor parks today and to determine the main tree and shrub species originally used in manor parks.

Research Questions

1. In keeping with the Florence Charter, what characteristics can and should be taken into consideration when restoring manor parks in Estonia and how can these characteristics be studied and measured?

This question focuses on a number of sub-questions. What are the special characteristics of the Baltic-German manor parks in Estonia? How have the values inherent in Baltic-German manor parks been preserved? What are the conditions and problems of the parks? What are the characteristics within the park that have been preserved as architectural elements and structural compositions as defined in the Florence Charter?

2. Tree stands are considered a critical element of the architectural and structural composition of historic parks. What factors should be evaluated when studying tree stands for restauration purposes and what are appropriate methods to evaluate these factors?

2a. What is the tree-stands species composition in a historic park?

What is the tree-stands composition by types (trees-shrubs-other, needle-leaf, indigenous-exotic)? What is the stands composition by species? What kind of species are dominant? What is the tree-stand formula that describes the stand species composition? Does the composition of old (over 150 years old) tree-stands differ from the young tree-stand composition? How does the old tree-stand species composition differ from the young?

2b. What is the historic manor park tree-stand age composition?

Based on what kind of parameters is it possible to determine the tree age? What kind of tree age assessment scale is suitable for determining the ages of park trees? What kind of method is suitable for describing the park tree-stands age composition? What is the age composition of historic park tree-stands? What is the species distribution of park tree-stands by age?

3. Inventories and Data used in this Study

3.1. Overview data and inventories problem

Due to the fact that data collection needs a lot of resources, a thorough analysis was carried out in order to evaluate if the data collected in previous invetories would be suitable for this thesis. During the Soviet times many forestry scientists and conservationists had a great interest in the dendroflora of parks. The aggregated information gives a good overview of all the species growing in parks. Dendrological inventories of parks have been done for restoration projects which use this information for compiling logging plans.

Suitable data was selected as a result of different inventory data analysis. Overview of this data is given in the Sample chapter in addition to a descriptive data overview table (Table 1). The initial aim of data collection, which the author of this work was also a participant of, was to compile restoration projects for these parks. Thus, this data needs to be treated as secondary data in the context of this thesis. Issues related to the suitability of data often arise when using secondary data. In this work these problems (incomplete data) were solved with additional inventories.The species richness inventory

During the Soviet times many forestry scientists and conservationists had a great interest in the dendroflora of parks. A thorough species richness inventory was done in the late 1970s, early 1980s led by Aino Aaspõllu (Aaspõllu 1977, 1978a, 1978b, 1980, 1981, 1982, 1984a, 1984b, 1986). In addition, inventories of park tree-stands have also been made by Aleksei Paivel (1954–1960), Jüri Elliku (Elliku 1984a, 1984b, 1984d, 1984e, 1984f, 1989, Elliku and Karis 1984, Elliku 1996, Elliku and Sander 1996, Elliku et al 1997), Heldur Sander (1984, 1991–1997) (Sander 1996), Urmas Roht (1983–1989), Priit Kohava (Kohava 1974, 1976), E. Tasa (Tasa 1977), Mare Vare (Vare 1977, 1980), Olev Abner (Abner 1997, 2001, Abner *et al* 2006a, 2006b, 2007) and Heiki Tamm (Tamm 1998). Veljo Ranniku (Ranniku 1978) has also put together reviews of manors and their parks.

Estonian historic park the species richness inventories have described the species diversity of woody plants and as a result thorough lists of woody plants that grow in the park have been compiled. The aggregated information gives a good overview of all the species growing in parks.

The concentrated data of species richness from the work of Piret Palm (Palm, 2009) was used to put together a concentrated list of species. The species frequency of occurrence and regional occurrence were analysed. Data of species richness enables to compile the so-called species distribution maps which give a great overview of parks where certain species can be found but do not give an idea of the species proportions in those parks. The species diversiy data enables to compile overview maps of each species separately and this for example can be done for the species distribution map of balsam fir given below (Figure 1). The species distribution map given as an example portrays the appearance of balsam fir (*Abies balsamea*) in parks. Balsam fir is rarely found in West-Estonia and on islands because it has been recognized as invasive. In rest of Estonia the species can be found in approximately half of the parks (Figure 1).

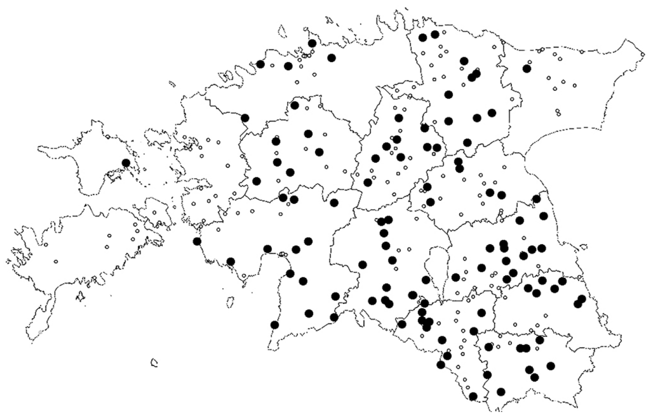

Figure 1. For example the distribution map of species Abies balsamea based on park inventory listings. The hollow circles mark the parks and black filled circles mark the parks where species Abies balsamea grows.

3.2. Dendrological inventory

This chapter gives an overview of the data collection method which was the dendrological inventory. This method is usually used for compiling park restoration projects. The data of 17 parks (141 hectares) was used all together. Dendrological inventory consisted of two phases: fieldwork and camera work. The data collected during fieldwork was summarized in a report. Actualized plan of trees stands for the inventory level (single tree in scale of 1:500) was used as the base plan for fieldwork. All the trees with a diameter larger than the agreed size (usually 6 cm) and groups of shrubs growing in the area were marked on this plan.

All the trees and shrubs were identified and evaluated to assess them on a single tree level. The diameters were measured with the precision of one centimetre. On a tree-stand level, the plot was evaluated separately and its composition of species was described with the compositional formula. All main species' average diameters at breast height, total height, main parameters and locations of significant specimens, conditions of tree-stands (by species if necessary), health, and density (pcs/surface measurement unit) were measured. The diameter at breast height (1.3 m from the root crown), the height and the width of the crown was measured on trees. For multi-trunk trees all the diameters of different trunks and the estimated trunk height were measured. If the branching started from the ground, they were considered as separate trees. If that height was between 0.7-1.3 m, then the diameters were measured 0.6 m above the branching point. The shrubs' diameter was measured only when the plant was shaped as a tree and the diameters were more than 6 cm. Tree caliper with an accuracy of 1 cm (diameter) or a flexible tape measure (circumference) was used for measurements.

Dendrological inventory reports made for reconstruction projects contain information on a single tree level (location, name of species (mostly as accurate as the family of species), diameter at breast height, health condition and so on). Some of the inventories have been done on a group or allotment level and some of the species determination is generalized to the species family.

Dendrological inventories of parks have been made for restoration projects which use this information for compiling logging plans but not more, for example for the selection of suitable species to the restauration. But the information gathered in large scale inventories is unfortunately an unused resource for dealing with issues involving the authenticity of plant material.

3.3. Suitable data for studying the material

The dendrological inventory is different from species richness studies because it does not deal with the park for its biodiversity value but studies it as a built monument and as an architectural work. Due to this, the level of detail in species richness studies is too generalized for assessing the proportions of species. The percentage of species given as the result of the study gives a false idea of the tree-stands in parks because it does not give the quantity of trees by species but gives the number of species regardless of the proportional size of the species. For example in Pagari park the quantity of specimens is small but it is assessed to be rich in species (Figure 2).

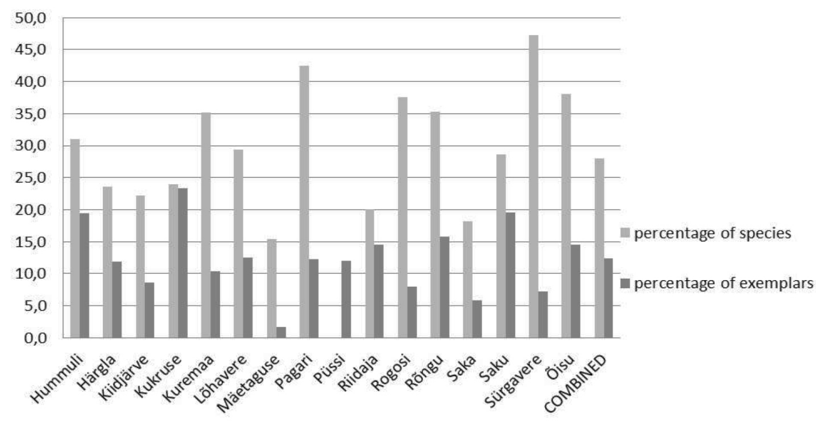

Figure 2. The comparison of species richness inventory and dendrological inventory data.

One can conclude that the information collected for dendrological inventories is suitable for the necessary analyses needed to create the methodological basis for the tree-stands model and historic manor park restoration. Based on this the species proportions and tree ages can be evaluated. It is necessary to specify the data on groups, allotments and determine the species because large allotments of trees of same species can significantly change the proportions of park trees in the whole park (Figure 3).

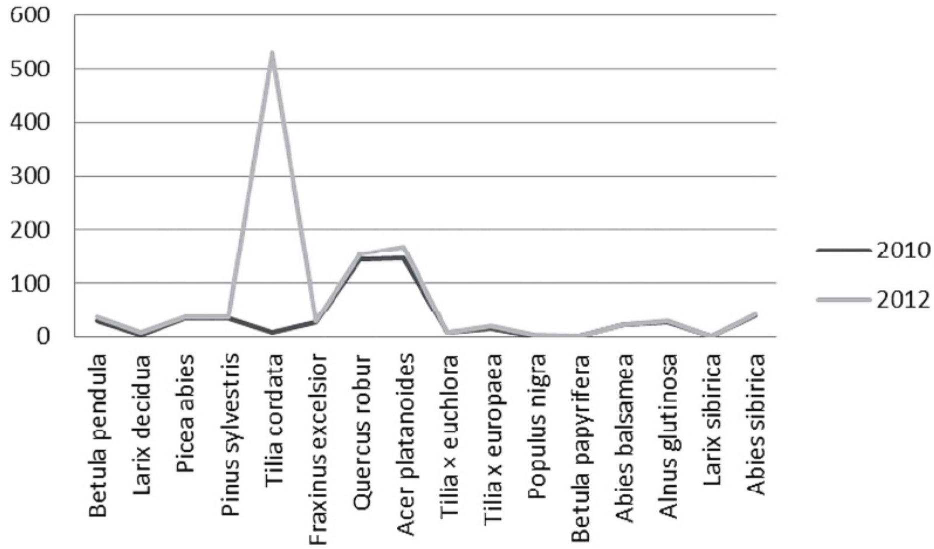

Figure 3. The tree species proportions of Räpina park before (2010) (without allotments) and after (2012) (with allotments).

There are two types of inventories (species richness and dendrological inventory) compiled for parks. The inventory data from species richness evaluations contain a list of species found in the park and finally the parks are designated into three types by the amount of species: high, medium and low species richness (Aaspõllu, 1984).

This research uses tree diameter, at breast height, based on the dendrological inventory method. The level of accuracy depends on the precision of the tree calliper (cm), and the experience of the person who conducts the measurements and the inventories.

In conclusion, it can be said that the necessary data for studying the historic park on a single tree level needs to contain the following information: location of the tree, the name of species and diameter at breast height.

3.4. Sample

This research input data was received from the detailed dendrological inventories in 2003-2009 of 17 manor parks under nature protection.

The criteria for the selection of inventories included in the research were as follows:

- the inventory was carried out less than ten years ago;
- the inventory dealt with individual trees, not groups of trees;
- the inventory specified the species and the diameter at crest height or the perimeter at crest height of trees;
- the inventory was carried out using similar methodology;
- the park was in the countryside;
- the park was a historic manor park;
- the park was founded in English style or redesigned to English style in the 19th century.

In all of these parks an additional inventory was carried out in 2012 when the information was renewed and specified.

The data used for analysis in this work was initially collected during the dendrological inventories neccessary for the compilation of restoration projects. Therefore, in the context of this work it needs to be treated as secondary data. The arrangement of information consisted of summarizing and concentrating the primary data. The information about groups and allotments were removed and the data from additional inventories was added (specifications about the allotments). Descriptions about the species (sp) and the most common species were summarized (mainly with the indigenous species). The final selection of 14,582 specimens (Table 1) included the nominal characteristic which was the name of the species (total of 206 species). The sample included specimens from 17 historic parks of different size (3.0 to 21.0 hectares), of different diversity of species (12 to 120 species) where the amount of growing specimen range from 211 to 1,754 and of different eras ranging from 18th to the beginning of 20th century all located in different parts of Estonia (Figure 4).

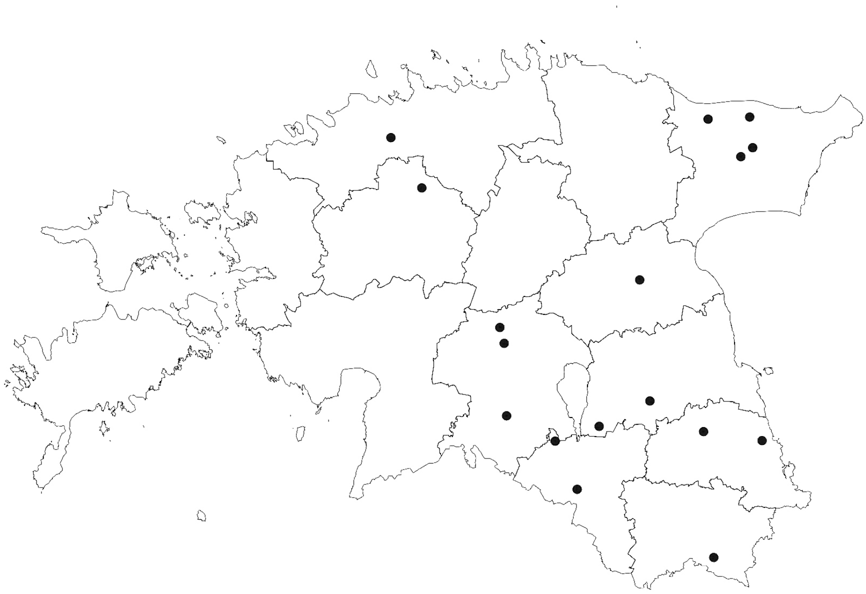

Figure 4. Locations of parks used for the selection of trees.

Table 1. Summary table of descriptive values of the sample.

Queue no.	Object name	Year of the inventory	Number of trees	Number of species	Area (ha)	Foundation period (c)	Location coordinate	
							X	Y
1	Hummuli manor park	2008	1,263	39	11.0	19.-20	6420226.3	622066.4
2	Härgla manor park	2007	211	16	5.0	19	6551702.7	551469.3
3	Kiidjärve manor park	2009	602	26	3.0	17.-18	6447826.1	677311.7
4	Kukruse manor park	2009	1,318	41	5.5	19	6587874.2	690912.1
5	Kuremaa manor park	2006	1,174	48	21.0	19	6513608.0	646771.0
6	Lõhavere manor park	2009	228	25	11.5	19	6490570.1	586415.2
7	Mäetaguse manor park	2004	716	13	9.5	19	6569682.4	687886.9
8	Pagari manor park	2007	1,517	48	8.0	19	6573781.9	692717.0
9	Püssi manor park	2009	532	43	7.0	19	6585561.8	673083.1
10	Riidaja manor park	2006	1,074	33	9.0	18.-19	6441002.6	611874.2
11	Rogosi manor park	2003	220	28	3.0	18.-19	6392434.4	684388.6
12	Rõngu manor park	2008	958	29	10.0	18.-19	6448102.3	631189.6
13	Räpina manor park	2010	1,754	120	8.5	19	6444810.7	703400.0
14	Saku manor park	2007	890	60	9.5	19.-20	6573613.6	537981.9
15	Sürgavere manor park	2008	255	12	3.0	18.-19	6483863.6	588411.0
16	Unipiha manor park	2010	515	18	4.0	19	6460174.0	653205.9
17	Õisu manor park	2008	1,355	47	12.5	18.-19	6452002.5	590769.1

4. Methodology

4.1. Qualitative and quantitative research method

Qualitative and quantitative research methods were used to create the model for the composition of stands of trees in a historic park. These methods were combined and used in different stages according to the objective set. Methodology for descriptive statistics was used to describe the data. This helped to determine the woody plant species occurence frequency park by park in order to find similarities which would characterize the tree stands in all the historical parks. Then all the parks were compared according to the characteristics group (shape, phylum, heritage etc). The similar characteristics found were analysed with the help of regression analysis. Linear regression equation coefficients were found by using the least squares method. The equation was solved and as a result of regression analysis a mathematical model was composed. The model was tested for all 17 parks.The study of park tree ages was based on the parameters of tree diameters at breast height. According to the diameter value and the distribution of tree diameters, the results were compared with the tree species age and diameter tables compiled for the Estonian forests. As a result of this the trees were divided into age groups. The received age distribution was used to complete the final data analysis in order to determine the initial species distribution neccessary for restoration. The following table gives an overview of the work process, methods used and the results of each phase (Tabel 2Table 2 and Table 3).

Table 2. Overview of research process, used methodology and results in different phases.

Queue no.	Activity in the phase	Methodology in use	Used materials	Result
1.	Data collection	Critical analysis of information sources	Inventory reports	Concentrating the suitable data
		Dendrological inventory	Fieldwork	
2.	Initial analysis of data	Descriptive statistics	List of data	Description of data
3.	Data analysis	Methodology for determining the age	Scale, list of data	Groups of trees of different ages are formed
4.	Assessment of the results of the previous phase	Comparative map analysis	Plans of dendrological inventories, historic maps, results of previous phases	Assessment – methodology inaccurate
5.	Developing a new methodology	Statistical data analysis	Scale, list of data	Creating a new scale
6.	Data analysis	Methodology for determining the age. statistical data analysis	Scale, list of data	The formula for the composition of old park stands of trees

Table 3. Overview of used datas, methodology and results.

<table>
<tr><th colspan="2">Data</th><th colspan="2">Methodology</th><th>Results</th></tr>
<tr><td rowspan="4">Suitable data for studying the material
Dendrological inventory</td><td rowspan="4">SAMPLE</td><td colspan="2" rowspan="3">Statistical data analysis</td><td>Proportional distribution of woody plants according to the type</td></tr>
<tr><td>The proportion model of majority tree species</td></tr>
<tr><td>The composition formula</td></tr>
<tr><td></td><td>Methodology for assessing tree ages</td><td>The proportional distribution of woody plants by age</td></tr>
</table>

4.2. Statistical data analysis

Preservation of a park among other things expects long-term periodic renewal programmes which are derived from the indigenous species and customs developed in the region ("The Florence Charter," 1981). The results of statistical analysis of data collected in dendrological inventories enabled to create a compositional formula for stands of trees in parks, on which scientific restoration can be based on.

Statistical data processing package R was used for data processing.

Descriptive statistics were used to characterise the division of woody plant species park by park. The woody plants were counted by species and the frequency of species appearances was described with a histogram of distribution. On the histogram the species were ranked in growing order of occurrence frequency on the y-axis and the percentage of occurrence frequency on the x-axis.

In order to analyse the occurrence frequency of species with a same type identifier, the data was grouped and coded.

The data was grouped as follows:

- by the shape of the stem or development: tree, shrub or other (liana);
- by the phylum: leaf or needle;
- by heritage: indigenous or exotic.

For further analysis the data in turn was grouped into three sub-groups and coded on the basis of three combined characteristics.

The data was sub-grouped as follows:

- indigenous conferous trees;
- indigenous deciduous trees;
- indigenous conferous shrubs;
- indigenous deciduous shrubs;
- exotic coniferous trees;
- exotic deciduous trees;
- exotic coniferous shrubs;
- exotic deciduous shrubs;
- other exotic deciduous;
- other exotic coniferous;
- other indigenous deciduous;
- other indigenous coniferous.

In order to analyse the occurrence frequency of different groups and sub-groups. The percentage of distribution for each park, for the whole sample and the difference between the park and the sample, was calculated.

The diameters at breast height by tree species were described with statistics (min, max, average, median, standard deviation, quartiles, kurtosis, skewness) which were presented with box-and-whiskers diagrams. The distribution of a characteristic compared to normal distribution was analysed with the help of normal probability plot (Q-Q Plot) and Shapiro-Wilk normality test W.

Regression analysis was used for creating a mathematical model that describes the relations between characteristics. Simple random sampling was used for data collection to compile a system of equation based on 100 samples. The equation was solved. Linear regression equation coefficients were found by using the least squares method. The model was evaluated through the average deviation of dependent variable values. The model was tested for 17 parks.

4.3. Methodology for assessing tree ages

4.3.1. The forest tree growth table and the forest tree growth model

The development of restorational principles for historic objects need to be based on scientific research that not only sets the current situation but studies the older (initial) part of the object. This issue is complicated by the factor that the object is constantly changing. In order to study the older stands of trees, a scale for assessing the age of park trees was developed. Irregular placement and growth conditions are characteristic to tree-stands, thus the growth of each tree is influenced by many different factors (density of trees, soil and moisture regime, light conditions etc.).

First growth tables of stands of trees (Krigul, 1971) used in forestry and compiled by all the main forest tree species were taken as the basis for assessing the tree age. It was assumed while compiling the park tree age assessment scale that the growth conditions in the park are better than in the forest (soil is more fertile, trees are placed sparsely). Thus the information about the diameters of trees in forests habitat quality rated 1 and 1a were used and compiled for 100 to 140 year old stands of trees.

The information from the forest growth tables gave the limiting parameters for the scale (hard deciduous trees D > 51 cm; soft deciduous trees D > 35 cm; coniferous trees D > 42 cm) and their results were verified by map analysis. It appeared that many trees with a smaller diameter at breast height but at least 100 years old were left out of the trees assessed to be at least 100 years old by the scale (see APPENDIX 1). Then a new model was compiled.

Estonian tree height, diameter and stand volume growth model was used as the basis for the new model. The model consists of data base inventory files of 206 forest districts compiled by Estonian State Forest Management Centre. This data describes the condition of Estonian State forest in 1984 to 1993. Growth model consists of 171 height, diameter and volume growth lists according to their age and they were the basis for putting together a non-linear system of equations (differential model) (Kiviste, 1997, 1995, n.d.). This system makes it possible to predict the height, diameter and stand volume value at any age of the stand but it depends on the current value of tree-stand's age, height, volume and on its habitat conditions.

The growth model was made by forest habitat types for the species grown in forestry (MA (*Pinus sylvestris*), KU (*Picea abies*), KS (*Betula pendula*), HB (*Populus tremula*), LM (*Alnus glutinosa*), LV (*Alnus incana*), SA (*Fraxinus excelsior*), TA (*Quercus robur*)), which is why it is not directly usable for assessing the park tree ages (Figure 5, Figure 6, Table 4).

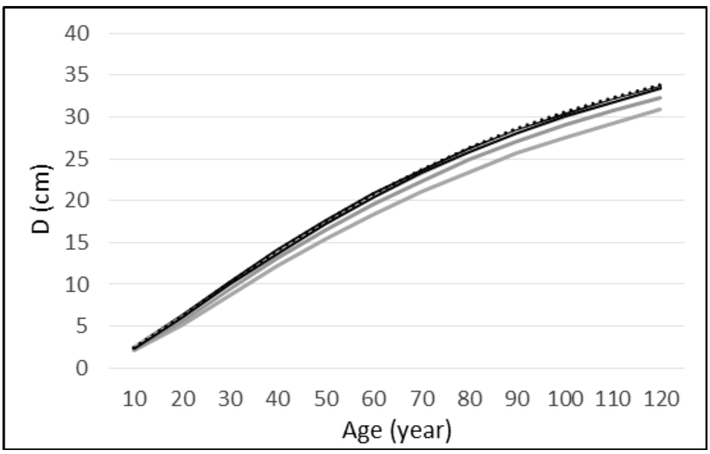

Figure 5. Species Quercus robur growth curves of different growth habitats. In order to create the assessment scale for park tree ages. The species average growth curves were calculated for 120-year period. The diameter data was converted into age data by the help of growth curves and an assessment scale for determining the park tree ages was compiled.

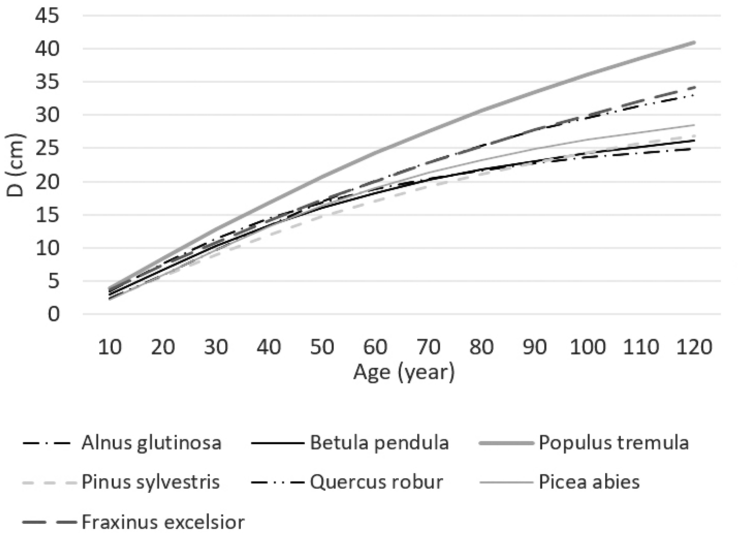

Figure 6. Growth curves by the species.

Table 4. Assessment scale. Diameter of species (cm).

Age (year)	Species name						
	Alnus glutinosa	*Betula pendula*	*Populus Tremula*	*Punus sylvestris*	*Quercus robur*	*Picea abies*	*Fraxinus Excelsior*
10	3	3	4	2	2	2	4
20	8	7	8	6	6	6	7
30	11	10	13	9	10	10	11
40	14	13	17	12	13	13	14
50	17	16	21	15	17	16	17
60	19	18	24	17	20	19	20
70	20	20	28	19	23	21	23
80	22	22	31	21	25	23	25
90	23	23	34	23	28	25	28
100	**24**	**24**	**36**	**24**	**30**	**26**	**30**
110	24	25	39	26	31	27	32
120	25	26	41	27	33	28	34

The obtained scale was analysed through variation curves of trunk diameter at breast height by species and through tree diameters at breast height growing in avenues. The variation curves of tree species’ diameters at breast height are similar to normal distribution and the date of establishment remains close to the peak when a large-scale planting took place. The limiting parameters of the scale compiled on the basis of forest growth curves were located left from the peak, which would mean that the more than 100 year old trees assessed by the scale originate from the period after the establishment of the park. As the park is founded by the means of planting the trees (peripheral parts also through forest thinning), then the large-scale planting precedes not follows the park establishment (Figure 7).

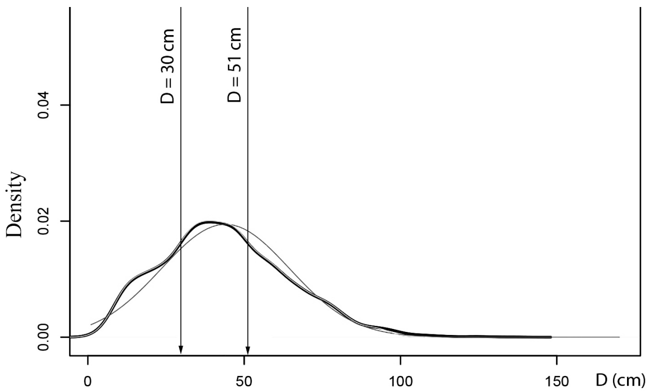

Figure 7. Distribution of common park species *Tilia cordata* by trunk diameter at breast height. The limiting parameters of two scales are marked on the illustration (based on forest growth tables D ≥ 30 cm and based on growth model scale D ≥ 51 cm).

In addition, park avenues and regular plantings were also analysed because they were planted simultaneously and therefore their tree diameters at breast height make it possible to assess the suitability of the tree age scale. In order to test the scale three indigenous species avenues (Hummuli manor entrance bordered by an avenue of pedunculate oak (*Quercus robur*) trees. Kiidjärve manor regular plantings of small-leaved lime (*Tilia cordata*) trees) and two larch tree avenues (Kukruse manor larch tree allée (*Larix sp*) and Hummuli manor park avenue of larch trees (*Larix sp*)) were chosen.

When using the hard deciduous trees age limit (D ≥ 51 cm) based on the forest growth table, 62% of the Hummuli manor oak avenue trees (105 trees in total, D = 20…89 cm) were determined to be more than 100 years old, but when using the growth model scale (D ≥ 30 cm), 100% of the trees were more than 100 years old. Kiidjärve manor park small-leaved lime trees (254 trees in total, D = 6...105 cm) figures were accordingly 23% and 62%. Based on the limiting parameter (D ≥ 37 cm) all the trees growing in larch avenues (Hummuli 49 trees in total, D = 37...82 cm and Kukruse 107 trees in total, D = 37...98 cm) were more than 100 years old (see Figure 8).

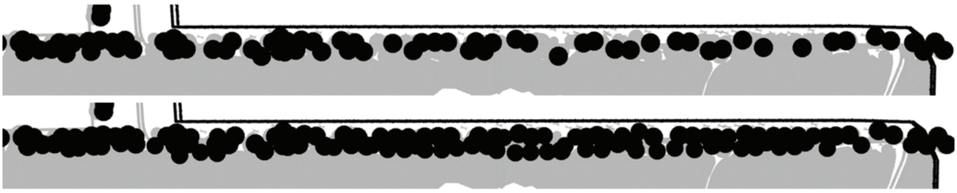

Figure 8. Hummuli manor park larch tree avenue. More than 100 years old trees (marked by black). Using scale what based to the forest growth tables D ≥ 42 cm (above) and to the growth model D ≥ 37 cm (below).

Based on the results the growth model age assessment scale is more suitable because according to this scale all the avenue trees and regular plantings which were planted simultaneously to the park establishment remained within the limiting parameter.

4.3.2. Comparative map analysis

When compiling restorational principles for historic park complex, they should be guided by the park's architectural composition where the structure of the layout combines single objects to an architectural whole.

The layout structure of a park reflects the locations of buildings towards each other and towards the park. It also reflects the network of roads and its relation to the park, different parts of the park and the surrounding areas. The layout also portrays the locations of design elements (monuments, pavilions, gazebos etc) and bodies of water (ponds, streams etc). When it comes to the park's tree stands the layout structure enables to evaluate the arrangement of trees, whether the park is of regular or of freeform style.Comparative map analysis is a widely used analysis method in landscape studies including studying the changes in park landscapes. The widespread use of GIS-systems has led to the use of this method in many fields that deal with landscape monitoring, changes *et cetera* (Chenyang and Wei, 2016; Martínez-Valderrama et al., 2016). There were two objectives in the research for map analysis: first, to recognise the changes that had happened in the layout structure and second, to evaluate the suitability of the grading scale based on the forest tree diameters at breast height (from now on grading scale) for assessing the old trees. Vectorgraphics files of dendrological inventories and small scale (1:4,200) paper maps (fund 1 - Estonian Swedish-era Governor-General collection, fund 854 - Estonian Knighthood collection, fund 2486 - Estonian Land Credit Society collection, fund 46 - Estonian Provincial Chamber of Drafting, fund 308 – Livonian Provincial Chamber of Drafting, fund 2072 – collection of maps, fund 3724 - collection of cadastral documents) preserved in Estonian Historic Archives were used for the analysis.

Vector graphics programme AutoCad 2012 was used for data processing. Historic maps were digitalised and raster files (jpg) of maps were scaled with vector data. Three layers of data were received as results (historic raster map, vector data of dendrological inventory and vector data of old trees determined by

the grading scale). Comparing the different layers helped to assess the preservation of historic park structure which in turn, enabled to make conclusions about the suitability of the tree age grading scale.
Comparative map analysis helped to assess the following:

- the changes that had occurred in the layout structure[1];
- the suitability of the assessment scale based on forest trees' diameters at breast height for determining old trees (APPENDIX 1).

[1] The analysis of changes in layout structure was part of the TTÜ Tartu College's Chair of Landscape Architecture's project „Looduskaitsealuste parkide dendrofloora inventuur" ["The Dendrological Inventory of Parks Under Nature Protection"] financed by Environmental Investment Centre in 2011. Triin Saarepuu helped to carry out the analysis and wrote her Master's thesis on the subject „Autentsed puuliigid Hummuli, Kiidjärve, Kuremaa, Räpina, Unipiha ja Õisu mõisa pargis" ["Authentic Tree Species in Hummuli, Kiidjärve, Kuremaa, Räpina, Unipiha and Õisu Manor Park"]: TTÜ Tartu Kolledž, Tartu, supervisor: Nele Nutt.

5. Results and Discussion

5.1. Results

This chapter summarizes the findings of this dissertation and addresses the research questions raised in the beginning of this work.

5.2. Research Question 1: In keeping with the Florence Charter, what characteristics can and should be taken into consideration when restoring manor parks in Estonia and how can these characteristics be studied and measured?

Based on the results of long term manor park studies, it appears that the preservation of manor park values (architectural composition) is very inconsistent and closely related to the park's maintenance.

Preservation of parks was evaluated in 54 manor inventories conducted in 2000-2003. The map analysis method was used for preservation study. The results of this have been published in "Manors of Tartu County". In order to map out the issues related to park maintenance more than 50 parks were visited during 2003-2010, their conditions and problems according to each park element (tree stands, avenues and indigenous trees, park meadows and courtyards, roads and paths, views, bodies of water, small design elements, ruins, information stands) were assessed. As a result "A Guide for Compiling a Park Maintenance Plan" (Nutt, 2011) was created which reveals the problems in parks and draws together guidelines for organizing park maintenance. The manual is used as the basis for the compilation of maintenance plans for Estonian historical manor parks. The following gives an overview of parks' conditions according to each architectural element:

<u>Planning and topography</u> - The condition and preservation of the original network of roads in the park is very inconsistent in all the parks. The network of roads in the park might not reflect the original planning. The views of nearby landscapes from the park and vice versa have been preserved differently in each park. Many new unrelated buildings have been constructed near the parks which obscure the original views.

<u>Structural and decorative features</u> - a large quantity of small design objects (sculptures, garden vases, benches, etc.) have been destroyed. Some parks have replaced small objects with their copies.

<u>Vegetation</u> − the herbaceous plants (annual plants or perennials) used as decoration have been destroyed, the condition of the old tree-stand is mostly satisfactory (regular plantings in formal style are recognizable, the relation between open and closed areas are perceptible in freeform design), but due to the lack of maintenance parks are partially overgrown with bushes.

Water - the condition of natural or artificial bodies of water used for park design is very inconsistent. Some parks have destroyed, unkept or polluted bodies of water while others are maintained.

Results

The analysis showed that the redesigning (expansion of settlement, construction of roads etc) of the surrounding landscape has brought along significant changes in the park's network of roads, layout, topography and bodies of water. Most of the structural and decorative features have been destroyed over 100 years. As described above, out of four architectural composition elements stated in the Florence Charter (plan and topography; vegetation, including species; structural and decorative features; water) one is best preserved. This is the tree stand which creates excellent opportunities to study the park's architectural composition. The preserved tree locations give an idea of the historic layout structure and the tree stand's species composition enables to study the park as a visual (voluminous) composition of an art piece.

The locations of single trees also enable the recreation of the historic composition and design. Therefore, this study focused on tree-stand as the building material of historic park.

Discussion

Baltic-German manor parks in Estonia have many special characteristics. In addition to the European aesthetic canons and the influence of the cultural context, the pastoral landscape has played an important role in the design of Baltic-German manor parks. Estonia has a very dense network of manor parks, ranging in size. Unfortunately, many of the parks have not been maintained for a long time. Since there is a lack of scientific research, beyond creating inventories of plant specimens, restoration efforts are inconsistent and often at the expense of the historical nature and intent of park designers.

Inspite of these inconsitent restoration efforts, many inherent values in Baltic-German manor parks have been preserved. The parks are considered to be monuments of historic value. The park's architectural and horticultural composition is formed by planning and topography, vegetation, structural and design elements such as water features, garden furniture and sculptures as stated in the Florence Charter.

5.3. Research Question 2a: What is the tree-stands species composition in a historic park?

The Florence Charter emphasizes that when dealing with restorational issues in historic objects, the solutions should be based on scientific studies ("The Florence Charter," 1981). Statistical data processing methods (Möls, 2014; Tooding, 2015) were used during the research and a statistical data analysis was carried out. The results of the analysis enabled to describe the composition of tree-stands and the creation of a model.

Although, there are 206 names of species on the species list (Table 5), the majority of the parks consist of a small variety of them. Regardless of the number of species in the park, there is one main species that dominates in every park, a couple of species with a little bit smaller frequency of occurrence than the main species and a large quantity of species with a very low frequency of occurrence make up the rest of the composition. The species distribution of plant material in a park is portrayed by frequency of occurrence histograms (APPENDIX 2). The occurrence of species in one study object is characterized by a non-linear distribution which rises from left to right and portrays the increasing proportion of species in the park.

Table 5. Overview of the research results.

Item	Sum	Percentage
Number of species	206	100.0
Number of tree species	106	51.5
Number of deciduous species	75	70.8
Number of coniferous species	31	29.2
Number of shrub species	100	48.5
Total number of examples	**14,582**	100.0
Total number of examples trees	**13,721**	94.1
Number of deciduous trees	12,285	89.5
Number of coniferous trees	1,436	10.5
Total number of examples of shrubs	861	5.9

Results

Descriptive statistics showed that six species form approximately 80% of all species (Table 6) and five out the six are indigenous deciduous trees and only one indigenous coniferous tree. All of the five indigenous deciduous trees were broad-leaved species (there are 6 indigenous broad-leaved deciduous tree species growing in Estonia and all of them can be found in parks) and four of them formed 69% of the total number of park trees.

Based on the results of the analysis it can be said that the material that forms today's general architectural appearance is largely of the same type. The majority of the park consists of woody plants which are trees (average of 94%). The percentage of shrubs was small (average of 6%). The origin of tree species is predominantly indigenous (average of 86%) and trees of exotic origin made up only 14% of species. The deciduous trees significantly exceed the number of coniferous trees (average of deciduous trees is 87% and of coniferous trees 13%). The indigenous deciduous tree made out of three types forms at average

80% of the park (Figure 9). A comparatively small part of the population (average of 20% in total) contains rest of the combinations.

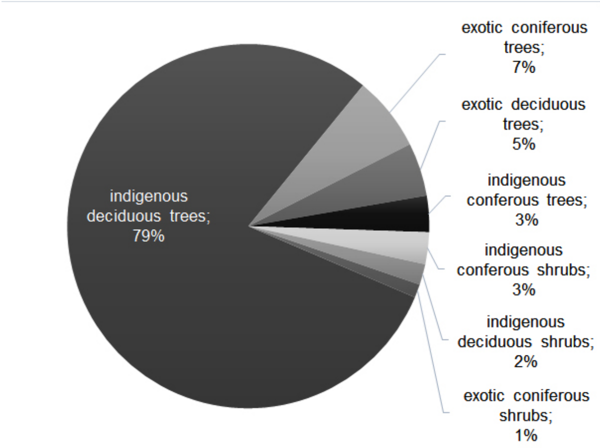

Figure 9. The distribution of woody plant types.

Table 6. The summary table of most frequently occurring species.

Queue no.	Species name	Amount of trees	Percentage of total amount	Type
1	*Acer platanoides*	2,597	19	indigenous deciduous tree
2	*Fraxinus excelsior*	1,606	12	indigenous deciduous tree
3	*Quercus robur*	2,278	17	indigenous deciduous tree
4	*Tilia cordata*	2,920	21	indigenous deciduous tree
5	*Ulmus glabra*	877	6	indigenous deciduous tree
6	*Picea abies*	510	4	indigenous coniferous tree
Majority of species in total		**10,788**	**78.5**	
Total		**13,721**		

The regression analysis done park by park showed that the proportion of deciduous trees frequency of occurrence in parks is very similar and remains close to 80%. The results are similar park by park (APPENDIX 3, APPENDIX 4).

Discussion

Preservation of a park expects long-term periodic renewal programmes which are derived from the indigenous park species and customs developed in the region ("The Florence Charter," 1981). In order to follow this principle it is necessary to have accurate knowledge about the region's typical composition of stands of trees in parks. When compiling restorational principles for a historic park, it is not enough to identify the special accent and exotic trees but it is necessary to evaluate the part which forms the main volume of the historic park. Thus the species that are typical (indigenous) to the region and form the majority of the composition in a park were assessed. The results of the analysis enabled the creation of a park model which describes the composition of tree-stands in the park and which can be used as a basis for park renewal.

Taking into account the large proportion of indigenous broad-leaved tree species (*Acer platanoides*, *Fraxinus excelsior, Quercus robur*, *Tilia cordata*, *Ulmus glabra*) they were considered to be majority tree species. Regression analysis was used to create the mathematical model for majority tree species. Simple random sampling of 100 samples was used to compile a system of equation which was solved and the result was a straight line y=0.6924x.

Linear regression equation coefficients were found by using the least squares method. The model was evaluated through the average deviation of dependent variable values.

By analysing the majority tree species proportions park by park, it can be said that it is similar to the model (R^2=0.9638) (Figure 10).

R^2 shows that the tree stands' composition by type in all 17 parks is very similar to the created model. The model describes accurately enough the historic manor park tree stand's composition and thus, it is a suitable basis for the compilation and coordination of park restoration projects.

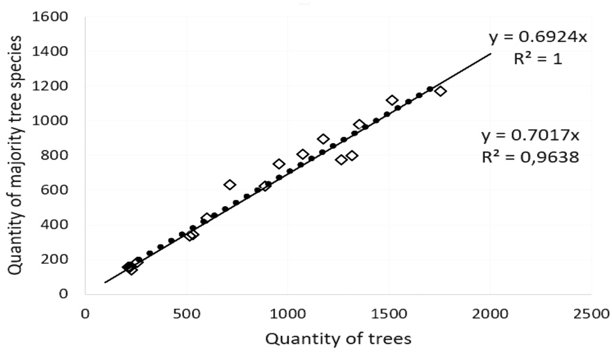

Figure 10. The proportion of majority tree species in 17 parks is similar to the model (R2=0.9638).

5.4. Research Question 2b. What is the historic manor park tree-stand age composition?

Studying plant material as a living object is complicated because of the constant change of parameters (diameter of the trunk, tree height etc.). The proportion of different age trees was studied during the analysis of tree-stands composition.

The data contained the following characteristics of 13,721 specimens:

- the name of the species (106 species in total);
- the trunk diameter at breast height (ranging from 5 to 170 cm).

The analysis of tree diameter data was performed on the 24 most frequently occurring tree species (APPENDIX 5). A statistical report of all the basic statistical values was compiled on every species (APPENDIX 7). Based on the statistical parameters, it can be said that in case of the diameter indicators of all the species the values are close to normal distribution. The fluctuation of skewness is small ($-0.7 \geq s \leq 1.8$) and median and average value are equal or close to equal (small differences of 2 to 3 cm, maximum of 4 cm). Statistical values of all the analysed species can be found in a summary table at the end of this paper (APPENDIX 6). Histograms of distribution (APPENDIX 8) and probability figures Q-Q Plot (normal probability plot) (Figure 11) portray that the variation curves of species diameters are similar to the normal distribution curve which means that based on the tree trunks diameters the trees are distributed evenly within the species and that there are trees with different diameters within all the studied groups of species. Kurtosis was positive for all the species remaining close to the normal distribution ($k_{max} \leq 5.2$) which portrays an even dispersion throughout the species. A species *Malus sylvestris* ($k = 10.2$) differed from other species because the difference within the tree diameters was smaller.

Results

The analysis showed that an essential part of old park trees had not reached the measurements given in the assessment scale which would have been the basis for grouping them with old trees (more than 100 years old). Thus, the new assessment scale based on the forest tree growth model was developed and used for identifying the relative tree age. The bar charts (Figure 12) describing the distribution of trees by age show that there are substantially fewer young trees than old trees.

Discussion

The results show that majority of the parks are older than 100 years and that the subsequent growth has been stable but small in number. The young part of the park is small compared to the old but the compositions of tree-stands are similar.

A composition formula of park trees was compiled based on the research results. It describes the distribution of most common woody plant types in percentages. The first layer of stand of trees in the historic parks is composed of 80% of the indigenous deciduous trees of which 70% are indigenous broad-leaved deciduous trees *Tilia cordata (*Pä*), Quercus robur (*Ta*), Acer platanoides (*Va*), Fraxinus excelsior (*Sa*)* and 10% are the rest of the indigenous deciduous trees. The combination of exotic and coniferous trees and shrubs form the rest of the 20% of stands of trees.

The results obtained in the study are primarily important because the created park composition model describes the historical tree stand composition and therefore, it can be used for the reconstruction projects of old parks.

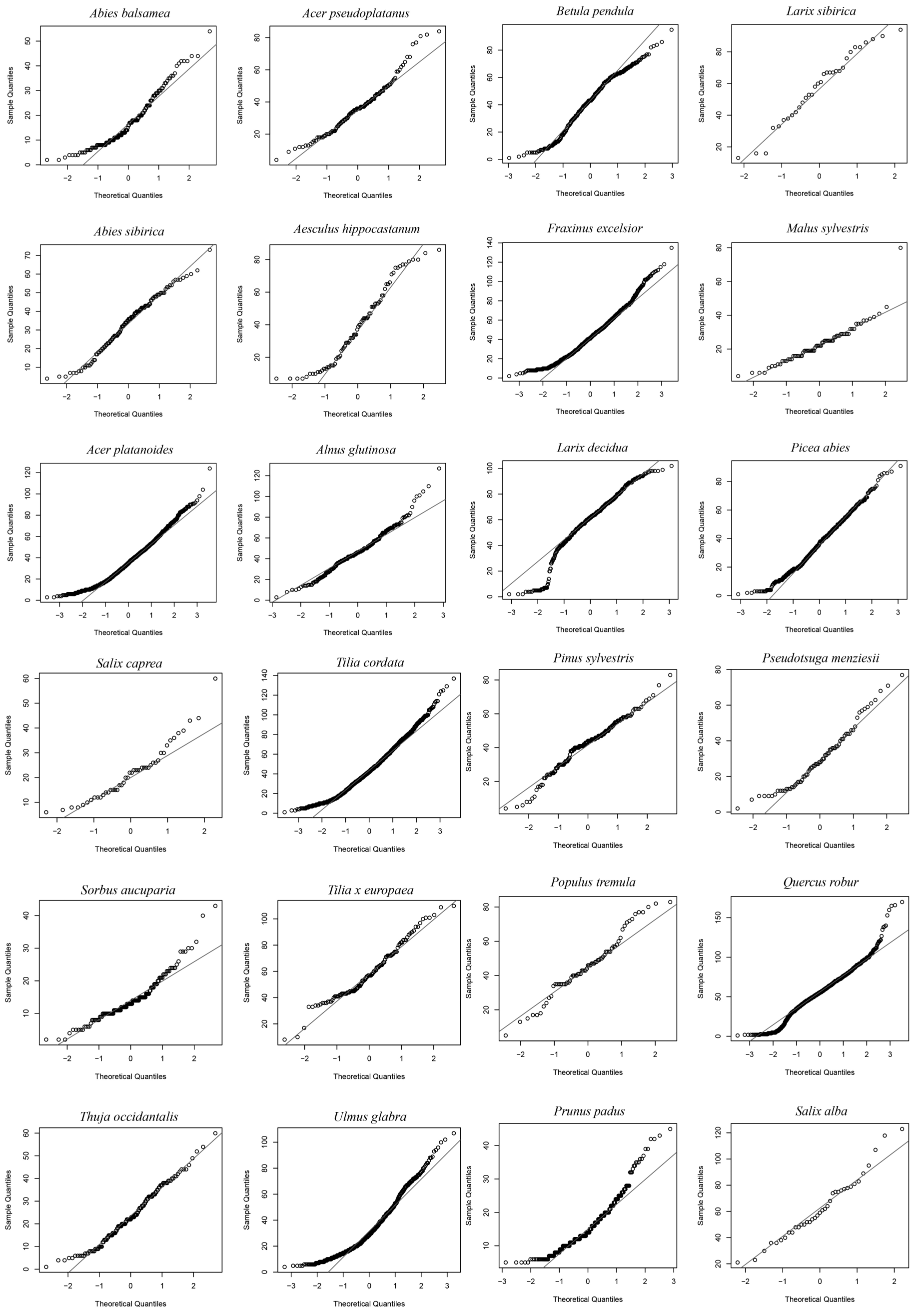

Figure 11. The 24 most abundant tree species histograms of probability figures Q-Q Plot (normal probability plot) portray that the variation curves of species diameters are similar to the normal distribution curve which means that based on the tree trunks diameters the trees are distributed evenly within the species and that there are trees with different diameters within all the studied groups of species.

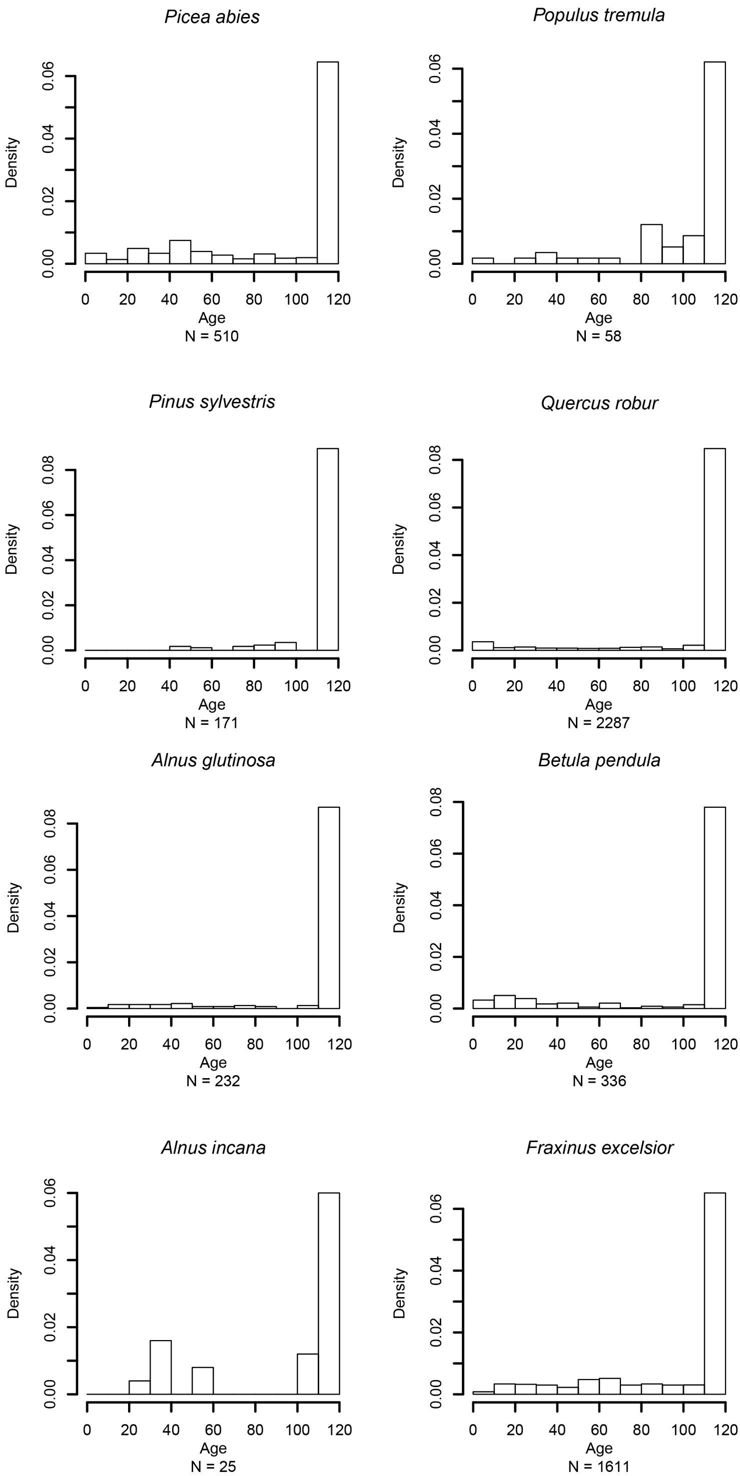

Figure 12. Distribution of tree ages by species. The bar charts describing the distribution of trees by age show that there are substantially fewer young trees than the old trees.

Conclusion

The park's architectural and horticultural composition is formed by planning and topography, vegetation, structural and design elements such as water features, garden furniture and sculptures. Investigating the manor parks revealed that their architectural composition has preserved very unequally, primarily due to the lack of proper maintenance of the parks. In the following, a summary of the preservation of values is given for each element that creates a historic park's architectural composition according to the Florence Charter.

Planning and topography - The condition and preservation of the original network of roads in the park is very inconsistent in all the parks. The network of roads in the park might not reflect the original planning. The views of nearby landscapes from the park and vice versa have been preserved differently in each park. Many new unrelated buildings have been constructed near the parks which obscure the original views.

Structural and decorative features - a large quantity of small design objects have been destroyed. Some parks have replaced small objects with their copies.

Vegetation − the herbaceous plants used as decoration have been destroyed, the condition of the old tree-stand is mostly satisfactory, but due to the lack of maintenance parks are partially overgrown with bushes.

Water - the condition of natural or artificial bodies of water used for park design is very inconsistent. Some parks have destroyed, unkept or polluted bodies of water while others are maintained.

Mapping the manor parks has revealed that a park's trees provide the best guidance in studying the park's architectural composition. The locations of single trees also enable the restoration of the historic composition and design. Therefore, this study focused on tree-stands as the building material of the historic parks.

As a result of mapping the manor parks it is clear that tree-stands provide the best guidance in studying the architectural composition of the parks. The locations of single trees also enable the restoration of the historic composition and design. Therefore, this study focused on tree-stands as the building material of the historic parks.

A composition formula of park trees was compiled based on the research results. It describes the distribution of most common woody plant types in percentages.

- The material of the park is made up of 80% of woody plants with a bright foliage and trunk and the rest of the 20% contains the diversity of species in the park formed by exotic trees, coniferous plants and shrubs.
- This proportion of distribution (20/80) characterizes historical parks regardless of the establishment period, size, number of trees growing

there, species diversity and location of the park.

- The first layer of stand of trees in the park is described by the compositional formula: 80 indigenous deciduous trees (70 *Tilia cordata (*Pä*), Quercus robur (*Ta*), Acer platanoides (*Va*), Fraxinus excelsior (*Sa*)*; 10 others) 20 others (needle, exotic tree, shrub).
- A large part of the woody plant material growing in the park is older than 100 years. The growth of younger trees has been stable but small in number.

Tree-stands compose the main architectural and structural framework of historic parks in Estonia, creating a great opportunity to study and restore historic parks.

For a park restoration based on the principles of the Florence Charter, the most important outcome of this dissertation is the creation of a composite scale for tree-stands in any given park. The established tree-stand composition scale enables one to base the renewal of a park on the original composition of a park and place the new tree specimens so that the species composition characteristic to a historic park would be preserved. Within the Estonian context, woody plant species are characteristic to manor parks, and are critical components to any maintenance, preservation, restoration and reconstruction works in Estonian historic parks. The results of the dissertation form the basis for compiling long-term periodic renewal programmes of Estonian historic parks. The results enable one to base the renewal of parks on deep traditions rooted in the region.

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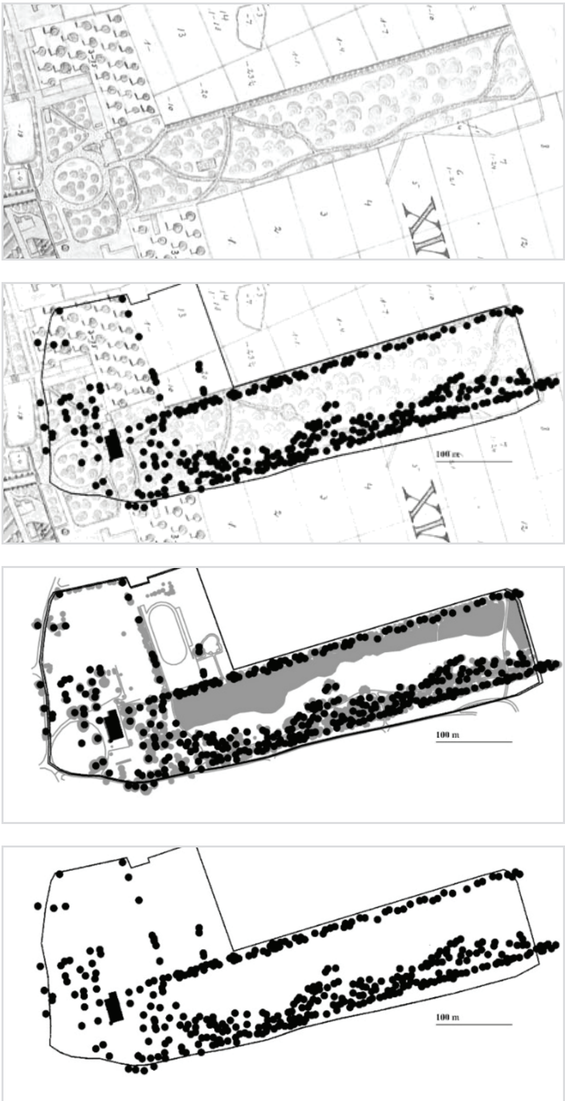
Estonian Historic Archives. EAA 3724, 4, 1203, 1. Charte der Wald-Bestände des privaten Gutes Kiddijerw. 1856.

Estonian Histoical Archives. EAA 3724, 5, 2768, 1. Generalcoupon des Gutes Euseküll belegen im Kreise Fellin und Kirchspiele Paistel. 1908.

Estonian Historic Archives. EAA 1388, 1, 1241, 1. Charte des Gutes Iensel. 1860.

Appendices

APPENDIX 1. Connections between material and structure



Hummuli manor park. A comparative map analysis portrays that the historic structure is easily recognizable through locating old trees and the structure has preserved well. At the same time behind the main building along the axis there are a lot of trees in the Larix allée (surrounded by yellow lines) that have not been defined as old. Historic map: Charte von den Feldern und Heuschlägen des privaten Gutes Hummelshof. 1910. EAA 3724, 4, 1345, 1.

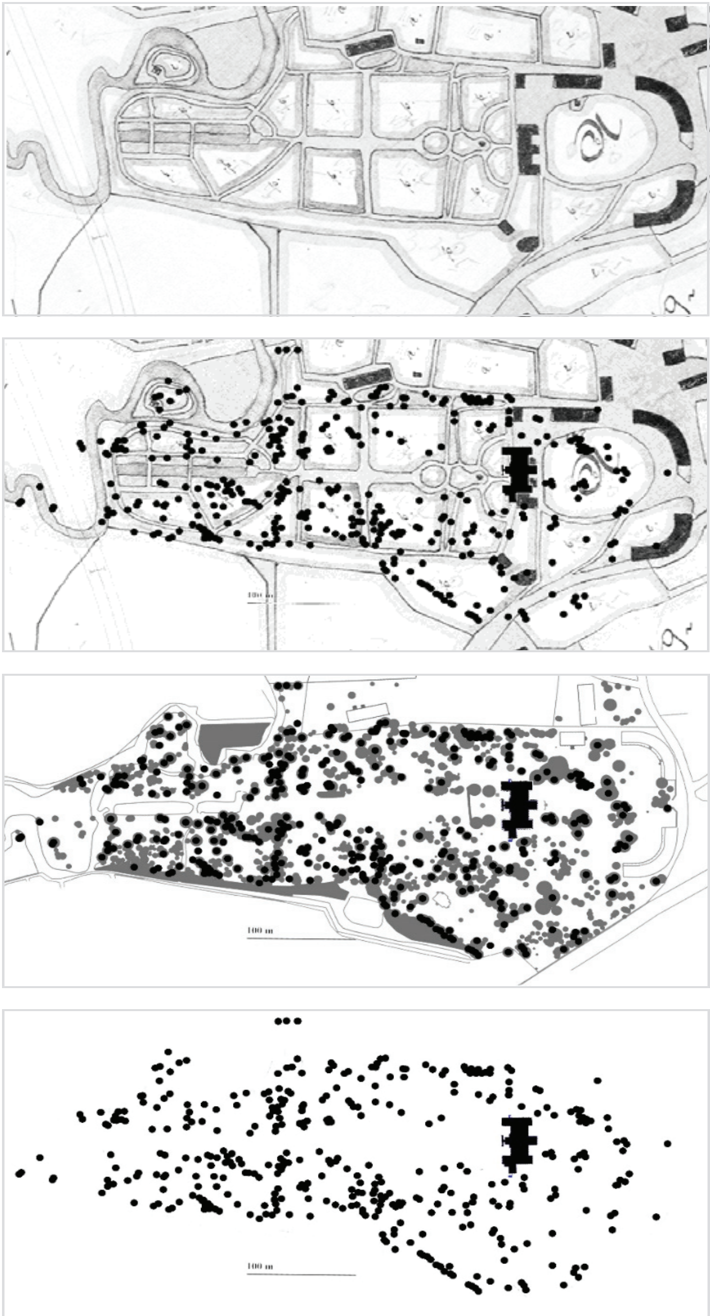
APPENDIX 1. continuation

Kiidjärve manor park. A comparative map analysis portrays that the historic structure is easily recognizable through locating old trees and the structure has preserved well. Historic map: Charte der Wald-Bestände des privaten Gutes Kiddijerw. 1856. EAA 3724, 4, 1203, 1.

APPENDIX 1. continuation

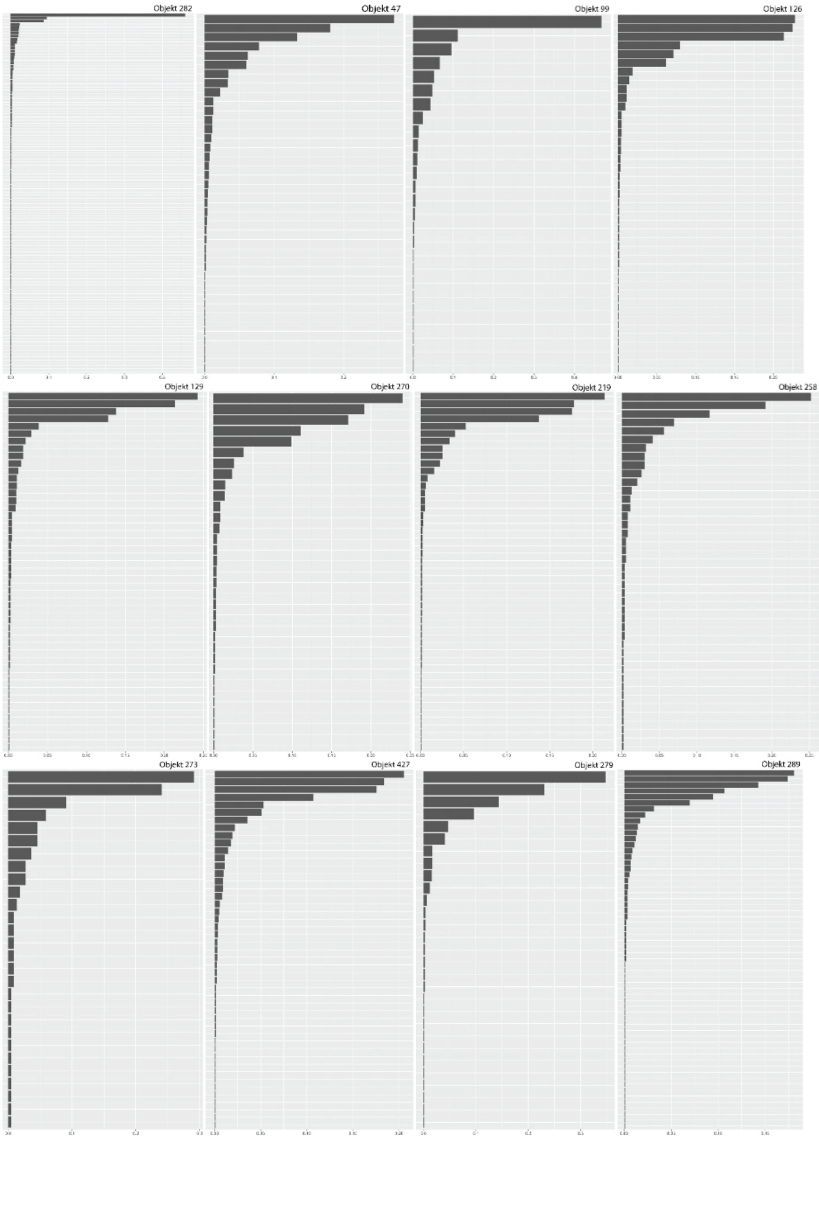
Kuremaa manor park. A comparative map analysis portrays that the historic structure is easily recognizable through locating old trees and the structure has preserved well. Historic map: *Charte des Gutes Iensel*. 1860. EAA 1388, 1, 1241, 1.

APPENDIX 1. continuation

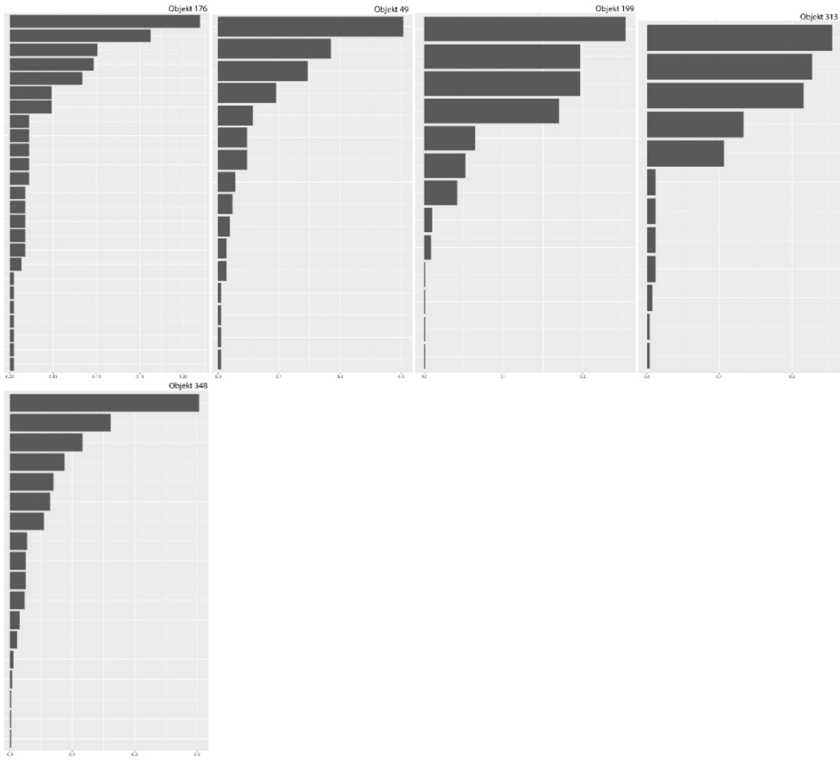


Õisu manor park. comparative map analysis portrays that the historic structure is easily recognizable through locating old trees and the structure has preserved well. Historic map: Generalcoupon des Gutes Eusekull belegen im Kreise Fellin und Kirchspiele Paistel. 1908 EAA 3724, 5, 2768, 1.

APPENDIX 2. Histograms of species' occurence frequency by object



APPENDIX 2. continuation



APPENDIX 3. Table of occurence

Object number	Total number	Trunk=1			Vital functions=1			Heritage=1		
		Sum	%	Difference from average	Sum	%	Difference from average	Sum	%	Difference from average
47	1,263	1,234	98%	4%	282	22%	10%	277	22%	8%
49	211	208	99%	4%	22	10%	2%	27	13%	1%
99	602	559	93%	1%	110	18%	6%	98	16%	2%
126	1,318	1,301	99%	5%	302	23%	10%	437	33%	19%
129	1,174	1,118	95%	1%	107	9%	3%	117	10%	4%
176	228	196	86%	8%	33	14%	2%	28	12%	2%
199	716	714	100%	6%	31	4%	8%	1	0%	14%
219	1,517	1,431	94%	0%	129	9%	4%	122	8%	6%
258	532	494	93%	1%	56	11%	2%	66	12%	1%
270	1,074	1,051	98%	4%	27	3%	10%	35	3%	11%
273	220	173	79%	15%	16	7%	5%	45	20%	7%
279	958	933	97%	3%	165	17%	5%	66	7%	7%
282	1,754	1,518	87%	8%	217	12%	0%	350	20%	6%
289	890	819	92%	2%	141	16%	3%	146	16%	3%
313	255	254	100%	6%	10	4%	9%	67	26%	12%
348	515	472	92%	2%	46	9%	4%	31	6%	8%
427	1,355	1,246	92%	2%	141	10%	2%	113	8%	6%
Total	**14,582**	**13,721**			**1,835**			**2,026**		

APPENDIX 4. Table of occurence

Object no.	Total number	111 Total no.	111 %	110 Total no.	110 %	100 Total no.	100 %	101 Total no.	101 %	211 Total no.	211 %	210 Total no.	210 %	200 Total no.	200 %	201 Total no.	201 %	310 Total no.	310 %
47	1,263	223	18%	28	2%	937	74%	46	4%	12	1%	14	1%	2	0%	1	0%	0	0%
49	211	7	3%	17	8%	172	82%	12	6%	3	1%	0	0%	0	0%	0	0%	0	0%
99	602	55	9%	2	0%	473	79%	29	5%	26	4%	15	2%	2	0%	0	0%	0	0%
126	1,318	295	22%	133	10%	866	66%	7	1%	0	0%	9	1%	8	1%	0	0%	0	0%
129	1,174	67	6%	17	1%	997	85%	37	3%	3	0%	30	3%	23	2%	0	0%	0	0%
176	228	5	2%	4	2%	163	71%	24	11%	3	1%	16	7%	12	5%	1	0%	0	0%
199	716	0	0%	0	0%	683	95%	31	4%	0	0%	1	0%	1	0%	0	0%	0	0%
219	1,517	45	3%	12	1%	1,294	85%	80	5%	4	0%	60	4%	21	1%	0	0%	1	0%
258	532	7	1%	42	8%	397	75%	48	9%	1	0%	16	3%	21	4%	0	0%	0	0%
270	1,074	11	1%	11	1%	1,018	95%	11	1%	5	0%	8	1%	10	1%	0	0%	0	0%
273	220	2	1%	1	0%	169	77%	1	0%	13	6%	29	13%	5	2%	0	0%	0	0%
279	958	46	5%	4	0%	775	81%	108	11%	11	1%	5	1%	9	1%	0	0%	0	0%
282	1,754	101	6%	73	4%	1,272	73%	72	4%	43	2%	131	7%	59	3%	1	0%	2	0%
289	890	35	4%	50	6%	657	74%	77	9%	29	3%	32	4%	10	1%	0	0%	0	0%
313	255	8	3%	58	23%	187	73%	1	0%	1	0%	0	0%	0	0%	0	0%	0	0%
348	515	13	3%	3	1%	423	82%	33	6%	0	0%	15	3%	28	5%	0	0%	0	0%
427	1,355	47	3%	14	1%	1,111	82%	74	5%	20	1%	32	2%	57	4%	0	0%	0	0%
Total	14,582	967		469		11,594		691		174		413		268		3		3	
Average	858	57	**7%**	28	**3%**	682	**80%**	41	**5%**	10	**1%**	24	**3%**	16	**2%**	0	**0%**	0	**0%**

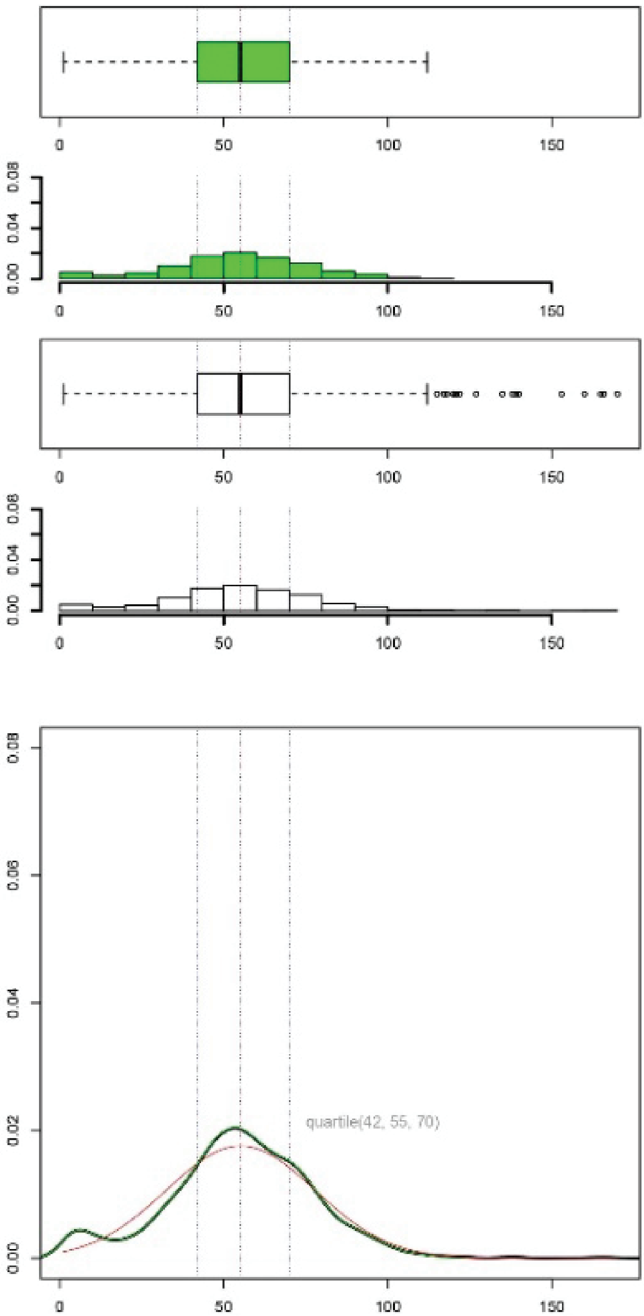
The codings for the combinations of characteristics

	0 – leaf	1 - needle	
1 – tree	100 101	110 111	0 - indigenous 1 – exotic
2 – shrub	200 201	210 211	0 - indigenous 1 – exotic
3 - other	300 301	310 311	0 - indigenous 1 – exotic

APPENDIX 5. The numbers and names of the species

Queu no.	Species no.	Species name (in Latin)	Broad-leaved
1	359	Picea abies	
2	271	Larix decidua	
3	683	Ulmus glabra	x
4	465	Quercus robur	x
5	442	Prunus padus	
6	49	Alnus glutinosa	
7	86	Betula pendula	
8	236	Fraxinus excelsior	x
9	27	Acer platanoides	x
10	674	Tilia cordata	x
11	534	Salix alba	
12	540	Salix caprea	
13	452	Pseudotsuga menziesii	
14	416	Populus tremula	
15	333	Malus sylvestris	
16	283	Larix sibirica	
17	46	Aesculus hippocastanum	
18	655	Thuja occidantalis	
19	681	Tilia x europaea	
20	583	Sorbus aucuparia	
21	400	Pinus sylvestris	
22	15	Abies sibirica	
23	3	Abies balsamea	
24	33	Acer pseudoplatanus	

APPENDIX 6. Example. Statistcal report for species's description



Quercus robur

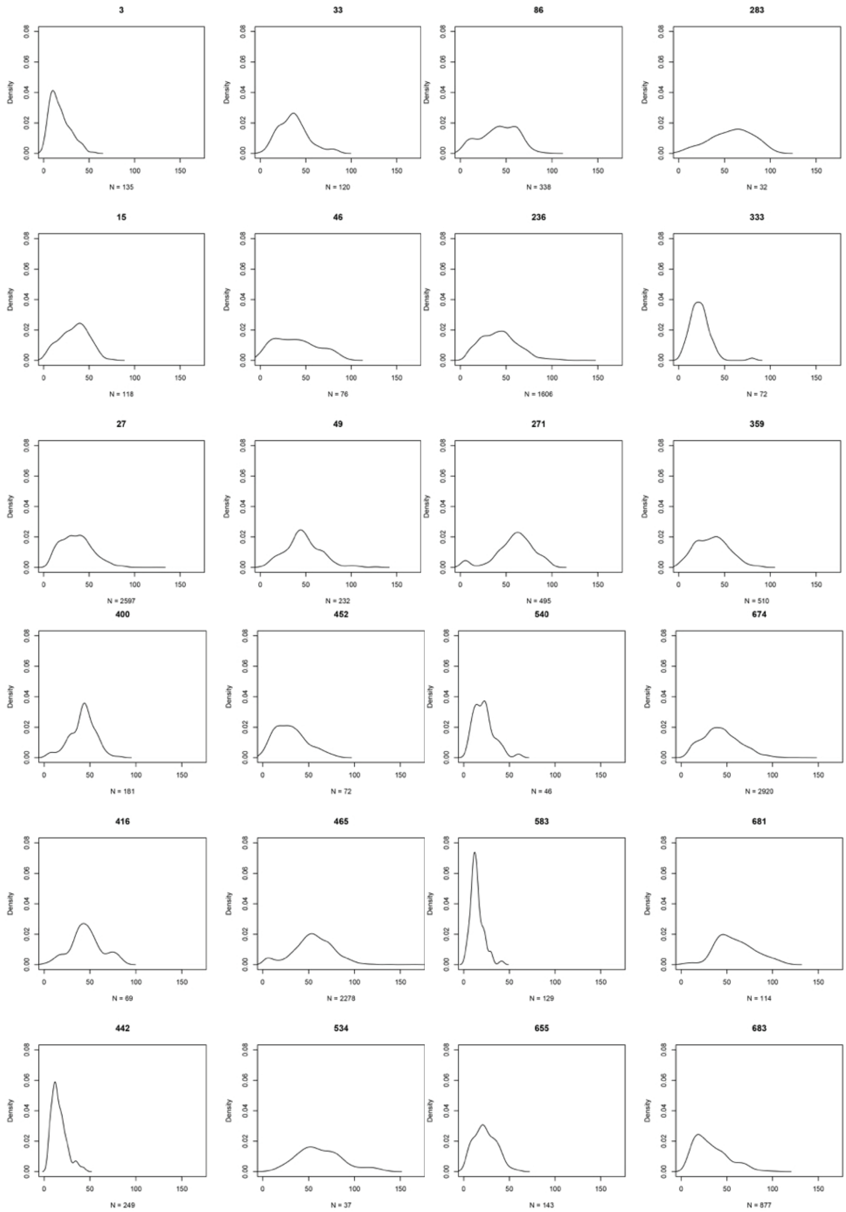
nimetus	arv
puuliigi ID	465
puude arv (tk)	2278
erindite arv (tk)	17
min diam. (cm)	1
max diam. (cm)	170
keskmine diam. (cm)	55
standardhälve (cm)	22.7
alumine kvartiil (cm)	42
mediaan (cm)	55
ülemine kvartiil (cm)	70
kurtosis	4.2
skewness	0.1
mood (cm)	53.6
Shapiro−Wilk normality test	
W	0.982
p−value	0

NN−201

APPENDIX 7. Summary table of diagrams by species

Queue no	Species no.	Amount of trees	Amount of specimens	Diameter (cm) Min	Max	Mean	Sd	Q1	Q2	Q3	Kurtosis	Skewness	Shapiro-Wilk normality test W
1	359	510	1	1	91	37	17.9	22	37	49	2.7	0.3	0.987
2	271	495	29	2	102	60	20.8	50	62	73	3.7	-0.7	0.953
3	683	877	10	4	107	33	19.1	18	29	45	3.4	0.9	0.935
4	465	2,278	17	1	170	55	22.7	42	55	70	4.2	0.1	0.982
5	442	249	9	5	45	16	8.2	10	14	20	4.2	1.1	0.914
6	49	232	6	3	127	47	19.7	36	46	58	4.1	0.6	0.976
7	86	338	0	1	95	42	19.8	28	43	58	2.2	-0.2	0.976
8	236	1,606	20	2	135	43	20.3	27	41	55	3.4	0.6	0.977
9	27	2,597	26	3	124	36	17.3	23	35	47	3.2	0.5	0.977
10	674	2,920	30	1	137	44	20.5	30	42	57	3.2	0.5	0.981
11	534	37	1	21	123	63	24.3	48	59	77	3.0	0.6	0.965
12	540	46	1	6	60	22	11.3	14	22	26	4.3	1.1	0.927
13	452	72	0	2	77	31	17.2	17	28	41	2.8	0.7	0.953
14	416	69	2	5	83	46	17.4	35	46	54	2.9	0.1	0.975
15	333	72	1	4	80	23	11.3	16	22	29	10.2	1.8	0.882
16	283	32	0	13	94	58	22.3	42	61	72	2.3	-0.3	0.964
17	46	76	0	7	86	39	23.3	18	38	54	2.0	0.3	0.941
18	655	143	1	1	60	24	12.1	15	22	32	2.6	0.4	0.978
19	681	114	0	8	110	59	20.7	44	57	72	2.9	0.3	0.972
20	583	129	3	2	43	14	7.1	10	13	18	5.2	1.2	0.924
21	400	181	5	4	83	42	13.9	33	44	50	3.5	-0.3	0.980
22	15	118	0	4	73	34	15.1	23	36	44	2.3	-0.1	0.982
23	3	135	1	2	54	18	10.9	9	16	24	3.1	0.9	0.928
24	33	120	5	4	84	37	16.3	25	36	45	3.5	0.7	0.963

APPENDIX 8. Histograms of species (24) distribution.



Acknowledgements

Firstly, I would like to thank professor Juhan Maiste who guided me on the complicated but interesting tracks of historic values and restoration philosophy and whose leadership enabled me to get acquainted with many different historical parks in many different regions. Juhan Maiste's extensive experience has been very helpful during the compilation of many books dealing with the subject of parks.

I would like to thank professor Zenia Kotval for the continuous encouragement and positive support both in writing scientific articles and during writing this work. Cooperation with professor Kotval has opened up many new prospects and international diapasons which create excellent possibilities for further scientific research.

My great respect is extended to professor Lembit Nei for his encouraging support throughout all the stages of this doctoral thesis.

I further would like to thank Ardo Kubjas whose knowledge and experience in the field of statistics helped me find the answers to even the most complicated questions and whose help was very valuable for getting the results from large amounts of data.

I would also like to thank landscape architect Sulev Nurme for a productive cooperation during the first stages of the work and also thank the landscape architects of Artes Terrae Ltd for contributing to data collection.

Surely I would like to thank Kadri Mets whose excellent translation has made it possible for this work to be read in English.

My appreciation is extended to professor Mari Ivask, Tiit Lepasaar, Ernst Tungel, Karin Muoni, Triin Saarepuu, Anu Torim, Kaie Lehtme.

I wish to express appreciation to the reviewers of this work for interesting point of views and comprehensive questions.

Summary

The research question for the thesis “The Restoration of Nationally Protected Estonian Manor Parks in the Light of the Florence Charter” comes from the value of a historic park as an architectural composition defined in the Florence Charter. First, the parts of a historical park, such as planning and topography; vegetation, its species, proportions, colours, arrangement and ratios; structural and design elements and water, highlighted in the Florence Charter were analyzed. The parts best preserved and their role in architectural composition were determined. As a result it turned out that the best wholly preserved part of the park is the tree stand which carries an integral role in the composition of the park as an architectural piece. When a sufficient amount of tree stand has preserved a study of the park as a composition of an architectural piece, for which an important criterion is its shape and volume, is enabled.

Biological diversity and the appearance of exotic plants has been mostly dealt with during the study of park tree stands. Lists of species ocurring in parks and lists of recommended species for these parks have been compiled. The proportional distribution of species in the tree stand has been left out of focus, but this is of decisive importance when it comes to architectural composition because it determines the general impression of the park as an architectural piece and its shape and volume. According to the Heritage Conservation Act established in Estonia parks are defined as monuments of historical value and they are considered to be built monuments. This work does not view the park as a biological substance, which park undoubtedly is, but it deals with the park as an architectural piece and studies its building material (stands of trees). Therefore, this work is a study of built monuments materials.

The data collected during dendrological inventories was used for research. Based on this and with the help of statistical data analysis a model for park’s tree stands was created. The tree stand model was described as a formula for tree stand composition which, in turn, creates a possibility for park and forest tree stands comparison in the future.

The first layer of stand of trees in the historic parks is composed of 80% of the indigenous deciduous trees of which 70% are indigenous broad-leaved deciduous trees *Tilia cordata* (Pä), *Quercus robur* (Ta), *Acer platanoides* (Va), *Fraxinus excelsior* (Sa) and 10% are the rest of the indigenous deciduous trees. The combination of exotic and coniferous trees and shrubs form the rest of the 20% of stands of trees.

The most important result for the restoration that follows the principles of Florence Charter is the tree stands’ composition formula which describes the tree species distribution in the Baltic-German manor park. The significance of this result is especially important for this type of restoration because the original appearance of a historical object needs to work as the basis for tree stand renewal.

Kokkuvõte

Töö „Riiklikult kaitstavate Eesti mõisaparkide restaureerimisest Firenze harta valguses“ uurimisküsimus tuleneb Firenze hartas määratletud ajaloolise pargi kui arhitektuurse kompositsiooni väärtusest. Esmalt analüüsiti Firenze hartas väljatoodud ajaloolise pargi koostisosi, milleks on planeering ja topograafia; taimestik, selle liigid, proportsioonid, värvid, paigutus ja vahekorrad; struktuuri- ja kujunduselemendid ja vesi. Selgitati välja kõige paremini säilinud osad ning erinevate osade roll arhitektuurse kompositsiooni moodustamisel. Tulemusena selgus, et ajaloolistes parkides on kõige terviklikumalt säilinud osa pargipuistu, mis üksiti kannab ka pargi arhitektuurses kompositioonis määravat rolli. Pargi puistu piisav säilivus võimaldab uurida parki kui arhitektuuriteose kompositsiooni, mille puhul on olulisteks kriteeriumiteks selle vorm ja maht.

Pargi puistute uurimisel on varasemalt käsitletud eelkõige nende bioloogilist mitmekesisust ja eksootide esinemist. Koostatud on nimekirju nii parkides esinevatest kui ka istutamiseks soovitatavatest liikidest. Tähelepanu alt on välja jäänud aga liikide proporstinaalne jagunemine puistus, mis on määrava tähtusega just arhitektuurse kompositiooni puhul, kuna see määrab ära pargi kui arhitektuuriteose üldilme, selle vormi ja mahu. Muinsuskaitseseaduse kohaselt on pargid ajaloolise väärtusega mälestised (ehitismälestised). Käesolevas töös ei vaadelda parki kui bioloogilist substantsi, mis park kahtlemata on, vaid käsitletakse parki kui arhitektuuriteost ning uuritakse pargi ehitusmaterjali (puistut) ehk tegemist on ehitusmälestise materjaliuuringutega. Uuringus kasutati dendroloogiliste inventuuride raames kogutud andmeid, mille põhjal koostati statistilise andmeanalüüsi abil pargi puistu mudel. Puistu mudelit kirjeldati puistukoosseisu valemina, mis omakorda loob võimaluse pargi- ja metsapuistute võrdlemiseks tulevikus.

Parkide materjal koosneb 80% ulatuses heleda lehestiku ja tüvega puittaimedest ja 20% suuruses osas sisaldub liigiline mitmekesisus, mille moodustavad eksoodid, okastaimed ja põõsad. Selline proportsionaalne jagunemine (80/20) on iseloomulik ajaloolistele parkidele olenemata nende rajamisajast, pindalast, kasvavate puude arvust, liigilisest mitmekesisusest ja pargi asukohast.

Parkide puistu I rinnet kirjeldab koosseisuvalem: 80 pärismaised lehtpuud (70 *Tilia cordata* (Pä), *Quercus robur* (Ta), *Acer platanoides* (Va), *Fraxinus excelsior* (Sa); 10 teised) 20 teised (okas, eksoot, põõsas). Suur osa pargis kasvavast puittaimmaterjalist on vanem kui 100 aastat, nooremate puude juurdekasv on olnud stabiilne aga väikesearvuline.

Firenze harta põhimõtteid järgiva restaureerimise jaoks kõige olulisem on töö lõpptulemusena koostatud puistu koosseisuvalem, mis kirjeldab puude liigilist jagunemist Balti-Saksa mõisapargis. Tulemuse olulisus on tähtis eelkõige Firenze harta põhimõtteid järgiva restaureerimise seisukohast, kuna puistu uuendamisel on vajalik aluseks võtta ajaloolise objekti algne ilme.

6. Publications

6.1. Publication 1

Nurme, Sulev; Nutt, Nele; Hiob, Mart; Hess, Daniel Baldwin. 2012. Talking ruins: The legacy of baroque garden design in Manor Parks of Estonia. In: Amsterdam University Press. 115−125.

1.7 Talking ruins: The legacy of baroque garden design in Manor Parks of Estonia

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ABSTRACT

The late 19th-century and early 20th-century 'grand era' of manor parks in Estonia coincides with a period when English gardening ideas dominated Europe. What is less recognised, however, is that manors in Estonia possess formal French-inspired gardens dating from the mid-18th century (the introduction of Baroque design in Estonia was delayed). Today, about 600 complete manor ensembles remain, retaining distinctive structural characteristics which date from the 18th-19th centuries. It is quite typical that in old parks of Estonia Baroque and English garden styles have merged, giving them a unique and original character. This research reports on archival study, field investigation and map analyses of 45 protected manor parks in Estonia. The analysis suggests that, despite the relatively short period (ca. 1730-1770), formal Baroque gardening was the dominant style practised in Estonia. The movement had a significant influence on local garden design, and on landscape planning more broadly. The Baroque elements in manor lands include formal geometric spaces, axial connections between landscape and buildings, orchestrated vistas and tree-lined roadways. Within the Baroque garden, formal plantings, pathways and water features were arranged in classical configurations. Finding physical traces of Baroque artefacts today is difficult because many manor parks were destructed during the Soviet era in the latter half of the 20th century. Nevertheless, archival materials and present-day visits to garden ruins in manor parks suggest that formal Baroque gardens dating from mid 18th-century manor lands were vivid and sophisticated ensembles of formal terrain, tree allées, sculptural elements and finely orchestrated water elements.

KEYWORDS

landscape design, park planning, manor parks, Baroque garden design, Estonia

INTRODUCTION

The Baroque garden design movement has given to mankind some of the most splendid and grandiose examples of spatial arrangement in the built and natural environment. For example, the legendary park at Versailles near Paris ranks amongst the world's greatest achievements in garden design. However, after the rise of ideals of equality one of the key ideologies of the French monarchy – formal Baroque design – fell out of favour during the 18th century. As the popularity of Baroque design waned in Western Europe, however, formal garden design continued to be practised in Estonian manor parks during 19th century by local German-influenced gentry.

At the beginning of the 20th century, there were 2,017 manors in Estonia (Rosenberg 1994). Today, about half this number survives, and approximately 400 manor parks are protected as natural or heritage areas. These protected manors are preserved (Sinijärv 2008) and they have been visited by experts who have conducted dendrological inventories (Sinijärv et al. 2007). For the most part, the manors and manor parks display 19th-century design characteristics of English landscape parks. Ideas governing manor park design, and the cultural features evident in manor lands, originate from two places. First, manor park design was imported to Estonia from northern and central Germany (Maiste 2005). Therefore, parallels with Germany's contemporary developments – the most famous English-style park being the one in Wörlitz – are useful for understanding the movement that inspired Estonian garden design (Rolf 2007). Second, local Estonian heritage is reflected in manor park design, celebrating local history and local culture. Features of Estonian origin in manor parks are especially evident from the late 19th century and early 20th century, the most splendid period of local manor culture, when existing manors were reconstructed and new manors were established. Shortly after, in 1919, manors were abolished in Estonia.

The late 19th-century and early 20th-century 'grand era' of manor parks in Estonia coincides with a period when English gardening ideas dominated Europe. Surprisingly, however, more than one-third of Estonian manor parks display traits of formal design. There were manor parks established in the 17th century, but unfortunately they are poorly documented and they have practically disappeared today. The major influence of the Baroque style arrived relatively late to Estonia, delayed by the Great Northern War and economic hardship in its aftermath. In one of the earliest examples of Baroque garden design in Estonia, Czar Peter I established Kadrioru park in formal Baroque style near Tallinn in 1718. In the 1740s and 1750s, various manor parks were founded in Estonia and many established formal garden elements (Hein 2007), while at the same time in Western Europe the era of formal Baroque park design came to an end (Turner 2005).

Although there are about 400 relatively well-preserved manor parks in Estonia, most appear today as park ruins. Twentieth-century events in Estonia – including World War I, World War II and the Soviet occupation – caused great losses within the parks as well as poor maintenance of manor land.

Now, to properly preserve the natural environments of manors, radical restoration efforts are needed. However, such restoration works face a number of challenges. For instance, it is often difficult to know whether formal garden elements, which appear to possess Baroque characteristics, are actually authentic

Baroque artefacts or are instead late 19th-century additions to the landscape. To distinguish between the two, it is helpful to identify which features characterise original Estonian Baroque-style gardens and to assess whether or not these features are still in evidence, even in a state of ruin, today. Determining the authenticity of garden elements that appear to date from the Baroque period is challenging for two key reasons. First, the original manor park plans and detailed design documents for manor projects are seldom available for study. In their absence, researchers usually rely on contemporary land-use plans. Secondly, the Baroque elements within manor landscapes are generally fragmented and in poor condition. These two challenges are interrelated, because without original plans it is difficult to identify the original elements of composition.

In this article, we provide a detailed study of Baroque elements of manor parks in Estonia, focusing on various elements of the built and natural environments, including spatial structure, design, characteristics and distinctive features. The research employs archival study, field investigation, and map analyses of 45 protected manor parks in Estonia (Heringas 2009). The objective of the research is to identify the formal, Baroque garden elements and develop trends about spatial construction and the relationship between manor landscapes and their surroundings. In most cases, due to a lack of primary research material, it is impossible to draw conclusions about single artefacts such as sculptures, vases, staircases, or pergolas. Instead, we focus on larger trends and broad design themes. In addition, the research provides an opportunity to better understand the evolution of landscape design in Estonia and the influence of manor landscape planning.

More broadly, this research situates the Baroque gardening movement in manor landscapes as a unique phenomenon in Estonian cultural history. Despite the relatively short period (ca. 1730-1770) that formal Baroque gardening was the dominant style practised in Estonia, it has had a significant impact on local garden design and landscape planning.

AN OVERVIEW OF ELEMENTS AND STRUCTURE OF HISTORIC ESTONIAN MANORS

The territory of Estonia was conquered by German knights during the 13th century. Gradually, a system of manors was developed, whereby large agricultural estates accounted for the majority of agricultural production. From the 17th century onward (and possibly earlier but no evidence remains), the manor centres, with economic and administrative functions, started to flourish as important sites of garden design. Manor owners established elaborate parks near the main manor buildings for their private enjoyment. Until the 19th century, manor parks remained almost the only form of garden design in Estonia.

In the design of manor parks, the most important model was formal Baroque gardening as developed to maturity in France during the 17th and 18th centuries. Thereafter, English-style landscape gardening was favoured in Europe. In Estonia, both styles were influential.

In a typical Estonian manor, a Baroque park space is formed by the connection of the front yard with the main building ensemble, or *cour d'honneur*, on the central axis (see figs. 1, 3). An entrance road provides access to the front yard. The largest part of the manor centre, or backyard, lay behind the main building. The structures are characterised by geometric order and well-defined forms of plants and plantations. Although there is a focus on physical order, the spatial structure of the park in some manors is not symmetrical nor does the central axis focus on the main building (Maiste 2005).

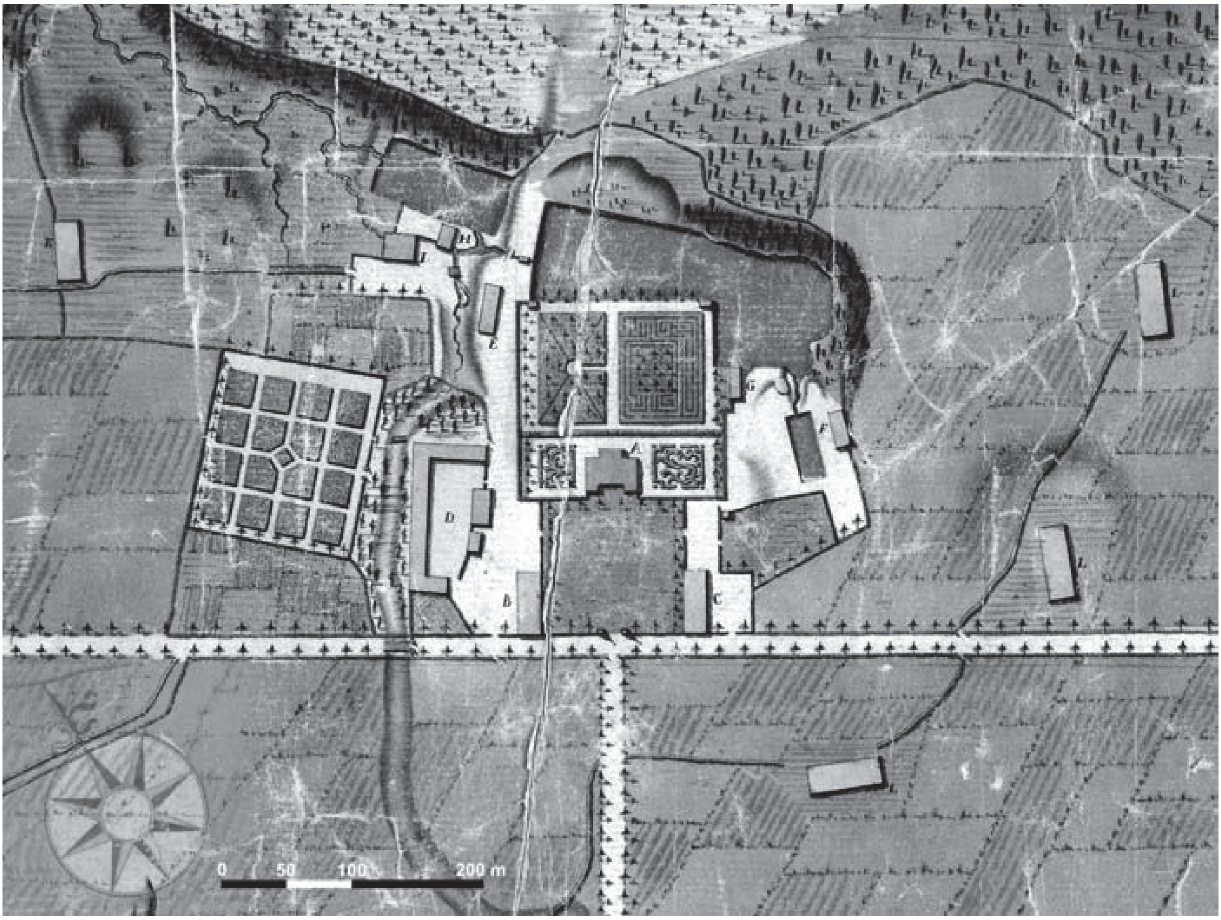

Figure 1. Plan of Palmse manor centre (1753). Source: Pahlen, G.F. 1753. Plan der Hoflage von dem Guthe Palms. *See also full colour section in this book*

The Baroque front yard of an Estonian manor complex is characteristically a spacious area, featuring a circular entrance road from the main gate to the main building entry. An open front yard provided opportunities for imposing views of the front façade; similarly, the view outward from the manor house windows, stairs and balconies focuses on the formality of the landscape design and its central axis. The front yards are usually among the best-preserved parts of the manor ensembles, having maintained their structure and visual and functional connections to the landscape. The largest part of a manor park is typically the backyard, with a formal garden and an adjacent landscape park. The design of these spaces was carefully planned. The backyard was typically divided symmetrically into smaller geometrical parts. It can be assumed that the backyards of Estonian manors, in the immediate vicinity of the main buildings, were more exclusively designed; typical surviving elements of backyards are allées of tree, terraces, water features and park boundary systems, such as stone walls.

INTERNATIONAL INFLUENCES ON GARDEN DESIGN IN ESTONIA

The oldest preserved manor landscapes in Estonia date from the second half of the 18th century – when Estonia was recovering from war and plague – during an important time for building and reconstructing manors (Maiste 2005). During this period, local garden design tended to follow one of two design philosophies. In the first, garden ensembles were created according to the above-mentioned Baroque principles of classical French formal design. This is evidenced by original landscape-planning documents produced in Estonia during the 18th century. The most famous is the 1753 plan of Palmse manor (see figs. 1, 2). In addition, there is evidence that classical French gardening literature was used by local garden designers in Estonia. These works – including André Mollet's *Le Jardin de plaisir* (printed in Stockholm in 1651) and Claude Mollet's *Théâtre des plans et jardinages* (printed in Paris in 1652) – were included in the library of the owner of Anija manor, Jacob Stael von Holstein (Hein 2007). The existence of newly-established Ba-

Figure 2. Palmse manor centre (1753).
Source: Plan of Manor Palmse 1753.

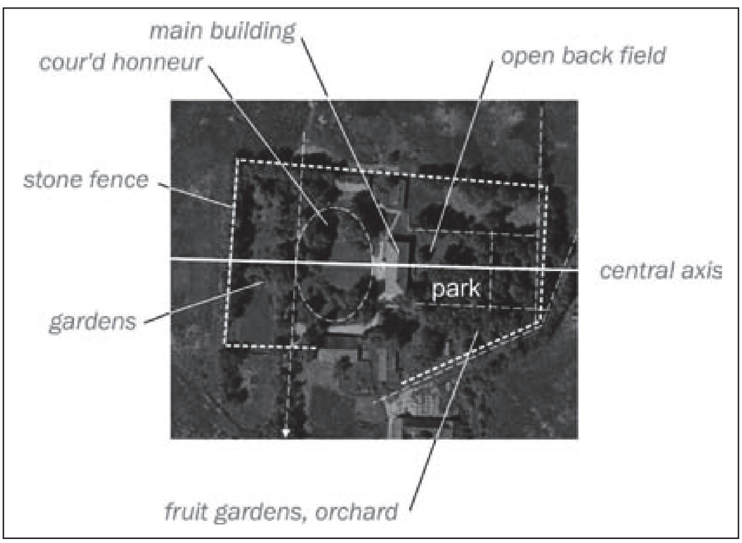

Figure 3. Schematic map of spatial composition of Vasta manor centre. Source: Nurme 2007. *See also full colour section in this book*

roque gardens in Estonia was confirmed by contemporaneous travellers. For example, the well-known architect Johann Wilhelm Krause produced a number of sketches in the 1790s that clearly depict formal design principles and even single Baroque garden elements in manors in northern Latvia, which at the time formed, together with southern Estonia, the province of Livonia (Janelis 2009).

The second gardening method – an English-style landscaped park – spread throughout Europe during 18th century. In 1785, *Theorie der Gartenkunst* by Christian Cajus Lorenz Hirschfeld was published, which significantly influenced the design of Baltic German gardening (Nutt 2008). Various manor landscapes founded or reconstructed in Estonia during the last quarter of the 18th century and the early years of the 19th centuries, such as Vatla, Aaspere and Õisu, are Baroque in structure, however landscape elements, including winding paths, irregular ponds and varied terrain, are formed in typical English 'picturesque' landscape design.

In fact, the English gardening style was dominant in virtually all new manor landscapes established in Estonia after 1770 (Hein 2007); the pre-eminence of this style gave rise to several beautiful landscaped parks in the 19th century. Nevertheless, the formal style was still dominant in older manor centres, probably because manor centres were already set in 18th-century landscape design and favoured the symmetric relations of the buildings and the park typical of Baroque layout (Maiste 2005). Moreover, the landscape parks surrounding the manor centres had matured to their best by the mid-19th century, and the desire and will to radically rearrange them was understandably weak.

A study of existing plans, drawings and postcards suggests that the designers of manor gardens in Estonia were often more conservative – drawing inspiration from formal, classical structure – than landscape designers elsewhere in Europe. This claim is supported by the built form of several parks created in the mid-19th century; for example, the general design principles evident in manor gardens in Raikküla, Hummuli, or Purila, where the spatial configuration of park elements, especially those closest to manor buildings, has been inspired by the ideas of formal Baroque design. A unique trait from the second half of the 19th century is a mixture of both styles, which is evident in Estonia in late 19th century and early 20th century manor gardens (e.g. Taagepera) or reconstructed manor landscapes, e.g. in Kärstna or Olustvere.

There are several explanations for the popularity of formal Baroque gardening in Estonia. The use of regular *cour d'honneur* as late as in the 19th century cannot be explained by the late arrival of original ideas to Estonia. On the contrary, the idea of 'freely flowing nature' used in Germany in one of the first great English style parks in Wörlitz (Gerhard & Erfurth 2000) was almost simultaneously applied in Estonia in Vana-Vigala manor in 1766, when '*Der Englische Garten*' was constructed (Hein 2007).

In addition, the use of formal Baroque garden elements in Estonian manors may be attributed to the introduction of techniques by international experts. For example, many Baltic Germans had family ties with building masters from Germany and, to a lesser extent, from Russia, Sweden and the Netherlands. For instance, the complex of Hiiu-Suuremõisa was planned by Swedish-French engineer Joseph Gabriel Destain (Särg 2006), Sagadi has been attributed to French-Italian-Russian architect Bartolomeo Francesco Rastrelli (Maiste 1983) and the largest Baroque-style park in Estonia, Kadriorg, was designed by the Italian architect Niccolò Michetti (Kuuskemaa 1985). The relationship between these designers and manors in Estonia demonstrate the great international mobility of landscape architects in the 18th century.

Although there are many examples of trained landscape-design professionals who planned manor gardens, the majority were laid out by the manor owners themselves, and the results reflect their knowledge, taste and views. For example, for a manor envisioned as a villa to be used as refuge from city life, an owner's garden design may have promoted peace and tranquillity (see Ackerman 1993 for a thorough analysis of villas and gardens). These ideas connect the local park design to Western European ideals (Kuuskemaa 1985).

A detailed review of spaces within manor parks protected by the National Heritage Board of Estonia (Heringas 2009; Vaine 2009; Mihkelson 2010) reveals evidence of formal Baroque spatial construction in 150 of 293 manor gardens from the final decades of the 19th century (National Heritage Board of Estonia 2009). Certainly, not all sites date from the 18th century as they are partly a result of the later designs which illustrate the vitality of formal design. At the same time, we often see mixed-era design, especially in parks reconstructed at the end of the 19th century, where formal Baroque structures, English-style planting systems and historical details intertwine (Nurme 2009).

MANOR STRUCTURE AND ELEMENTS

The formal Baroque garden is a distinct element of the manor landscape due to its compact nature and integration – both visual and structural – with the built and natural composition, formed from carefully-chosen axial relationships. Due to the axial structures, manor parks are visible and often dominant in the cultural landscape. The ensemble core, formal garden and landscape elements that are compositionally connected within a typical manor can produce a dramatic visual impact. For example, in Suure-Lähtru, the length of the main road and viewshed along the central north-south axis of the park is 1,200 metres. From the main road, perpendicular intersecting side roads emanate east and west, which in turn provide views of 1,400 metres (Nurme 2009).

Usually, contemporary circulation systems in manor landscapes are focused on roadways established during the grand era of Estonian manors. Therefore, the roads approaching the manor centre from the outskirts are in most cases similar to the original planned circulation system, which makes it possible to observe the park in the landscape from the perspectives that the designers originally planned.

Tree allées line roadways that lead to focal points in the landscape; in addition, tree allées form the boundaries of components of the landscape, delineating the border, for example, of the formal garden from the landscaped park (see fig. 4). Usually, design motifs within this landscape have been preserved only in a fragmented fashion and therefore they are less readable today. However, there is evidence of topiary cuttings, which are a key feature of a formal garden. The study of parks in situ gives valuable information about 'invisible' elements (Järvela 2009); for example, a geo-radar technique has been used to detect buried pathways (Artes Terrae 2010).

In Estonian manor landscapes, low dry-stone walls or higher mortar stone walls often serve as boundaries. Usually, the landscaped park was separated from other sections by walls and gates. In many places, such walls have been preserved, along with occasional gateposts and gate structures.

Water features, including ponds and fountains, were carefully designed, using natural characteristics of the landscape, to be integral features of the garden. For example, a formal garden could include rectangular ponds, circular islands, or a pond system connected with canals (see fig. 5), e.g. in Elistvere (Map of Elistvere manor 1825) and Õisu (Maiste 2008; Map of Õisu manor 1908).

Figure 4 .Luke manor park and tree allées (2008). Photo by S. Nurme, Autumn 2008.

Figure 5. Õisu manor park and canal (2008). Source: Photo by S. Nurme, Autumn 2008.

Terracing the land was an important technique of Baroque garden design, however terraces divided with structural support walls – such as those in Luunja park (Map of Luunja manor 1827) – are quite rare. Most of the original terraces were formed from sloping sections of garden. On one hand this is an indication of Scandinavian influence, and on the other hand it shows relatively mature formal garden design. Stone walls make the garden boundaries more rigid and unnatural, while grass-covered slopes suggest less control and greater organicism.

Engravings, photographs and postcards depicting the former milieu of Estonian manors suggests that, at least during the second half of the 19th century, garden design techniques produced rich, vivid environments. The landscapes in the images depict picturesque views of wooden bridges, pavilions, sculptures and flowerbeds (Nurme 2009), suggesting that much of what people admired in European formal Baroque parks was evident in Estonian manor parks.

Unfortunately, finding physical traces of Baroque artefacts today is difficult because there was much destruction of the cultural heritage of manor parks during the Soviet era in the latter half of the 20th century. As a result of short-sighted practices and a lack of cultural awareness, many manor centres were subdivided into smaller plots, used as construction sites, or abandoned and laid waste. Therefore, today, there is unfortunately little hope of uncovering additional examples of Baroque artefacts in what appear today to be clumps of old trees surrounded by undergrowth that mark the old manor gardens and landscaped parks.

Based upon the compositional features of preserved manor parks and historical documentation of destroyed manor parks, we suggest that manor parks dating from the second half of the 18th century possess classical Baroque garden features, and such features are evident even today, more than a century after they were first established. The rise of manor culture after the Great Northern War enabled the creation of elaborate manor estates, which give distinctiveness to local landscapes. Road networks on manor lands, which unified the manor ensemble together with the orchestrated views of the landscape, gave shape to the manor land, thereby giving shape to the local Estonian landscape which is still visible today.

CONCLUSION

Formal Baroque gardens in Estonia (created between ca. 1730 and 1780), in their purest form, were based on classical Baroque garden design. Due to its late rise compared to Western Europe, the Baroque structures remained an essential part in the design of Estonian manor parks throughout the 19th and 20th centuries. Therefore, regularity in garden design was never fully forgotten, which is evident in the landscape plans of 19th-century manor centres and may be observed in the parks today. It is difficult to determine how many Baroque gardens in Estonia are authentic, dating from the mid-18th century, and which were rebuilt at a later time using French garden design inspiration. As a result, our research allows us to describe the general spatial-design characteristics of a Baroque garden but we cannot fully articulate the detailed formal design when original garden design documents are not available.

Unfortunately, a lack of reliable archival material and a lack of opportunities to view preserved elements in gardens today prevent us from better describing the Baroque gardening period in Estonia. However, many manor lands today exhibit the essential values of Baroque gardens, and this provides opportunities to experience the elements of formal garden design that is still evident in the Estonian countryside more than 250 years after the gardens were estbalished.

A formal Baroque garden was intended to sparkle like the contemporaneous music of Händel. Such gardens, characterised by grandeur and dramatic spaces linking manor centres with other manor features, such as a landscaped park, formed memorable views into the distance. Formal terrain, tree allées forming enclosing 'pillars' and finely orchestrated water elements contributed to the sophisticated ensembles. If a visitor still senses surprise, amazement, playfulness and joy when visiting an unreconstructed park – despite destructive physical transformations of historic landscapes during past centuries – then it is surely an authentic Baroque garden and its uplifting atmosphere prevails.

ACKNOWLEDGEMENTS

An earlier version of this research was presented at the First Landscape Archaeology Conference at the VU University in Amsterdam, sponsored by the European Geosciences Union, the Cultural Heritage Agency and the Royal Academy of Sciences in the Netherlands in January 2010. When this article was written, Daniel B. Hess was a Fulbright Scholar at Tallinn University of Technology, Tartu College, Estonia.

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6.2. Publication 2

Nurme, Sulev; Kotval, Zenia; Nutt, Nele; Hiob, Mart; Salmistu, Sirle. 2014. Baroque manorial cores and the landscape. Journal of Cultural Heritage Management and Sustainable Development, 4 (2), 166−183.

Baroque manorial cores and the landscape

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Abstract

Purpose – The concepts of "historically valuable landscape," "historical landscape space," "landscape space attached to an object of cultural importance," etc. seem to be understood by most landscape professionals, yet these terms are highly abstract with many possible interpretations. The protected zone of cultural monuments prescribed by law helps to ensure the preservation of these historic artifacts and signifiers of local heritage. The paper aims to discuss these issues.

Design/methodology/approach – This paper seeks to provide guidelines that can be articulated to protect cultural landscapes. These guidelines are based on a manorial core study was carried out in 2010 to analyze the changes in road networks and spatial systems of manors over the past 150 years. This study is part of a larger research effort on different aspects of Estonian baroque manor gardens.

Findings – Many landscapes may contain historically relevant objects and phenomena not protected by law, which, nevertheless form the basis of a unique local landscape. The altering of such a landscape not only changes its natural form, but may directly impact the cultural identity and milieu of the area, thereby affecting how its inhabitants relate to their environment.

Originality/value – Preservation of historic buildings and landscapes plays an important role particularly in relation to manor landscapes. This network has remained well preserved, and the rural landscape based on this Baltic-German manor culture is still strongly reflected in the current landscape through the existing historic landscape elements like housing, viewsheds, roads, etc. Without landscape analysis, it can be challenging for an outsider to understand the spatial context, especially when it has changed and evolved through the years.

Keywords Cultural heritage, Cultural landscapes, Cultural sustainability

Paper type Case study

Introduction

Estonian cultural "space" is quite unique in a European context due to Estonia's location. The country's historic architecture, visual arts and landscape design are influenced mainly by German, Polish, Swedish and Russian culture, along with influences of manor architecture from other Western European countries. This combination and adaption of cultures is quite unique and characteristic only of Estonia (Maiste, 2005) and Northern Latvia (Janelis, 2011). Furthermore, during the nineteenth century when manorial estate culture in Europe was dramatically declining, it remained strong in Estonia (Maiste, 2007) due to historic and geopolitical reasons, such as the archaic feudal manor system (Hein, 2003) still in place and the production of grains and potatoes for vodka exports to Russia. This explains why in Livland and Estland specific rural landscapes appeared only in the eighteenth and nineteenth centuries, with strong

Journal of Cultural Heritage Management and Sustainable Development
Vol. 4 No. 2, 2014
pp. 166-183

2044-1266
DOI 10.1108/JCHMSD-06-2013-0024

physical and spiritual centers defined by manor cores. Their presence in the local landscape was characteristic of sixteenth and seventeenth century Europe, and they mirrored the philosophy of this age. Christian Norberg-Scultz describes this phenomenon with words such as "system," "centralization," "extension" and "movement" (Norberg-Schultz, 1979). But in Estonia, in fact, this landscape has generally survived to the present day.

Today preservation of historic buildings and landscapes plays an important role particularly in relation to manor landscapes. This network has remained well preserved, and the rural landscape based on this Baltic-German manor culture is still strongly reflected in the current landscape through the existing historic landscape elements like housing, viewsheds, roads, etc. Without landscape analysis, it can be challenging for an outsider to understand the spatial context, especially when it has changed and evolved through the years. Today Estonia (as well as Latvia) has numerous structures and sites protected by law. For example, 270[1] historic parks are protected as cultural heritage and nature preserve areas (Nutt *et al.*, 2013). During the planning and restoration efforts, the philosophical framework of international charters such as the Venice Charter and the Florence Charter are respected and supported by law (Heritage Conservation Act. Riigi Teataja I, 2002). For example, in October 1996, Estonia ratified the Convention for the Protection of the Architectural Heritage of Europe (Ratifying Act of the Convention for the Protection of the Architectural Heritage of Europe. Riigi Teataja II, 1996). Estonian Heritage Conservation Act regulates all actions related with protected object, included planning of conservation, conservation works and maintenance. Furthermore, over 360[2] parks are protected by Nature Conservation Act (Nature Conservation Act. Riigi Teataja I, 2004), which regulates actions.

This status usually comes with numerous restrictions within the protected area, such as the typical guideline of maintaining an additional 50-meter buffer around protected objects in the zone. The zone borders, however, are the current borders of the existing park. But is this enough? Can this protection buffer guarantee the defense and preservation of existing values? While today's developers may value the historic structure and abide by the protection buffer requirements, they may still inevitably cause damage to the "manor core" or the greater landscape's spatial system and view sheds. While these developments may not intend to disrupt the cultural heritage of the area, irreversible damage is done once they are implemented.

Estonia is a sparsely populated country, with little demand for new development. This lack of development pressure, however, can act as a double-edged sword. On one hand, Estonians have the luxury to protect and preserve their cultural heritage in a meaningful way. Yet slow incremental changes can be hard to detect, making it easy to stray away from the holistic view, leaving the gradual destruction of the cultural landscape unnoticed or unchecked. The authors contend that with deeper understanding and stronger definition, many of the manor cores or landscapes can be viewed holistically and protected in much more meaningful ways that go far beyond current law or standard 50-meter protection buffers.

The new residential area around Kukruse Manor near Jõhvi, built near an old mill, serves as a good example. This housing development technically adheres to the requirement of a 50-meter protected zone around the mill, but does not take into account the visibility of the mill or manor in the landscape (which has remained intact for at least one and a half centuries[3]), nor the specific milieu next to the four lane avenue, relatively unique in Estonia. Indeed some households had been built previously in the avenue space located near the mill since the 1919 land reform, but they are smoothly integrated into the existing landscape. When viewing the

Kukruse avenue within the entire landscape, its compact one-story house complexes do, in fact, blend in with the old oaks and larches, making them quite unnoticeable from a distance. Despite the relatively small scope of buildings in the new housing area around the mill, they still manage to disrupt not only the views of the mill and manor, but also the authentic surrounding landscape that has contributed to the uniqueness of the historic manor landmark for decades.

When interpreting the designed manor ensembles and their contact zones, planners are often confronted with various problems. Throughout the twists and turns of twentieth century history (Sinijärv, 2009) many unsuitable houses or structures were built in manorial cores while many historic buildings were demolished. Furthermore, there are many instances where historically valuable objects or spaces have disappeared from the landscape due to negligent or unsuitable development activities. For example, the apartment building erected directly opposite the manorial core of Raadi Manor near Tartu in no way takes into account one of the most symbolic buildings on the site, the gate building. The new housing obstructs the views of open landscape from both the main gate and the road, damaging the desired spatial element so vital to the ensemble of structures, thus destroying a 150-year-old (План о ближной окружности трактира и питейнаго дома принадлежащего к мызы Ратсгофу, с начертанием всех ведущих туда дарог и с обазначением отдаленности его от Города Дерпта, 1838) cultural heritage site. While one can debate the nature of landscape space and its historic value and significance, be it a result of pure coincidence or planned development over the centuries, it can be easy to lose the greater sense of space when focussed on protecting only one element of the entire ensemble (Figure 1 and Plate 1).

It is certainly debatable in which cases or on what conditions one can discuss valuable landscape spaces and perceptions of historic objects. The definitions invariably depend on those who define them and their pertinent knowledge and beliefs. Planners and designers enjoy vast interpretative freedom within this valuable landscape interpretation methodology (Hellström, 2001). Sometimes we simply protect our valuable landscapes or objects in landscape based on regulations and often without too much critical analysis. As such, protected areas are isolated from the greater landscape, and we fail to notice changes in the surrounding landscape that affect

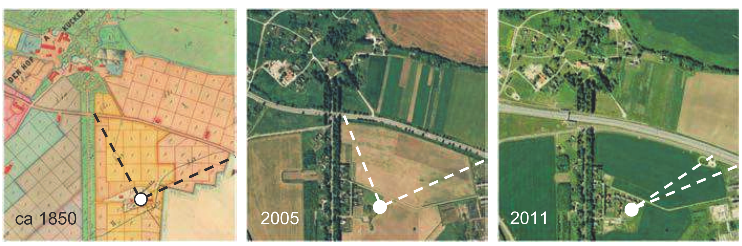


Figure 1.
View of corridor and landscape openness connected with Kukruse mill: on the left side and center – situation from mid-nineteenth century to 2005, right after housing area development

Notes: The figure shows that new housing area alters more than 80 percent of the view area from the road and manor center. In the 2005 and 2011 figures one can note the reconstructed highway. The highway changes local views in the main axis of main alley, but it stays generally in historic location and thus does not change landscape openness

Sources: Estonian Historical Archives (EAA) EAA 2062-1-171; orthophoto by Estonian Land board

Source: Photo by: Sulev Nurme

Plate 1.
New development obstructing landscape view from Raadi manor main gate

protected areas as well. The "historical" landscape does not end after crossing borders of cultural heritage protection areas.

Frankly, the historical landscape and its key elements are not only issues of cultural heritage protection but hold community identity and form, local and regional landscape patterns while also characterizing local historic settlement. Landscaping can yield positive impacts on property values (Jansson, 2010); similarly authentic historical landscaping around historic buildings increases their economic value and makes them more attractive for tourists (Hellström, 2001). This is, in fact, a key rationale for developing peripheral rural areas and making them more attractive for potential investors looking for quality places to invest.

Manor centers with their old parks are often also like ecological oasis's, with incredible biodiversity and often, in intensive rural agricultural landscape, the last refuge for many species – plants, insects, birds, etc. Centuries of evolved specific and unique habitat, where the biodiversity is typically richer than what is found in "real nature." Irresponsible change to these landscapes can destroy ecological balance and lower ecological, cultural heritage and real estate values (Uustal *et al.*, 2010).

This paper seeks to provide guidelines that can be articulated to protect cultural landscapes. These guidelines are based on a manorial core study was carried out in 2010 to analyze the changes in road networks and spatial systems of manors over the past 150 years. This study is part of a larger research effort on different aspects of Estonian baroque manor gardens.

Methodology

The study included 34 manor complexes throughout Estonia. Manors were selected based on previous research involving baroque parks that was carried out by Tartu College of Tallinn University of Technology, as well as the regular composition of manor complexes (Vaine, 2009; Mihkelson, 2010; Heringas, 2009). The preference for parks with standard composition resulted for various reasons, the most important of which being the clear distinction of regular composition from the landscape as well as clearer, more unambiguous and easily determined links between core ensemble and landscape, both on paper and *in situ* (Nurme *et al.*, 2012). Age was a key factor in the choice of the ensembles, with most of the selected manorial cores featuring the late baroque style. Thus, the specific preserved landscape components are influenced by the oldest ones in the post Great Northern War manorial culture. The selection took into account the existing records from 1750 to 1917 reflecting the mutual influences of manorial core and landscape. The rationale for picking this timeframe was quite pragmatic, as any helpful maps displaying details about manor center design and structure before the Northern war did not exist. Only after 1750 were greater efforts taken to maintain detailed maps and preserve in local archives (Figure 2).

The study was largely based on map analysis. Its theoretical basis derived from the methodology developed during the studies of Alatskivi (Nutt, 2003) manorial core along with the analysis methods used during the inventory of manors in Tartu County (Nutt, 2004). The study focussed on the changes in spatial openness of manor landscapes and spatial expanse of manorial cores. The study also sought to evaluate and compare the state of historical roads related to the manorial core. Road networks clearly illustrate changes and landscape developments, and can provide a rather objective form of spatial structure analyses (Tarkin, 2011). Road networks may not be visible at first, yet their footprint still exists. These road corridors define the basic spatial pattern and make it easier to interpret the view sheds, unique composition and landscape elements so critical to the manor complex. As such, roadbeds may be critical in evaluating the extent of preservation required to truly protect cultural heritage.

In both cases, the changes could be assessed by comparing the presumed initial and current situation, using modern orthophotos and historical plans of the manors. Map analysis enables one to assess changes in landscape structures by comparing the

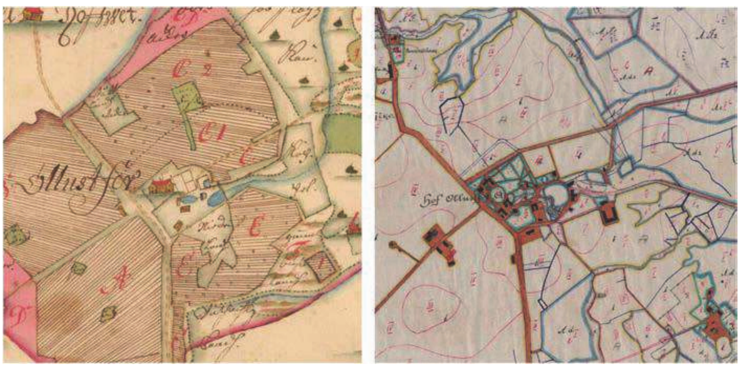


Figure 2.
On the left: Olustvere manor center in 1741 (map copy from 1688) (Charte von denen Ollustferschen Hoffes Ländereien, im Pernauschen Kreise und St. Johannes Kirchspiele belägen, 1741) and on the right: Olustvere manor center in 1906 (map copy from 1864 to 1866) (General-Coupon des Gutes Ollustfer, 1906)

Notes: The older map provides much less information on landscape space compared to more recent map. For example, in older maps main roads, important buildings, field boundaries, ponds and land use can be noted. Newer map shows all roads, buildings, relief, ponds, ditches as well as land use etc.

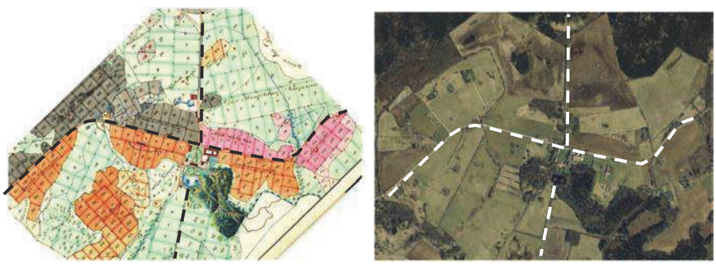
Sources: Estonian Historical Archives EAA 3724.5.2784.1; EAA 308.6.167

areas or dimensions of the given structures (Steenbergen and Reh, 2003), whereas the processes in landscape, that these changes reflect, can be evaluated qualitatively.

The main consideration when selecting historical maps involved keeping the interpretation of data they contained as simple as possible. Therefore, the map needed to clearly identify a typical baroque architectural spatial system, groundcover (land use), buildings, park, roads, etc. In cases of having several existing plans to choose from, the earliest version or most detailed was preferred. In order to pass the selection criteria, the maps also had to provide an integral and general overview of the area, with all territories surrounding the manorial core clearly marked as well. Orthophotos from Estonian Land Board were used as modern reference plans (Figure 3).

In cases of landscape open space, the changes in landscape views from the manorial core resulting from changes in land cover class (Koppa, 2006) were studied and utilized as a reference to construct historical and modern extent of visibility. This enables one to draw conclusions about the whole spatial structure surrounding the manorial core. The key points of the ensemble composition (the main observation points with reference to the composition of a specific park) near the main building and on the border of the manorial core determined the selection of observation points. The study on the spatial extent concentrated on the territorial changes of the manor core, comparing the historical borders on the map with an orthophoto. The extent of changes was expressed in terms of area. In order to determine the state of road corridors, the roads attached to the manorial core were compared to the roads in orthophotos, with the length of overlapping (i.e. existing road corridors) roads then calculated. The results of map analysis were checked during fieldwork in May 2010. The fieldwork mainly focussed on the changes concerning viewsheds and other territorial changes in the manorial core. The key points in the park landscape, previously determined with map analysis, were found in nature and captured with the panoramic photography. In cases where the results of map analysis and on site documentation did not overlap, the likely scenario was determined on site.

The results of map analysis were assessed as a percentage change, in view of their estimated territorial changes. For interpretation of changes, 0 was used to indicate marginal changes in the landscape with 100 representing cases where the present-day landscape had changed beyond recognition. In order to facilitate the assessment,



Notes: On the left side, the center in 1856 (Taschenatlas über die Feld-, Wiesen- und Forst-Wirtschaft des Gutes Saggad, 1856), with the present view at right. This comparison shows how the historical road network and main spatial axis connected with manor ensemble architectural composition are clearly recognizable on orthophoto

Sources: EAA 1324.1.590.3.; orthophoto by Estonian Land board

Figure 3.
Sagadi manor center

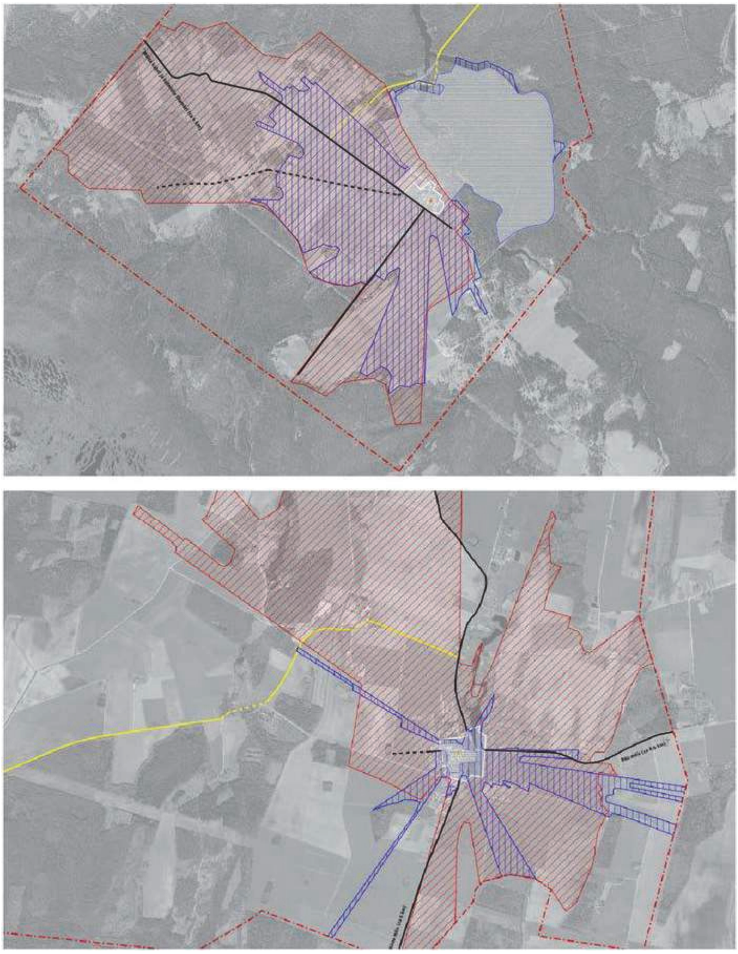
the results were divided into five classes by capacity of altered landscape. The state of roads was expressed as a percentage of road still intact and calculated as a ratio between the total lengths of survived and destroyed roads. The same method to divide territorial changes into four classes by capacity of changed road length. Both classifications are given by percents in scale from 0 to 100.

When comparing the results of the map analysis, the researcher can determine the relationship of each park with its overall connection to the surrounding landscape. Thereby, changes in landscape trends surrounding the old manor parks may be noted. These trends can be used as framework to predict different scenarios of different developments. For every unique case the analysis can generate a list of most threatened objects and spatial structure elements within the surrounding landscape and its relationship to park composition, as well as, perception of the park from a distance. This inturn could help to prioritize the value of objects and/or elements within the viewsheds and the necessary actions to preserve those valuable elements and perceptions in the surrounding landscape. The results also point out the elements that have significance and are essential for proper understanding of park composition (Figures 4 and 5).

Research on characteristics of manor core landscapes

The results of the study reveal that the landscape surrounding manorial cores has changed significantly. The landscape openness of studied premises has changed significantly (75 percent on average). In all cases (map analysis regarding spatial openness was conducted on 24 manors out of 34) viewsheds and open spaces have decreased significantly. Spatial openness has decreased by half in the case of four manorial cores, while in other cases the change has been significantly higher. Audru manorial core deviates from the general rule with its spatial openness changing the least (ca. 38 percent) but this is understandable considering the manor's view of the sea. At the other end of the spectrum, Arbavere manorial core saw almost all spatial openness practically vanish (ca. 98 percent) due to scrub and forest growth. The decrease in spatial openness around manorial cores results from scrub or forest growth of former grass and farmlands, along with the construction of new buildings and in the proximity. Keeping in mind the significant increase in forested areas (compared with 1919; Tarkin, 2011) and the decreased role of agriculture, this should not be surprising; however, the scope of changes is rather alarming. Fieldwork revealed that landscape openness remains on the decline. Scrub growth and young forests taking shape on former grass and farmlands increasingly destroy the visibility from manorial cores and attest to this alarming trend. Disappearance of open spaces around manorial cores diminishes their visibility as landmarks; consequently, the visual relationship between the manorial core and its surrounding landscape fails to maintain an engagement, leaving historically important or valuable elements (alleys, separately standing trees, stone fences, remains of bridges and outbuildings, etc.) further away from manorial core to be covered in scrub growth. In the latter case, the objects are not as much at risk physically but rather face being forgotten by local people, due to an "out of sight, out of mind" mentality (Figure 6).

In comparison to the openness of the contact zone, the spatial extent of the manorial core within its landscape has been much more preserved. The results of the analysis concluded that although the spatial extent of most manorial cores has decreased (evident in 21 cases), the decrease has been by more than 20 percent only in six cases. In 13 cases, as opposed to the trend, the extent of the manorial core has actually increased. In nine cases out of 34 manorial cores, the change remains within 5 percent. The largest decrease in the extent was evident in Väätsa (56.4 percent from the



Notes: Above: Palmse manor – spatial structure and territorial reach of baroque ensemble is practically unchanged. Below: Väätsa manor – manor core territory has decreased by more than 50 percent

Source: Tarkin (2011)

Figure 4.
Changes on manor centers

original), with the largest increase in Palmse. This indicates that historical space as a whole is still rather well preserved. The land reform in 1919 further explains why the extent of manorial cores has decreased, as parks were divided into smaller lots and collective farms were built during the Soviet regime, when several buildings were

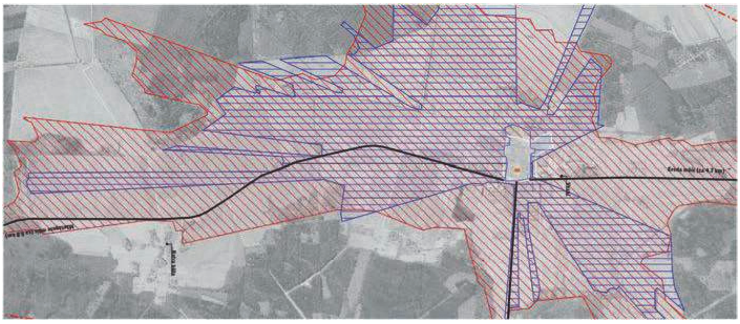


Figure 5.
Changes in road network

Note: Good example of well preserved axial roads in Kiikla manor
Source: Tarkin (2011)

Figure 6.
Landscape view openness on case of Sagadi manor: blue – today (2012), red – in middle of nineteenth century (based on 1856 map; Taschenatlas über die Feld-, Wiesen- und Forst-Wirtschaft des Gutes Saggad, 1856)

Source: Tarkin (2011)

erected within and in close proximity to the manorial cores. In the majority of cases, a portion of the historical manor territory has become an open area (grass- or farmland) or a yard lot, and in some rare cases the parks in the manorial core are covered with scrub or forest growth. A large-scale territorial increase in the manorial core has mainly stemmed from the establishment of new parks in the nineteenth century (Palmse, Hiiu-Suuremõisa, Kaagvere, Kõljala, Pidula, Koigi, Pilguse). When discussing this increase, one must consider the impact from map analysis methodology – during the analysis the earliest possible maps of baroque parks were compared against the present-day situation resulting in a remarkable increase in the nineteenth century, whereas if parks are analyzed as a whole it is likely that in most cases the extent of manorial cores will have decreased. The manorial cores, which have increased by < 5 percent, are explained by the establishment of new park areas in former open spaces within the immediate vicinity of contact zone in the twentieth century, therefore increases in present-day manorial core are related to increases in park areas (Hellenurme, Luke) (Figure 7).

An analysis of roads emanating from manorial cores revealed that only the roads of one studied manor (Pilguse) were not preserved (36.6 percent). In other cases the roads have survived well or very well. Interestingly, the roads emanating from Ahja, Kiikla, Tilsi and Urvaste manorial cores have survived in their complete state. Given that the general traffic patterns have not changed due to the topography of the manorial core contact zone and general housing structure of the area, the roads have been well preserved. Usually roads become obsolete when new direct routes are created, with the existing roads straightened and new buildings erected within the manorial core or its contact zone.

This analysis of roads leading through manorial cores included 31 manors, since in three cases the current roads were not depicted on the historical map. Map analysis indicated that for 21 manors surveyed, the roads have survived in their old site, and in ten cases the location was precisely the same. The survival of given roads and roads emanating from manorial cores is due to the same reasons. The state of road networks in Loodna, Pilguse and Arbavere manorial cores, for example, is much worse. However, this does not mean that the road corridors have completely vanished; they are now simply used instead as local byroads. As a result of new road development and straightening, old road segments have lost their significance, thus leading to the disappearance of historical roads (Figure 8).

During fieldwork when map analysis was re-validated, it became evident that the data acquired from the analysis broadly corresponded to the situation on site. As was expected, the primary differences concerned landscape openness. In most cases (e.g. Ahja, Väätsa), open space on site appeared to be somewhat smaller, resulting from line structures (e.g. tall hedges, ditch banks covered in scrub growth and calm traffic areas which visually close the space, yet divide the landscape) which are hard to identify from orthophoto during map analysis. Since calm traffic areas have been integrated into manorial cores, it is sometimes difficult to determine the actual spatial extent of the manorial core on site, whereas in map analysis this had been less complicated. Landscape openness is also determined by relief – spatial openness in manorial cores with active relief depends on the particularities of the relief. For example, the results of landscape openness obtained on site in Luunja, Kaagvere and Purdi are greater than the results of map analysis. However, observations during fieldwork affirm that although the openness has usually altered, in most cases the key views tied to the manor ensemble main axis still exist and are easily discerned in the landscape.

The parks analyzed in this research are located in very different locations all over Estonia. Basically they can be separated into three categories of manor parks. First,

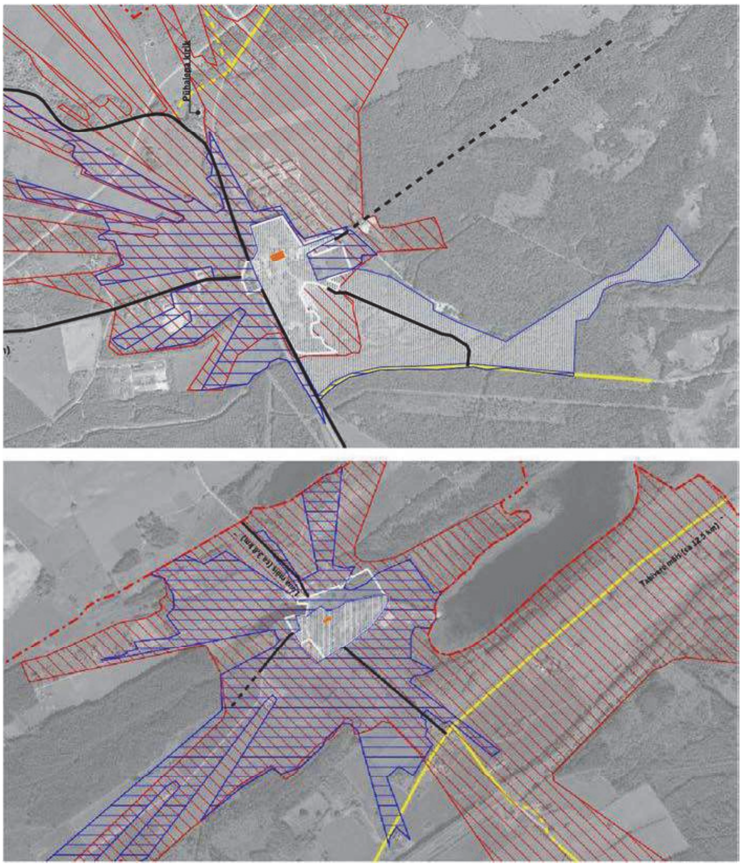
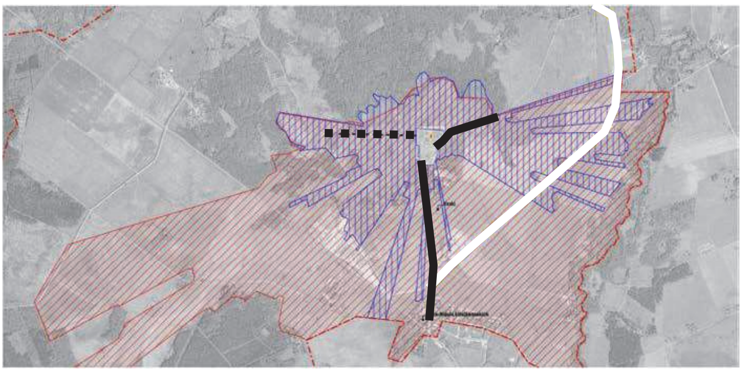


Figure 7.
Examples of territorial changes of researched manor centers

Notes: Above: Hiiu-Suuremõisa manor center as example of enlarged case. Below: Kaarepere manor center, whose territory decreased approximately 50 percent. White hatch shows manor core territory today, white line territory in the middle of the nineteenth century
Source: Tarkin (2011)

parks located near towns or bigger villages that are used as tourist attractions, as well as by local residents for recreational purposes (e.g. Ahja, Koigi, Luunja, Roosna-Alliku, Vana-Võidu, Väätsa, etc.). The second category are parks that are well known tourist attraction in small places and have importance mostly as well known tourist attractions (e.g. Palmse, Sagadi, Luke, Õisu, Hiiu-Suuremõisa, Vatla, etc.). The third group are individually located manor houses or manors in small villages that are rarely used by local residents nor are they well known as tourist attractions (e.g. Urvaste, Saare, Kassinurme, Kiikla, etc.).



Notes: White line indicates the preserved historical main road, with the black line marking preserved historical roads connected with the manor ensemble spatial axis, and dotted black lines showing unpreserved main roads connected with ensemble spatial structure
Source: Tarkin (2011)

Figure 8.
Main road network of Vasta manor center

This research concludes that important tourist sights are in fact well maintained and regulated in terms of maintenance and the surrounding land uses are respectful of the historical context (e.g. Palmse, Sagadi, Hiiu-Suuremõisa, etc.).

The most threatened perhaps are the first category where landscape changes in surrounding areas, due to the construction of new buildings and streets and renovating existing structures, can causes significant changes of visibility and perception. Old parks, as attractive landscapes, evoke greater interest from real estate developers. Also these parks are under pressure, from local government or local citizens that want to revitalize and reuse historic parks as recreation areas, children playgrounds, parking lots and adding other different modern structures and park elements. If this process goes against the Florence charter, then the historical layers (valuable elements and phenomenas) and significance will be destroyed (e.g. Vana-Võidu, Kaagvere, Luunja, etc.). On other hand, if this developing process is done properly and all important relationships between park and landscape are accepted, then they are preserving their significance for local community and for visitors. Those cases, where a local community accepts park as valuable historical spatial system, that requires special treatment not only within the borders of the park, but also in the surroundings, do not need additional protection (e.g. Roosna-Alliku, Väätsa). In any case, processes of change are not easily reversible.

The second most threatened category are the individual manors or parks located in small villages. The biggest problem is insufficient maintenance, which causes increase in brush areas and enclosures. The second issue is the disappearance of significance, which is related to the lack of maintenance. Often park and their related surroundings are understood by specialists not visitors (Urvaste, Kassinurme, Rasina, etc.). Problems are often caused by changes in surrounding landscape, such as changes in land use where local agricultural fields are abandoned. The second reason is, that buildings in manor core are destroyed or abandoned. On the other hand, these areas do not have real estate pressures and most changes in surrounding landscape (and often in park) are related to vegetation and can be reversed by proper maintenance (Plates 2-4, Figure 9, Plates 5-8).

Plate 2.
Palmse manor

Notes: View from road, which is built on main spatial axis of manor ensemble to the main building of manor center. This road is built only for compositional purpose, as historic maps (Pahlen, 1753) illustrate many featuring dead ends

Source: Photo by Sulev Nurm

Plate 3.
Sagadi manor

Note: View from the manor main building, back stairway to overlook park and well preserved historical road which is connected with main axis of ensemble

Source: Photo by Sulev Nurme

Notes: This road leads to the main gate of the manor center and is part of the typical perpendicular road crossing (road in photo marked with dotted line in historical map (Figure 9)). In the center of photo lies a typical silhouette in Estonian landscape – the shape of manor park, which indicates local landscape pattern center

Source: Photo by Sulev Nurme

Plate 4. View from historical, preserved main road to Urvaste manor center

Conclusion

Manor ensembles featuring standard composition have a relationship with the surrounding landscape through their roads and vistas – baroque park structure with its mathematical composition had to perform a "show" long before reaching the main building. The most broad and general application of this study lies undoubtedly in the confirmation that structures attached to the baroque park landscape still exist and may be observed in the present-day environment. This would suggest that the historical spaces of manor ensembles from later periods are more well-preserved, and can be determined through simple map analysis. Empirical observations during fieldwork suggest that data from map analysis is reliable and similar to the results of observation. Style specifics must of course be considered regarding English-style and historical parks but in case of problem areas where planned construction works could threaten the visibility of historical objects or the space essential for appreciating (thus also existing) them, the analysis could help us determine sensitive and less sensitive areas. This, in return, would help to preserve the identity and essence of one of the most important cultural landmarks in Estonian landscape – manorial cores. The research illustrates that we can locate and analyze surviving manor core landscape characteristics and these data as they are very easily transferred to modern maps, so we can use them as necessary helping tool in planning process. This is not a new concept – map analysis is a very common tool in landscape architecture practice, but since historical landscape map analysis is not strictly required for protected objects and their surrounding landscapes, there are missed opportunities that would help prevent damaging valuable landscapes as a result of accidental planning.

Another outcome of the process revealed that spatial volume of manorial cores has remained largely unchanged. Accordingly, it could be said that space-wise the

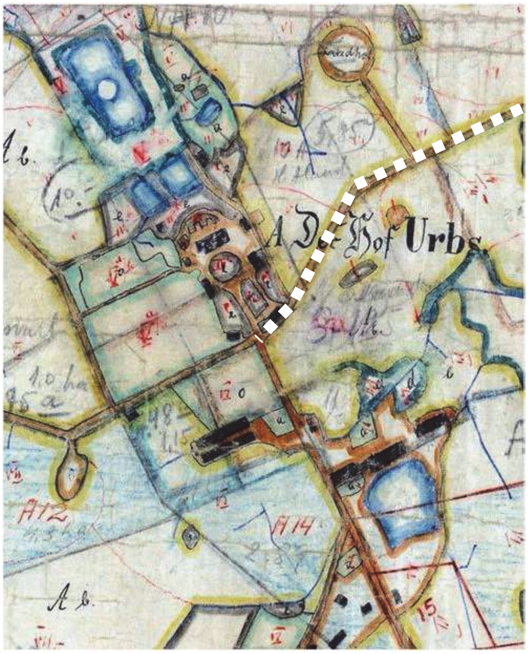


Figure 9.
Plan of the Urvaste Manor center from 1873

Sources: EAA 1401.1.5 leht 1 (General-Charte des im Livländischen Gouvernement, Dörptschen Kreise und Anzenschen Kirchspiel belegenen privaten Gutes Urbs, 1873)

Plate 5.
Panorama-view to the south from Väätsa manor center main gate

Note: On the left appears kolkhoz-time built buildings which obstructs originally open views to the fields
Source: Photo by Eigo Tarkin

ensembles have survived as an integrated system where poorly planned construction could spoil both the milieu and integrity of the ensemble. It is only natural that over time there have been additions to the parks, and in some cases these changes are irreversible. For example, construction of a new schoolhouse in the Väätsa complex completely altered the frontal square of the ensemble, whereas in Vasta, despite some minor changes in the road network and outbuilding facades, the front square of the manor can still be appreciated in its entirety.

Without doubt another key outcome involved the realization that the road networks emanating from the manorial cores have largely survived in their original locations. Roads, as a "functional backbone" of the landscape, provide a stable measure for spatial definition of the manorial core and its related landscape in both its current and original state. This should serve as a key prerequisite when managing road networks, if the intention is to preserve historical space. Knowing the location of roads makes it is easier to determine former open (or closed) spaces currently covered with forest or scrub growth, thereby providing crucial information when planning, for example, landscape maintenance work.

Of course, there is no need to protect all historic landscapes. When dealing with historic areas it is necessary to realize that valuable areas are those where spatial structure (view sheds, open-closed areas, etc.) is more authentic and well preserved. The key question is whether the planning area and its surroundings are valuable as

Notes: Kaagvere manor center is visible across the river. Spontaneous vegetation is growing that without proper maintenance will soon obstruct the historical view
Source: Photo by Eigo Tarkin

Plate 6. Panorama-view from border of Luunja manor center over river Emajõgi

Note: The landscape openness is well preserved, although the spontaneous vegetation on the left could soon consume half of panorama
Source: Photo by Eigo Tarkin

Plate 7. Panorama view from Purdi manor main gate to the east

Notes: The landscape openness on the right side is obstructed by buildings built during soviet era, but on the left side the historical view is well preserved, because few years ago made detail planning respects historical open view
Source: Photo by Eigo Tarkin

Plate 8. Panorama view from Tilsi manor main gate to the west

key element for reading or understanding local landscape. Nowadays, when planning real estate developments, the larger landscape is forgotten. Dealing better with historical landscapes through planning processes would address several issues. The first issue is to teach planners to really respect historical landscapes – manor cores are just one example of them. This means planners should be able to read the historical layers of landscape and interpret them within context. The second issue is that our current planning system does not require presenting documented landscape analysis along with site-specific planning documents. If this documentation were required, perhaps the quality of planning and landscape projects would better respect historical values and understand that by respecting the genius loci of site, cultural and economic value can be gained. The third issue is how to handle historical landscapes located in or near towns that are pressured by real estate development and often "over used" by visitors. Both problems can be solved by proper planning and conservation processes. In Estonia, rural populations are shrinking due to migration to urban areas resulting in greater, everyday, recreational user pressure on historical parks in urban areas. For that reason the handling of historical parks in plannings and conservation processes must not focus so much on the conservation of past but on social-functional integrity (Jokilehto, 2007) to save objects with values for future generations.

Considering the extent of changes that the landscape has witnessed over the last hundred years, it is rather surprising to see that landscape attached to Estonian manorial cores after the Great Northern War have been preserved quite well. This is remarkable not only in regards to Estonia cultural heritage, but also in the general European context. If we want to preserve those values that reside in our landscapes for future generations, we must not look for lost details, but survived great picture – because there are hidden our roots.

Notes

1. National Registry of Cultural Monuments, 2012
2. By the data of Information page of Estonian Nature Information System (EELIS); http://loodus.keskkonnainfo.ee
3. Map of Kukruse manor 1874-1875 (Ysenflamm, 1874/1875)

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6.3. Publication 3

Kalberg, Heiki; Nutt, Nele; Nurme, Sulev; Hiob, Mart. 2013. Simple, but Therefore Clever Idea - an Effective Dendrological Inventory Process for Landscape Archi-tecture and Design Projects. In: Buhmann. Ervin; Ervin. Stephen M.; Pietsch. Matthias. Ed. Buhmann. Ervin; Ervin. Stephen M.; Pietsch. Matthias. Berlin: Wichmann. pp 48−54.

Simple, but therefore clever idea - an effective dendrological inventory process for landscape architecture and design projects

Heiki KALBERG, Nele NUTT, Sulev NURME and Mart HIOB

1 Introduction

Good solutions do not necessarily need to be highly complicated or costly. This article introduces a simple way to improve the economic efficiency of the digitalization of dendrological inventory data. The application developed in this study makes it possible to effectively link drawing and database programmes so that data can be utilized in both CAD (computer-aided design) and GIS (geographic information system) systems. Furthermore, no additional investments in training or technology are necessary, as this application uses software already featured in most plan design offices.

In Estonia, more than four hundred parks are protected areas (SINIJÄRV, 2008), but there are many more historical parks (HEIN, 2003). After Estonia regained independence (1991), people grew more passionate in restoring and rebuilding historical parks, which explains why landscape architects deal with compiling restoration projects on a daily basis. Compiling park design projects involves the inventory of park trees (EESTI STANDARD, 2010), and provides a much needed overview of park conditions along with the data needed for choosing the best restoration methods that promote sustainable design (NURME 2008). Dendrological inventory is a time-consuming process due the extensive fieldwork involved and the detailed data digitalizing and systemizing processes that follow.

2 Application for inventory data integration

2.1 Reasons and causes of application development

There are two kinds of dendrological inventory data: primary data and collected data. {*Primary data involves geodetical base plans that have been compiled during surveys (RTL, 2007) on which locations of tree trunks are marked, together with the area layout that links to the L-EST97 coordinate system.}* For compiling digital base plans, the CAD system software is suitable; in Estonia the most commonly used are vector graphics programmes MicroStation (dgn) and AutoCad (dwg). The geodetical measurements must be taken with professional equipment, usually an automated theodolite operated by one geodesist. GPS measurements are not suitable as they are too inaccurate. Another component of inventory data consists of data collected during fieldwork. In Estonia, no specific methodology has been established for dendrological inventory (KUPPER 2012). Trees are most commonly taken into inventory as individual items. The species of each tree is determined and certain parameters are measured (trunk diameter, crown projection area, tree height). Landscaping value (TALLINNA LINNAVALITSUS, 2006) and condition of the tree (NURME, 2008) are also analyzed, with damages described when necessary. Two people are needed for data collection, with one researcher taking measurements as the other records the information.

During fieldwork, this data is recorded by hand into inventory data tables, while geodetical base plans are used to mark tree locations. Data from the tables and trees on the plan are systematically linked to each other with numbers. Data collected during fieldwork is then entered into a spreadsheet table (Microsoft Excel is used primarily) and marked on a plan in a vector graphics programme, but this table and plan are not digitally linked to each other. This process is extremely time-consuming and creates excessive data entry after concluding field research.

Fig. 1: Determining the damage on a tree trunk (Researcher is shown holding a calliper, a device for measuring trunk diameter).

2.2 Methodical basis of the application and description of the work process

The objective was to develop an application that would:

1. be easy to use, save time and resources, work on basic programmes found in offices that deal with compiling plans (MS Excel, MicroStation);
2. combine MS Excel data tables with digital plans into a linked spatial database that would make it possible to automatically read data from the database and mark the information down on the plan, while also adding coordinates from the plan to the database;
3. create the necessary structure of layers on the plan and allow data to be added to these layers;
4. allow adding information derived from the data collected during fieldwork to the database;
5. allow for flexible data interpretation regardless of the inventory methodology used;
6. perform independently if necessary, but could also be combined with GIS programmes (MapInfo Professional or ArcGIS).

In 2012, the landscape architecture office Artes Terrae started looking for ways to optimize the inventory process by utilizing already existing tools. They focused on two objectives: Digitally recording data collected in the field through the use of existing tools such as phones and tablet computers, while also working with licensed programmes already in use to further refine the data analysis process.

First, an Android-based Smartphone (Samsung GALAXY S III) was used to record measurements. As a result, data entry took slightly more time during fieldwork than it had when recording the data onto tables by hand; however, the lengthy process of transferring the data after completing fieldwork into MS Excel tables was avoided. Researchers also utilized tablet computers (Samsung GALAXY tab 2 10.1) for entering plan data. The tablet computer with its larger screen was more practical to use during fieldwork, but had issues with processing the plan information entered due to the low productivity of the CAD software used in tablets, making it impractical for drawing plans. Researchers then started looking for other ways to increase the economic efficiency of the project.

Several existing applications such as Ezytreev Tree Management software, Treeworks, and Tree Tracker offer good options for arborists, dendrologists, and other specialists involved in tree inventory, evaluation, and planning maintenance (RUNNEL, 2012), but they are not suitable for the plan projection process. MicroStation, the CAD system vector graphics programme used by Artes Terrae, allows for entering various types of data in addition to plan information by using tags, like GIS systems. Still, using this during fieldwork can be impractical and time-consuming compared to MS Excel. Furthermore, GIS programmes such as MapInfo Professional are too inaccurate for practical application to the plan projection process. For this reason, to satisfy the needs of plan compilers, a macro working on MicroStation basis that could share data with MS Excel was developed.

During the first stage of the application development process, researchers defined the structure of data used for dendrological inventory (order of fields, data type of entries, abbreviations of entries, etc.) then used these for creating the table structure of the MS Excel programme along with the MicroStation macro. {*During the second stage, a technical solution was developed, but its specifics will not be discussed in this article. However, the usage purposes of the application will be described*}.

To use the application, the plan in the MicroStation programme must be opened; symbols of trees are linked to coordinates and the Excel table containing fieldwork data. When clicking on a symbol representing a tree, the programme automatically transfers its coordinates to the corresponding row in the Excel data table, and therefore links the plan to the table. It is important to make sure that when clicking on tree symbols on the plan, they are chosen according to their numbers.

The programme automatically chooses the parameters of the correct tree from the MS Excel table, and with the next click a circle with the necessary diameter is created on the plan. In drawing the diameter of the tree, the programme chooses data from the MS Excel table in a certain order. It first chooses measurements of the crown projection area or diameter, or when no data is given, uses the diameter of the trunk. When the necessary data is not supplied (for instance, diameters of shrubberies, individual shrubs, and dense groups of young trees are not measured), the manual drawing programme is activated and the image of the crown is mechanically marked on the plan using fieldwork data. If necessary, the digital drawing can be manually corrected using the fieldwork plan because the fieldwork plan is visible on the desktop as the bottom layer.

Moreover, the application simultaneously organizes database entries by adding related information, such as the full names of tree species in both Estonian and Latin. Abbreviations are converted into text with the help of special support files which have been created for this purpose.

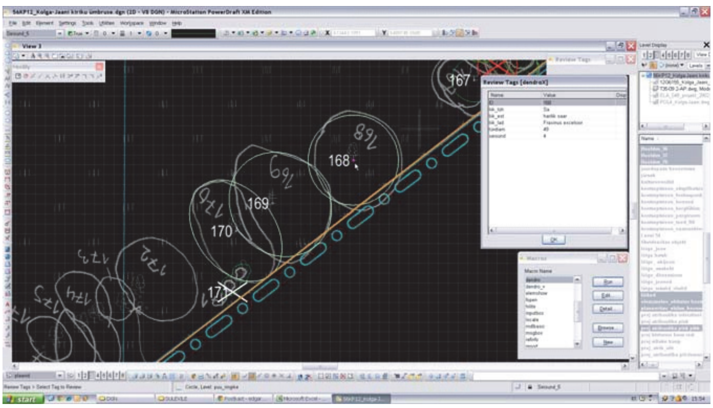

Fig. 2: When clicking on a symbol, the number of the tree and a circle marking the crown diameter automatically appear. The accuracy of the data can be easily verified with the help of the fieldwork plan stored in the bottom layer.

3 Results

The application was first tested in August 2012 with the inventory of Toila Oru grove park, which covers 105 hectares and contains over 6000 individual trees that were inventoried (NURME ET AL., 2012). The application worked well and no technical problems occurred. Half as much time was spent on data digitalizing, and data conversion into MapInfo went smoothly. Some problems arose when reading the data table, and therefore the format of the data needed alterations (abbreviations were needed, order of letters needed changing, etc.) Legends for abbreviations were created, which thanks to their universality can also be used in the future.

As expected, developing a technical solution (macro programming) for the application was cheaper in comparison to the cost of the previously mentioned programmes. This application fulfilled the developers' expectations, and with further development its economic efficiency can be maximized.

4 Conclusions

In conclusion, it can be said that the application developed in this study:

- is very easy to use;
- can be used on the basis of existing programmes;
- requires no special knowledge or additional tools
- requires no additional investments in training or software
- makes managing large amounts of data easier;
- saves time previously spent on digitalizing and analyzing data;
- makes for cleaner analysis of various types of data such as volume of tree-felling, species composition and landscape condition by systemizing different types of information (placing on different layers);
- allows for conversion of the spatial database into CAD and GIS system programmes;
- can be used to create a database that compiles information on all parks in Estonia for use in renewing national registers.

Goals for the future:

- making analysis and summarization processes more automated;
- automatically detecting possible errors made during the data entry process by setting size limits;
- calculating total amount of maintenance work, for example, tree-felling;
- automatically converting chosen codes and abbreviations into text and vice versa;
- converting data for different geodetic systems (WGS->L-EST);
- possibly adding a date to the fieldwork data to make it ready for database storage.

In the future, the dendrological data could be recorded during the geodetical survey of the area. This adds to the costs of the survey, for in addition to a geodesist, an arborist or landscape architect must be present to evaluate measures such as health, condition, species or damages, but would further improve efficiency in the compilation of park design plans.

The results – time expenditure in different work phases using different methods and additional characteristics of the methods – are summarised in the following figure.

Traditional method		New method		Possible future method	
Geodetical survey	1	Geodetical survey	1		
Dendrological fieldwork, two specialists using paper-table and paper-plan	2	Dendrological fieldwork, two specialists using tablet	2	Geodetical survey and dendrological fieldwork, two specialists using self-registering tacheometer	2
Spreadsheet data transfer to computer	1				
Map data transfer to computer	1	Map data transfer to computer	0,2	Map data transfer to computer	0,06
Total working days	5	Total working days	3,2	Total working days	2,06
Possibility to put data to different layers depending of condition-class of tree	No	Possibility to put data to different layers depending of condition-class of tree	Yes	Possibility to put data to different layers depending of condition-class of tree	Yes
Coordinates from digital map to MS Excel	Additional work	Coordinates from digital map to MS Excel	Automatic	Coordinates from digital map to MS Excel	Automatic
Names of species to the map	Additional work	Names of species to the map	Automatic	Names of species to the map	Automatic
Transfer of species' abbreviations to full names	Additional work	Transfer of species' abbreviations to full names	Automatic	Transfer of species' abbreviations to full names	Automatic

Fig. 3: An example of work process, a 3 hectares area with 400 trees. The numbers indicate the number of working days per person.

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6.4. Publication 4

Nutt, Nele; Hiob, Mart; Nurme, Sulev; Salmistu, Sirle; Kotval, Zenia. 2014. Restoring Manor Parks: Exploring and Specifying Original Design and Character Through the Study of Dendrologous Plants in Estonian Historic Manor Parks. Baltic Forestry. 19 (2). 280−288.

Restoring Manor Parks: Exploring and Specifying Original Design and Character through the Study of Dendrologous Plants in Estonian Historical Manor Parks

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Abstract

Manor parks are an integral part of the Estonian landscape, given that we have about 1000 manors with smaller and larger parks of which about 400 are under nature protection or declared as national heritage objects. Manor park restoration is an important national goal for the country. However, restoration techniques and expertise is not readily available. While there is great interest in cataloguing and inventorying the plant species in the Estonian Landscape, particularly in Manor Parks, knowing the types of different species is far from adequate to understand the original composition and design of the parks for true restoration. While historical documents, maps, writings, poetry and paintings give us useful background information regarding the overall scheme, such as spatial orientation and road patterns, little is understood about detailed plantings, tree species etc. Under specific circumstances the old trees in the park may yield valuable information for restoration decisions. The most important question in restoration is which woody plants and on what conditions are the part for the original design concept. That is the key question posed by the researchers of this paper. Due to the fact that the development of manors and manor parks in the Baltic countries is similar the topic is equally interesting for all Baltic States. Moreover, the addressed problems of restoration of parks are similar in every place with the lack of primary data.

The researchers contend that in addition to the inventories performed by many foresters and naturalists, it is equally relevant to know the actual count of each type of tree to begin composing the original landscape. Furthermore, one needs to understand that these parks have evolved over many years and the current structure might be very different than the original plan. To make it even more complicated, it is difficult to really say what era was „original" or what were the glory days of the Mansions. One of the ways to deal with this issue is to identify the really old trees from the new or subsequent growth, and focus attention on those. The authors have begun the tedious task of identifying, inventorying (types and number of species) and understanding this footprint in each of the 16 parks in 2003 - 2009.

This paper addresses the significance of focusing on the identification and composition of old trees and their influence/significance in understanding the original intent of the park design and the amount of original matter in today's historical parks, thereby aiding in better restoration efforts.

Key words: historical manor parks, examples of dendrologous species.

Introduction

Many Manor Parks in Estonia are preserved as sites of national heritage. It is deemed important to protect and preserve these parks, which involves restoration and replanting. However, due to the Estonia's complicated history (Sinijärv 2009), little is actually known about their original design or character. What is extensively documented is the types of different species that currently exist in the park. This is evidenced by a large number of inventories conducted by foresters through the ages. However, when restoring a park, one needs more than an inventory of existing woody plant species. In addition, characteristic of the park and its changing role thought out history needs to be examined. One key aspect in renewing the park is the overall composition and regularity. Given that the only parts that have remained of the original design in historic parks are the old trees (Nurme 2009), the woody plants have an important role in the restoration decision making. If there are little primary sources the decisions about the original details of the design of the park can be made by studying the composition of the old trees.

The article presents data from detailed research on dendrologous plants in 16 Estonian historical manor parks. As opposed to existing inventories that catalogue the different types of tree specimens, this research takes into account the age of the trees to differentiate between original plantings and subsequent growth as well as the number of examples in each of the different species. Both these elements are important for describing manor parks in general and for making decisions about restoration concepts and practice. Because of the similar issues that Estonia has (Grazulis 2007) not only with Estonian manor parks but with parks throughout the Baltic countries and the former Soviet Union and elsewhere the documented historic data for restoration purposes has not survived or does not exist.

Historic Character of Parks

The majority of the nationally protected parks (nature conservation or national heritage) in Estonia are manor parks. Estonia with a total area of 45,227 sq. km has had about1100 manors (Rosenberg 1994). Many manors had grandiose parks of which about 800 have been preserved. The oldest manor gardens and modest parks were probably created already in the 17th century, which is supported by the engravings of Adam Olearius and Antonis Goeteeris (Maiste 2006) and few manor plans from Livonia (nowadays Latvian territory) dating back to the end of 17th century (Janelis 2010). Generally there are no documents preserved and gardens and parks that were created back then have disappeared in the rebuilding processes. Most of the manor parks that have remained were founded in the 18th-19th centuries and are thus the oldest parks in Estonia.

According to the data of the Ministry of the Environment [EELIS] (www.eelis.ee) there are ca. 450 manor parks out of the total number of 548 parks and arboretums under nature protection. Approximately 2/3 of the manor parks under nature protection (ca. 270) are also on the list of monuments of national heritage[1]. In other words, the majority of Estonian parks under nature protection are historical and more than 150 years old. As previously mentioned the preserved historical manor parks in Estonia date back to the 18th century and as such, the question about their future becomes increasingly relevant. If we let the parks stay as they are, then they are likely to deteriorate and leave a vanishing footprint within this century. If the trees die, then the manor building complexes will be left to ruin as the lifetime of the buildings is a lot longer than the lifetime of the trees. Furthermore, given the Estonian climate conditions, most of the old plantings have reached or exceeded their life expectancy (for example *Tilia cordata*, which is a common park tree in Estonia has a life expectancy of 300 to 400 years in normal conditions) (Laas 1987). Thus, more and more of these trees will continue to vanish as age, illness and climate change catch up with them. The building complexes need, as they have done for centuries, suitable surroundings and beautiful parks. One of the critical issues connected with the age of the parks is that there is a need for historic preservation and renewal in order to preserve the character of the manor houses and parks for the future. This poses a serious concern as the parks have evolved over time and the notion of what is considered “original” is hard to define. Two of the major causes for changing appearance of the old parks are that many of the parks were left without continuous maintenance (Nurme 2008) and second, after the end of the manor era, there have been new and perhaps unsuitable plantings in the parks (Sander and Merikar 2004). This tendency is common for shrubs, fruit trees and certain coniferous trees (*Pinus mugo*, *Picea pungens* etc.) which were often planted in parks during Soviet times. The result is that the species growing in the parks nowadays can be quite different from the ones originally planted. If our aim is to restore these parks, according to the values and principles recognized and appreciated in Europe and preserve our cultural heritage, then studies and research about authentic or original species in different historical parks is certainly needed. Research method that results in allowing us to make scientifically based decisions on types and numbers needed replacement plantings when restoring the parks becomes an important step toward reaching this goal.

A Focus on Dendrologous Plants

Manor parks are of interest for different reasons – from an environmental aspect, there is a unique semi-natural habitat where the old trees play a central role. Dendrologous plants, mainly woody trees, make up the structural elements of many of these manor parks. The interest towards dendrologous plants has been constant in Estonia which is proved by frequent dendrological inventories which give a good overview of dendrologous species and their condition (Sinijärv 2009). The acclimatisation of foreign species, the dendrological diversity and ancient trees with extraordinary size have been of great interest (Nutt 2008). Generally, the inventories did not pay much attention to the connection between woody plants and park composition, and authentic species from the period of original park construction and the proportion of different species. The most extensive of inventories were carried out by Paivel from 1954 -61, Aaspõllu in 1970-80s of parks under nature protection (Aaspõllu 1977, 1978, 1980, 1981, 1982, 1984, 1986), Elliku and Sander

[1] National Registry of Cultural Monuments, 2012.

in 1984-95 in the counties of Virumaa and Pärnu (Elliku and Sander 1996, Sander 1996), Tallinn Botanical Garden in different periods of Kadrioru park, and the Ü/K 'Metsaprojekt' Eesti Metsakorralduskeskus (Estonian Forest Management Centre) in 1970-80s of different parks (Palm 2009). A number of research projects dealing with plantings in Estonian manor parks have also been undertaken (Uustal 2003, Palm 2009). However, in all the existing surveys, which present an accurate list of species primarily used in manor parks, they do not address the major elements of park design and construction. While much interest in the types of plants in the parks were expressed by forest researchers and ecologists during the Soviet occupation, many of their surveys lists the different species growing in the parks but present no data about the number of existing specimens or a comparison to the original park composition (Nutt 2008). Therefore these surveys cannot be used as a basis for decision-making in the restoration works. The previous inventories do not give the correct idea of the age structure of the park trees because the age of the trees was usually determined only for the largest examples. There are also problematic issues with shrub inventories because shrubs have short life expectancy and therefore no original shrubs are preserved. Usually in old parks few shrub species, mostly *Sorbaria sorbifolia*, *Spiraea chamaderyfolia*, *Syringa josikaea* and *Symhoricarpus albus,* due to vegetative renewing, have become large shrub massives that have shifted from their original planting area as a result of the lack of maintenance. Therefore, their initial location in the original design is nearly impossible to determine. Abovementioned reasons imply that prevous inventories cannot be used in restoration and studying the historic parks because the interpretation does not give us the correct concept of initially used species and therefore does not give us the correct original park design.

As a consequence, the original composition and authentic species of historical parks are not clarified and the composition of parks may be misunderstood. In this article the researchers focus on the possible original species that were planted taking into account the inventory data and the age structure of the trees. They are concentrating on tree species, leaving out shrubs due to previously mentioned reasons. The aim of the current research was to clarify the proportion of examples of distinct tree species in manor parks today and to determine the main tree species originally used in manor parks. Also one important research element was the determination of the approximate tree age to understand whether the tree was part of the original composition of the park.

Defining Elements in Park Restoration

The joint International Committee for Historic Gardens set up by International Council on Monuments and Sites [ICOMOS] and the International Federation of Landscape Architects [IFLA], inacted the Florence Charter from 1982 at their meeting in Florence on 21 May 1981. The 'Florence Charter' was drafted by the Committee and registered by ICOMOS on 15 December 1982 as an addendum to the Venice Charter covering the specific field concerned. Article no. 15 of the Florence Charter (Florence Charter 1982) states that no restoration work and, above all, no reconstruction work on a historic garden shall be undertaken without thorough prior research to ensure that such work is scientifically executed and which will involve everything from excavation to the assembling of records relating to the garden in question and to similar gardens. Before any practical work starts, a project must be prepared on the basis of said research and must be submitted to a group of experts for joint examination and approval.

Due to the lack of original detailed project designs and plantation schemes, one of the tasks for this group of researchers was to try to understand the original planting design structure through large-scale maps (1:4,200) from 19th century. The number of 'old' trees (planted prior to 1919), as measured by the size of the trunk and getting information on the composition of different trees within the parks became necessary to clarify the composition of park space, identify the details of original design and give suggestions for restoration according to the original ideas.

Methods

The aim of the current research was accomplished in three distinct steps. First, using the same methodological approach (Nurme 2008) an inventory of all existing species and their counts was created for each park. This included both Estonian and Latin names, diameter of tree at breast height and type (coniferous or deciduous). The input data was received from the detailed inventories in 2003-2009 of 16 manor parks under nature protection done by specialists of Artes Terrae Ltd (Table 1). The number of selected parks is about 3,5% of all protected manor parks in Estonia. The selected parks are located in different areas of Estonia and they were built or rebuilt around second half of 18th century to first half of 19th century. Therefore, the selection is balanced and representative and the obtained results can be extended to other manor parks of Estonia and North-Latvia (historic Livonia).

The criteria for the selection of inventories included in the research were as follows:

Table 1. Overview of the inventories used in the research. Inventories are available in the archives of Artes Terrae Ltd.

Name of the park	Year of the inventory	The name of the work
Hummuli manor park	2008	Hummuli mõisapargi heakorrastusprojekt (Reconstruction project of Hummuli manor park)
Härgla manor park	2007	Härgla mõisapargi dendroloogiline inventeerimine (Dendrological inventory of Härgla manor park)
Kiidjärve manor park	2009	Kiidjärve pargi rekonstrueerimisprojekt (Reconstruction project of Kiidjärve manor park)
Kuremaa manor park	2006	Kuremaa mõisapargi heakorrastuse põhiprojekt (Reconstruction project of Kuremaa manor park)
Lõhavere manor park	2009	Lõhavere hooldushaigla pargi puude dendroloogiline inventuur (Dendrological inventory of Lõhavere Hospital park[1])
Mäetaguse manor park	2004	Mäetaguse mõisapargi heakorrastuse põhiprojekt (Reconstruction project of Mäetaguse manor park)
Pagari manor park	2007	Pagari mõisa pargi heakorrastuse põhiprojekt (Reconstruction project of Pagari manor park)
Puurmani manor park	2005	Puurmani pargi rekonstrueerimise project (Reconstruction project of Puurmani manor park)
Püssi manor park	2009	Püssi mõisa pargi heakorrastuse põhiprojekt (Reconstruction project of Püssi manor park)
Riidaja manor park	2006	Riidaja mõisapargi rekonstrueerimise I etapp (Reconstruction project of Riidaja manor park, I phase)
Rõngu manor park	2008	Rõngu lossimäe pargi puistu hindamine ja hooldussoovitused (Dendrological assessment of Rõngu castle hill park and recommendation for management)
Saka manor park	2008	Saka mõisapargi heakorrastuse põhiprojekt (Reconstruction project of Saka manor park)
Saku manor park	2007	Saku mõisapargi heakorrastuse põhiprojekt (Reconstruction project of Saku manor park)
Sürgavere manor park	2008	Sürgavere mõisapargi heakorrastuse põhiprojekt (Reconstruction project of Sürgavere manor park)
Õisu manor park	2008	Õisu mõisapargi heakorrastuse põhiprojekt (Reconstruction project of Õisu manor park)
Rogosi manor park	2003	Rogosi pargi puistu dendroloogiline inventeerimine ja hindamine (Dendrological inventory and assessment of Rogosi manor park)

[1] Initially Lõhavere manor park

- the inventory was carried out less than ten years ago,
- the inventory dealt with individual trees, not groups of trees,
- the inventory specified the species and the diameter at breast height or the perimeter at breast height of trees,
- the inventory was carried out using similar methodology (Nutt 2008),
- the park was in the countryside,
- the park was historical manor park,
- the park was founded in English style or redesigned to English style in the 19th century.

The second element of the research concentrated on the investigation of the proportion of different species in every park. The proportion of species gives the park its distinctive character.

For example, the dark trunks of oaks with masculine branch patterns, exhibit a strong and powerful character while the white trunks of birch and long hanging branches provide an airy impression. Similarly, old tree plantings that show design details such as regular composition (alleys, tree lines, solitaires etc.), as well as free composition (tree clumps, round plantings, groups etc.). As previously mentioned one of the aims of the research was to determine the ten relatively most widespread deciduous tree species. This was necessary for deciding whether it is possible to draw general conclusions which may be useful when preparing restoration design projects.

The third research element was to determination of approximate age of tree to understand whether the tree was a part of the original composition of the park. Determining the age without knowing the date of planting proposes a number of difficulties. The most accurate way would be to use Pressler's increment borer and count the growth rings but due to the decay of tree core, the results are often incomplete when applied to old trees. Second possibility is to apply the yield tables used in forestry (Krigul 1974). Here we have to be aware of the different growing conditions for trees in forests and in parks. Generally the park trees grow less in length and become thicker since they are not surrounded tightly by other trees. Parks also have usually good growing conditions in general. Furthermore, Estonian growth tables exist only for widespread forest species and just a few foreign species, e.g. European larch (*Larix decidua*) and Siberian larch (*Larix sibirica*). Given these restrictions, it was decided not to try to determine the age of the trees but rather find out whether the tree was at least one hundred years old using the diameter of the trunk. In other words, whether the researched tree belonged to the period of the construction of park. The limits of the yield tables for 1 and 1a quality class growing conditions for maximum age (100…140 years) are as follows (Kiviste 1997):

1. Scots Pine (*Pinus sylvestris*) D > 47 cm,
2. Norway Spruce (*Picea abies*) D > 42 cm,
3. Silver Birch (*Betula pendula*) D > 41 cm,
4. Common Aspen (*Populus tremula*) D > 34 cm,
5. Common Alder (*Alnus glutinosa*) D > 35 cm,
6. European Larch (*Larix decidua*) D > 38 cm,
7. Siberian Larch (*Larix sibirica*) D > 41 cm,
8. Common Ash (*Fraxinus excelsior*) D > 40 cm,
9. English Oak (*Quercus robur*) D > 51 cm (140 y) / 60 cm (180 y).

To include all possible indigenous species in the selection, the smallest diameters were chosen for each group of trees. In order to take into account the better growing conditions in parks, the limit for hardwood species (e.g. ash, oak, elm etc.) was set on 51 cm, for soft deciduous species (e.g. birch, aspen etc.) on 35 cm and for coniferous species on 42 cm (e.g. spruce, larch etc.). While these approximations do not provide accurate results, they offer a good start for the current research.

In different works some of the evaluation results had minor differences which is why the data was adjusted in order to analyse work in hand (for example the perimeters were calculated into diameters, woody plants that were counted as groups in some works were left out of the list etc.) Additional observations were carried out when necessary. Basic statistical methods (summarising, giving proportions and comparing different parks) were used to analyse data.

Results and Discussion

Our results showed approximately 37 different species in 16 inventoried parks. The number of species in each park ranged from 17 in Riidaja manor park to 74 in Saku manor park. There were on average 26 tree species and 11 shrub species. Detailed breakdown and count can be seen in Table 2.

Table 2. Overview of the research results.

Item	Sum	Percentage
Average number of species	**37**	**100.0**
Average number of tree species	**26**	**70.4**
Number of deciduous species	18	69.3
Number of coniferous species	8	30.7
Average number of shrub species	**11**	**29.6**
Total number of examples	**12,019**	**100.0**
Total number of examples of trees	**11,613**	**96.6**
Number of deciduous trees	10,076	86.8
Number of coniferous trees	1,537	13.2
Total number of examples of shrubs	**406**	**3.4**

The large difference in type and count of species is evident when we compare trees and shrubs. Altogether, there were on average variety of 70.4% tree species and 29.6% shrub species actual counts showed a predominance of trees (96.6%) rather than shrubs (3.4%). The similar conclusion may be drawn from the comparison of deciduous and coniferous trees. While the variety of deciduous trees makes up 69.3% and coniferous tree species 30.7%, deciduous trees far outnumbered (86.8%) their coniferous counterparts 13.2%. This fundamental difference between variety of species and counts in each category illustrates the problems of looking at just one aspect of an inventory. The proportion of species compared to the proportion of exemplars for shrubs and trees are illustrated in Figures 1 and 2.

These proportions are in coherence with the tendencies of 19th century which had interest of introduction of new species (Hein 2004) and were characteristic to 19th century park architecture practice. Original park design consisted primarily of leafy trees, accented by groups of shrubs and coniferous trees which were mainly imported as exotic species (Sander, Meikar 2004). This explains the remarkable minority of coniferous trees. The smaller proportion of shrubs can be explained by their short life expectancy (Laas 1987) compared to trees, which is why most of the shrubs that were planted as late as the end of 19th century have disappeared or as for few species what is remained is the vegetative renewal that has run wild.

The results of the research show that a limited number of species represents the majority of examples. Norway Maple (*Acer platanoides*) had the highest proportion of examples in the parks (on average 22.9% of trees and shrubs). This fact is explainable by the high level of natural renewal of maple. The next most widespread species were Small-leaved Lime (*Tilia cordata*, 14.7%), Common Ash (*Fraxinus excelsior*, 13.7%),

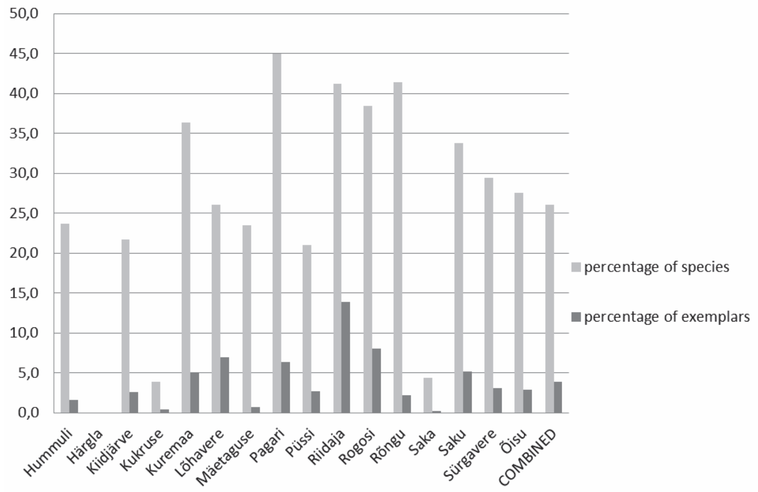

Figure 1. Proportion of species compared to the proportion of exemplars: shrubs. The large difference in number of species and proportion of species is uncovered. This reveals that the shrubs are not as widespread in the parks as the number of registered species would suggest because the number of exemplars of each species is small

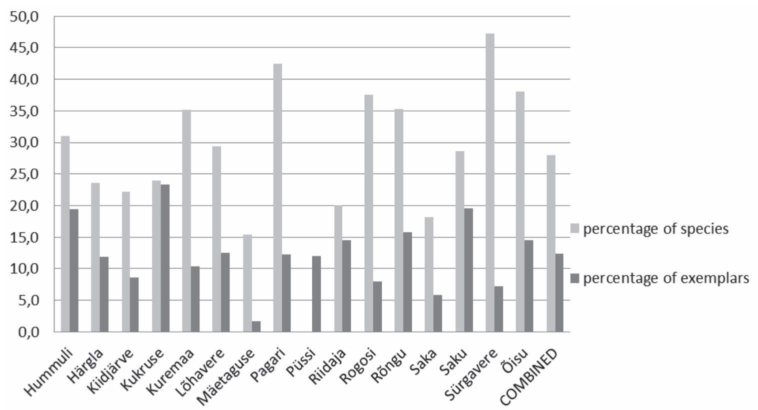

Figure 2. Proportion of species compared to the proportion of exemplars: coniferous trees. The large difference in the number of species and the number of exemplars reveals that parks have remarkably less coniferous trees than the number of species would suggest. The parks are generally dominated by deciduous trees even though the number of species is might be close to coniferous trees

English Oak (*Quercus robur*, 13.6%) and Scots Elm (*Ulmus glabra,* 11.4%). The rest of the species were represented with much fewer examples such as Norway Spruce (*Picea abies*, 3.3%), different larch species (*Larix* sp., 2.8%), Silver Birch (*Betula pendula,* 2.1%), Bird Cherry (*Prunus padus,* 1.7%), different firs (*Abies* sp., 1.6%) and Horse-chestnut (*Aesculus hippocastanum*, 0.9%). Similarly, the results show that the largest proportion of trees and shrubs is composed of indigenous trees – English Oak (*Quercus robur*), Small-leaved Lime (*Tilia cordata*), Norway Maple (*Acer platanoides*), Common Ash (*Fraxinus excelsior*), Scots Elm (*Ulmus glabra*), Silver Birch (*Betula pendula*), Common Aspen (*Populus tremula*), Bird Cherry (*Prunus padus*), Norway Spruce (*Picea abies*) and Scots Pine (*Pinus sylvestris*) (Kull 2009).

The larger proportion of indigenous species is expected because they are more adapted to the local natural conditions and more capable of natural renewal (including vegetative renewal by offshoot of the stump or the root). This tendency is vividly illustrated by Kukrus manor park created by Robert von Toll in 1866-75 which had the most diverse range of species in Estonia during that time (Sander and Läänelaid 2007) and today has only 11 woody plant species making it one of the poorest parks of species in North-Estonia (Abner, Konsa, Lootus and Sinijärv 2007). The main reason for that besides the decrease of park area in 20th century is the perishing of alien species.

When we compare different parks, the specific characteristics of each parks is revealed. For instance, in Kiidjärve and Rõngu manor parks trees have the greatest proposer Small-leaved Lime (47.9% and 33.9% respectively), but in Härgla, Sürgavere and Rogosi manor parks Norway Maple (32.8%, 33.9% and 36.5% respectively) dominates. In Mäetaguse manor park Scots Elm is the most widespread species (30.6%) and in Riidaja manor park Common Ash (34.2%). The conclusion is that the main tree species vary greatly from park to park. As an example the incidence of Small-leaved Lime and English Oak are shown in Figure 3. We may conclude that the number of examples of different species vary in different parks which is why we cannot say that in 19th century Estonian parks were dominated by certain specific species.

Finally, the proportion of old, authentic trees was analysed. The results show that the proportion varied greatly from park to park as well. Roughly half of the trees growing in manor parks today are from the period of the original plantation. It must be noted that younger specimens that have grown in the initial planting area from offshoot of the stump or the root have not been taken into account here. Also shrubs for previously mentioned reasons have not been taken into account. As an example, the situation in Hummuli manor park is presented in Figure 4. The examples of English Oaks and Scots Elms were mostly old trees and Norway Maples, limes and firs were mostly young trees. These results suggest that due to lack of consistent maintenance the vast majority of the younger trees consist of self-initiated, relatively fast-growing regeneration typical to the species just mentioned. As these species are naturally widespread in Estonia we cannot unequivocally say that older trees growing in the park are the only source for young trees.

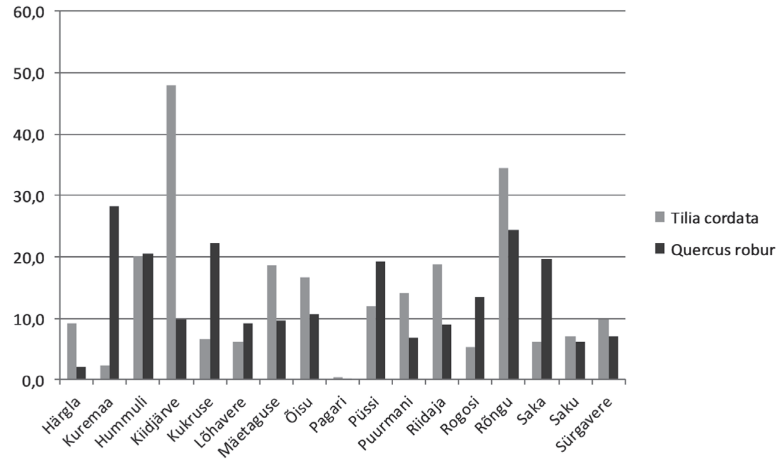

Figure 3. The proportion of exemplars of Small-leaved Lime (*Tilia cordata*) and English Oak (*Quercus robur*) in analysed parks

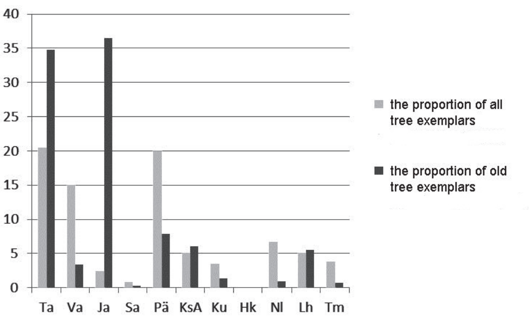

Figure 4. The proportion ten species of all tree exemplars (light) and old tree exemplars (dark) in Hummuli manor park. The abbreviations stand for Ta: English Oak *(Quercus robur),* Va: Norway Maple (*Acer platanoides*), Ja: Scots Elm (*Ulmus glabra*), Sa: Common Ash (*Fraxinus excelsior*), Pä: lime species (*Tilia* sp.), KsA: Silver Birch (*Betula pendula*), Ku: Norway Spruce (*Picea abies*), Hk: Horse-chestnut (*Aesculus hippocastanum*), Nl: fir species (*abies sp.*), Lh: larch species (*Larix* sp.), Tm: Bird Cherry (*Prunus padus*)

However, the current composition of the stand of each park has its own mechanism of formation. Broadly speaking, the great fluctuation of the proportion of authentic trees may be due to several factors such as the natural aging and diseases of trees, habitat changes resulting loss, replacement plantings specificity, proliferation of natural regeneration etc.

Conclusions

The manor parks in Estonia are of unique character –the historical circumstances that enabled the creation of large number of well-developed parks in the countryside were in the centuries before WWI present only in Estonia and Latvia. As far as the authors know no similar research on the proportion of species used in the original plantings has been carried out. Therefore, unfortunately it is not possible to make any direct comparison with similar work.

The results show that how helpful identification of old trees is to the analysis of the spatial structure of the park. However, it also highlights the difficulties related with documenting species of trees and shrubs in manor parks today. Existing plantings do not give us an accurate impression of the original composition of parks because on average only half of the current trees are original and due to the lack of original plantation plans and pictures it is difficult to determine the original number of species and examples. Despite these difficulties, it is critical to investigate the composition of the park's old trees (to the extent possible) as well as to use all written historical material to detect the original plan of design for restoration purposes.

It is necessary to continue researching in this direction, specifying the primary data, comparing the original historic planting schemes in detail, taking into account the possible vegetative renewal of species in their initial planting location, determining the exact age of the trees using the alternative methods previously mentioned in this article etc. Comparison to other countries, first and foremost the Baltic States with similar historic background is also useful.

Today, we do not have appropriate information about the original species and the number of examples planted. This lack of knowledge complicates the optimal restoration practice as appropriate species for planting are not specified. Analysis of the old tree species and their locations in the park in connection with historical maps and documents is a time sensitive task that is necessary.

In conclusion, we reiterate that there has been much research about dendrology in Estonian parks, but parks have seldom been considered as works of art. Most of the studies are conducted by scientists who have studied manor park issues about the introduction of alien tree species, biological diversity, exotic species, old (ancient) trees and exceptionally large exemplars. But when restoring a park one needs to consider it as a system and therefore all trees must be considered in the analysing process. In addition, characteristic of the park and its changing role thought out history needs to be examined. When renewing the park the key element is to study overall regularity and composition of plantings. While this is probably not enough to create authentic restoration plans, it is a step closer to understanding the original intent of the design. Results from this pilot project shows the importance of documenting both age and composition of the plantings can make a big difference. Needless to say, this primary research on existing plants, needs to be coupled with historic research through paintings, writings and other references would help us to restore the parks in an authentic manner.

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Received 26 November 2012
Accepted 28 November 2013

ВОССТАНОВЛЕНИЕ УСАДЕБНЫХ ПАРКОВ: ИЗУЧЕНИЕ И УТОЧНЕНИЕ ОРИГИНАЛЬНОГО ДИЗАЙНА И ХАРАКТЕРА НА ОСНОВАНИИ ИССЛЕДОВАНИЯ ДРЕВЕСНЫХ РАСТЕНИЙ В ИСТОРИЧЕСКИХ УСАДЕБНЫХ ПАРКАХ ЭСТОНИИ

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Резюме

Усадебные парки являются неотъемлемой частью эстонской ландшафта, учитывая, что у нас есть около 1000 поместий с меньшими и большими парками, из которых около 400 находятся под защитой природы или признаны объектами национального наследия. Восстановление усадебных парков является важной национальной задачей для страны. Однако методы восстановления и экпертные знания не являются легко доступными. Хотя существует живой интерес к каталогизации и инвентаризации видов растений в пейзаже Эстонии, особенно в усадебных парках, знание типов различных видов является далеко не достаточным, чтобы понять оригинальные композиции и дизайн парков для их истинной реставрации. Хотя исторические документы, карты, письменные источники, стихи и картины дают нам полезную справочную информацию относительно общей схемы парков, таких как пространственная ориентация и дорожные модели, мало известно о подробных насаждениях, видах деревьев и т.д. При определенных обстоятельствах старые деревья в парке могут дать ценную информацию для принятия решений по восстановлению. Наиболее важным вопросом в реставрации является какие древесные растения и на каких условиях являются частью первоначальной концепции дизайна. Это ключевой вопрос, поставленный исследователями в этой работе. В связи с тем, что развитие поместьев и усадебных парков в странах Балтии схоже, эта тема одинаково интересна для всех балтийских стран. Более того, рассматриваемые проблемы восстановления парков похожи повсеместно за отсутствием первичных данных.

Исследователи утверждают, что в дополнение к инвентурам, выполненым многими лесоводами и натуралистами, имеет столь же важное значение определить фактическое количество каждого типа дерева, чтобы начать составление первоначального ландшафта. Кроме того необходимо понять, что эти парки развивались на протяжении многих лет, и нынешняя структура может весьма отличаться от первоначального плана. Задание усложняется тем, что трудно сказать, какая эра была «оригиналом» и какими были дни славы особняков. Один из способов решения этой проблемы является выявление действительно старых деревьев в отличие от новых и последующего роста и сосредоточение внимания на них. Авторы начали кропотливую работу по выявлению, инвентаризации (типы и количество видов) и понимания этого узора в каждом из 16 парков в 2003-2009.

В настоящем документе рассматривается значимость сосредоточения на идентификации и составе старых деревьев и их влияние / значение в понимании первоначальной цели дизайна парка и доли исходного вещества в исторических парках сегодня, тем самым помогая улучшить усилия по восстановлению.

Ключевые слова: исторические усадебные парки, экземпляры древесных видов.

6.5. Publication 5

Nutt, Nele. 2013. Mõisaparkide dendroloogiline autentsus [The Dendrological Authenticity of Manorial Parks.] Acta Architecturae Naturalis. 3. 93−103. (In Estonian).

Eesti mõisaparkide dendroloogiline autentsus

Nele Nutt

Sissejuhatus

Keskkonnaministeeriumi andmetel on Eestis 540 looduskaitsealust parki, puistut ja arboreetumi[1], millest ligikaudu 450 ehk rohkem kui kaks kolmandikku on mõisapargid.[2] Mõisaparkidest rohkem kui pooled (*ca* 270) on ühtlasi ka arhitektuurimälestised.[3] Valdav osa Eesti parkidest on seega ajaloolised pargid, millel vanust juba 150 aastat ning mille puhul tõusevad aina teravamalt päevakorrale restaureerimisega seotud küsimused. Üks neist on Firenze harta artiklist 12 tulenev nõue arvestada korrapäraselt asendatavate puu- ja põõsaliikide ning mitme- ja üheaastaste taimede valikul igas botaanilises ja aianduskultuurilises piirkonnas välja kujunenud tavasid, et määrata kindlaks algsed liigid ning neid säilitada.

Parkide ja nende dendrofloora vastu on Eestis huvi tuntud pikka aega, mida näitab tehtud dendroinventuuride suur arv. Kuid jätkuvalt puudub ülevaade puistu liigilisest osakaalust, millele saaksid restaureerimisprojektide koostajad liikide valikul toetuda.

Käesolevas artiklis tutvustatakse Tallinna Tehnikaülikooli maastikuarhitektuuri õppetoolis 2009. aastal käivitatud projekti, mille raames on tegeldud ajalooliste pargipuistute liigilise koosseisu uurimisega.

Teema aktuaalsus

Kuigi mõisad ja nende juurde kuuluvad pargid on pärandina uurijatele[4] ja restaureerijatele huvi pakkunud juba alates 1970. aastatest, mil viidi läbi

1 Eesti Looduse Infosüsteem. [WWW] www.eelis.ee (31.12.2012 andmetel on parkide ja puistute arv 540).

2 Eesti Looduse Infosüsteem. [WWW] www.eelis.ee (05.08.2013)

3 Muinsuskaitseameti koduleht. [WWW] www.muinas.ee (05.08.2013)

4 Piirkonniti on puittaimestiku uuringuid tehtud ka varasemal ajal (Viirok, Rühl jt).

suuremahuline mõisate inventeerimine[5], on teemasid, mis tänaseni käsitlemata. Üks neist on parkides kasvavate puittaimede liigiline osakaal.

Paljud mõisapargid, mille rajamisaeg jääb enam kui 150 aasta taha, on pikka aega olnud hooldamata. Pargipingid, paviljonid ja lillepeenrad on hävinud, kuid suhteliselt elujõuline puistu annab hea ettekujutuse parkide planeeringust ja ajaloolisest üldilmest. Lisaks sellele on allesolev puistu tänuväärne uurimismaterjal parkide algse liigilise koosseisu teadasaamiseks. Parkide vanuse suurenedes muutub puistu uuendamisega seotud teemadering aina aktuaalsemaks ning vajadus liigilise osakaalu andmete järele kasvab.

Eespool öeldust tulenevalt on TTÜ uurimisrühm viimastel aastatel Firenze harta 12. artiklis äratoodud põhimõtte fookusesse asetanud ning tegelnud puistu liigilise osakaalu uurimisega, mille tulemustele tuginedes oleks võimalik säilitada ajaloolisele pargile omast algilmet, kasutades restaureerimisel autentseid liike kui ka säilitades nende algse vahekorra.

Ülevaade tehtud uuringutest

Parkide dendrofloora vastu tundsid Nõukogude ajal suurt huvi metsandusteadlased ja looduskaitsjad. Uuringute tulemusena on koostatud parkides kasvavate puu- ja põõsaliikide üldnimekirju. Ulatuslik inventuur tehti dendroloog Aino Aaspõllu juhtimisel 1970. aastate lõpus – 1980ndate alguses. Pargipuistuid on inventeerinud ka Aleksei Paivel (1954–1960), Jüri Elliku ja Urmas Roht (1983–1989) ning Jüri Elliku ja Heldur Sander (1984, 1991–1995). Piret Palm on oma 2009. aastal kaitstud magistritöös[6] andnud põhjaliku ülevaate parkide liigilisest mitmekesisusest, tuginedes eespool nimetatud uuringutele, ja Urve Sinijärv on 2012. aastal kaitstud doktoritöös[7] põhitähelepanu pööranud liigilise mitmekesisuse suurendamisele hoolduse abil. Peale selle on tehtud suurel hulgal üksikute parkide inventuure.

Mitme eespool nimetatud töö tulemusena on valminud pargis kasvavate liikide koondnimekirjad, mis kajastavad parkide liigilist mitmekesisust inventuuri tegemise ajal. Kuigi tegu on äärmiselt vajaliku infoga, ei ole see piisav restaureerimisotsuste langetamiseks. Restaureerimisotsuste tegemisel

5 Üprus, H. (1978). Mõisaarhitektuuri uurimisest. – *Ehitus ja Arhitektuur*, 2.

6 Palm, P. (2009). Eesti looduskaitsealuste parkide puittaimestik 19.–21. sajandil: magistritöö. Eesti Maaülikool, Tartu.

7 Sinijärv, U. (2012). Kunst ja loodus pargis. Kujunduslike ja liigikaitseliste eesmärkide ühendamine parkide restaureerimisel ja hooldamisel Saare maakonna looduskaitsealuste parkide näitel: doktoritöö. Eesti Kunstiakadeemia, Tallinn.

tuleks lähtuda mitte inventeerimise ajal kasvavatest liikidest, vaid nn autentsetest liikidest ehk siis liikidest, mida on kasutatud pargi rajamisel. Lisaks tuleks arvestada ka rajamisaegse liikide vahekorraga, mis oli oluline pargi üldilme kujundaja.

Tallinna Tehnikaülikooli maastikuarhitektuuri õppetoolis on viimasel kümnendil üheks uurimisvaldkonnaks olnud mõisapargid[8] ja -maastikud.[9] TTÜs on kaitstud mitmeid magistritöid[10], mis käsitlevad ajalooliste mõisaparkide seotust ümbritseva maastikuga ja selles toimunud muutusi, aga ka tehnilisi aspekte, mis võimaldaksid lihtsustada uuritava valdkonna andmekogude kasutamist ning optimeerida aja- ja ressursimahukaid väli- ja arhiivitöid. Samuti on tegeldud parkide hoolduse teemaga.[11] Alates 2009. aastast on käesoleva artikli autori eestvedamisel Tallinna Tehnikaülikooli maastikuarhitektuuri õppetoolis uuritud ajalooliste parkide puistute liigilist koosseisu.

Uuringu eesmärk ja kirjeldus

Uuringu eesmärgiks oli koostada ülevaade ajalooliste mõisaparkide puistute liigilisest osakaalust, mis võimaldaks langetada puistu uuendamist puudutavaid otsuseid.

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8 Nurme, S., Nutt, N., Hiob, M., Hess, D. B. (2012). Talking ruins: The legacy of baroque garden design in manor parks of Estonia. – *Landscape Archaeology between Art and Science*: LAC 2010: First International Landscape Archaeology Conference, Amsterdam. Amsterdam University Press, lk 115–125.

9 Nurme, S., Nutt, N., Hiob, M. (2009). Baroque park in Estonia. – Landscape & Ruins planning and design for the regeneration of derelict places. 23rd-26th september 2009, Genova; Nurme, S., Kotval, Z., Nutt, N., Hiob, M., Salmistu, S. (2013). Baroque manorial cores and the landscape. *Journal of Cultural Heritage Management and Sustainable Development* (ilmumas).

10 Tarkin, E. (2011). Eesti regulaarne mõisaansambel maastikus. Uuring maastiku avatuse, mõisasüdame ulatuse ning teekoridoride muutustest: magistritöö. TTÜ Tartu Kolledž, Tartu; Mihkelson, H. (2010). Eesti 18.–19. sajandi regulaarpark. Pargi ja maastiku suhe: magistritöö. TTÜ Tartu Kolledž, Tartu; Heringas, D. (2009). Eesti 18.–19. sajandi regulaarpark. Pargiruumi säilivus: magistritöö. TTÜ Tartu Kolledž, Tartu; Vaine, J. (2009). Eesti 18.–19. sajandi regulaarpark. Pargiruumi kompositsioon: magistritöö. TTÜ Tartu Kolledž; Paalo, P. (2013). Reljeef Eesti regulaarsete mõisaparkide kujunduses 1750–1850: magistritöö. TTÜ Tartu Kolledž, Tartu; Saarepuu, T. (2011). Autentsed puuliigid Hummuli, Kiidjärve, Kuremaa, Räpina, Unipiha ja Õisu mõisa pargis: bakalaureuse töö. TTÜ Tartu Kolledž, Tartu; Ratas, L. (2011). Kukulinna mõisa pargi hoolduskava: bakalaureuse töö. TTÜ Tartu Kolledž.; Bassova, O. (2012). Väikeparkide hoolduskavad. Vara, Reola, Vesneri ja Kriimani parkide näitel: bakalaureuse töö. TTÜ Tartu Kolledž, Tartu.

11 Nutt, N. (2011). Pargi hoolduskava koostamise juhend. Tallinn: Keskkonnaamet.

Töö jaotati kahte etappi, millest esimeses võrreldi olemasolevate dendroloogiliste andmete põhjal pargi tervikpuistu ja puistu vanade puude liigilise osakaalu omavahelist erinevust ning teises hinnati dendroloogiliste inventuuride andmete sobivust parkide liigilise osakaalu uurimiseks. Alusandmetena kasutati maastikuarhitektuuri firma Artes Terrae OÜ poolt tehtud mõisaparkide dendroloogilise inventeerimise tulemusi.[12] Esimese etapi valimisse kuulus 16 väljapool linnu asuvat 19. sajandil vabakujulisena rajatud või vabakujuliseks ümber kujundatud ajaloolist mõisaparki, mille dendroloogiline inventuur oli tehtud vähem kui 10 aastat tagasi (ajavahemikus 2003–2009) ja ühtset meetodit rakendades.[13] Eesmärk oli saada vastus küsimusele, kui suur on erinevus tänase puistu ja vana, eeldatavalt rajamisaegse puistu liigilise osakaalu vahel. Seetõttu võeti esmalt vaatluse alla kõigi valimisse kuuluvate parkide puistute liigiline osakaal, seejärel võrreldi saadud tulemusi ainult vanade puude liigilise osakaaluga. Võrdluse jaoks eristati dendroloogilisel hindamisel mõõdetud tüve läbimõõdu põhjal vanemad puud. Vanemateks loeti kõvadel lehtpuudel 51, pehmetel lehtpuudel 35 ja okaspuudel 42 sentimeetrist suurema rinnasdiameetriga isendid.[14]

Tulemused

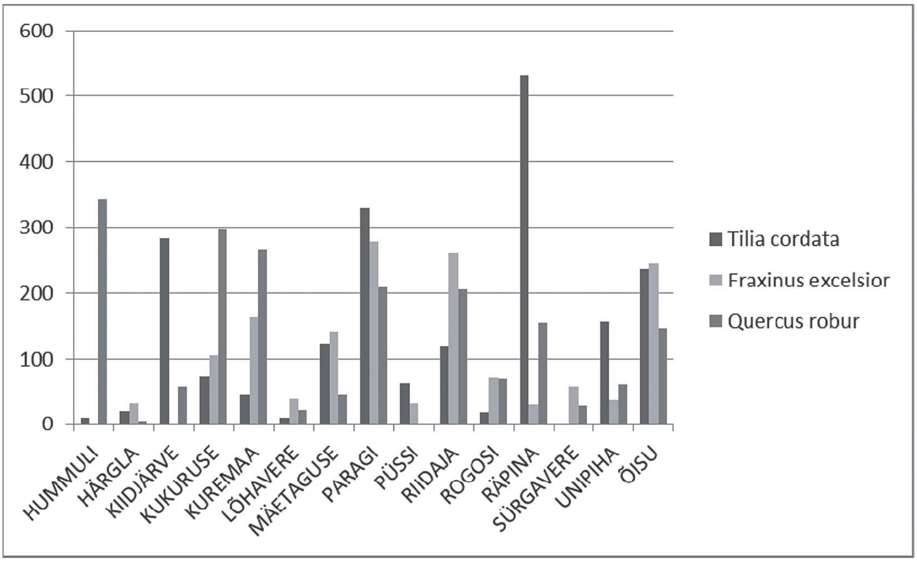
Kogu puistu liigilise osakaalu uuringu tulemusena selgus, et kõige enam (keskmiselt 22,9%) on uuritud parkides harilikku vahtrat (*Acer platanoides*). Vahtra suurearvuline esinemine on seletatav loodusliku uuenduse rohkusega. Veidi vähem on harilikku pärna (*Tilia cordata*) (keskmiselt 14,7%). Harilikku saart (*Fraxinus excelsior*) ja harilikku tamme (*Quercus robur*) esines peaaegu niisama palju, vastavalt 13,7% ja 13,6%. Rohkem esines ka harilikku jalakat (*Ulmus glabra*), keskmiselt 11,4%. Märgatavalt vähem oli aga harilikku kuuske (*Picea abies*; keskmiselt 3,3%), lehiseliike (*Larix sp.*; 2,8%), arukaske (*Betula pendula*; 2,1%), harilikku toomingat (*Prunus padus*; 1,7%), nululiike (*Abies sp.*;1,6%) ja harilikku hobukastanit (*Aesculus hippocastanum*; 0,9%). Võrdluse tulemusena selgus, et pärismaiste lehtpuude osakaal ajaloolistes parkides on suhteliselt suur ja okaspuude osakaal märgatavalt väiksem. Kui võrrelda omavahel uuritud

12 Artes Terrae OÜ. Mõisaparkide dendroloogilised inventeerimised aastatel 2003–2009.

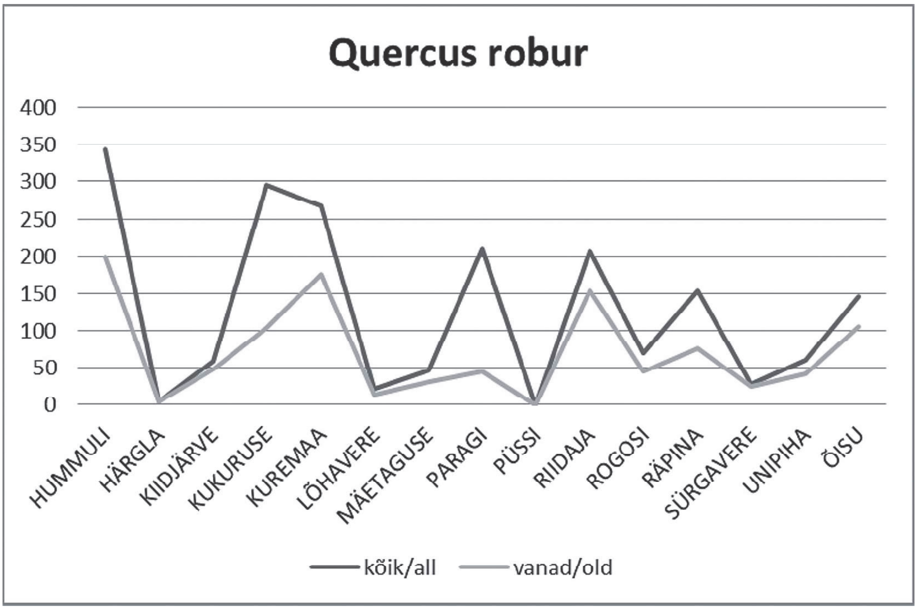
13 Nutt, N. (2008). Ajalooliste parkide kujundus nende hiilgeajal. – *Parkide restaureerimine*. Tallinn: Tallinna Tehnikaülikooli Tartu Kolledž, lk 292–302.

14 Nutt, N.; Nurme, S.; Hiob, M.; Salmistu, S.; Kotval, Z. 2013. Restoring manor parks: exploring and specifying original design and character through the study of dendrologous plants in Estonian historical manor park. – *Baltic Forestry*. Vol. 19 (2).

parkide puuliikide osakaalu, on näha olulisi erinevusi. Näiteks on vaadeldud parkidest hariliku pärna (*Tilia cordata*) osakaal puistus suur Kiidjärve ja Rõngu mõisa pargis, vastavalt 47,9% ja 33,9%. Hariliku vahtra (*Acer platanoides*) osakaal on suur aga Härgla (32,8%), Rogosi (33,9%) ja Sürgavere mõisa pargis (36,5%). Mäetagusel on kõige suurem hariliku jalaka (*Ulmus glabra*) (30,6%) ja Riidaja mõisa pargis hariliku saare (*Fraxinus excelsior*) osakaal (34,2%). Esitatust on näha, et kuigi parkide põhipuuliigi osakaal jääb üldiselt 1/3 lähedale, on liik ise pargiti erinev. Seda näitab ka tabel 1, kus on võrdlevalt esitatud kolme puuliigi osakaal parkides. Teises tabelis, tabelis 2, on esitatud näitena parkides kasvava hariliku tamme (*Quercus robur*) kõigi eksemplaride ja vanade eksemplaride arvu võrdlus.

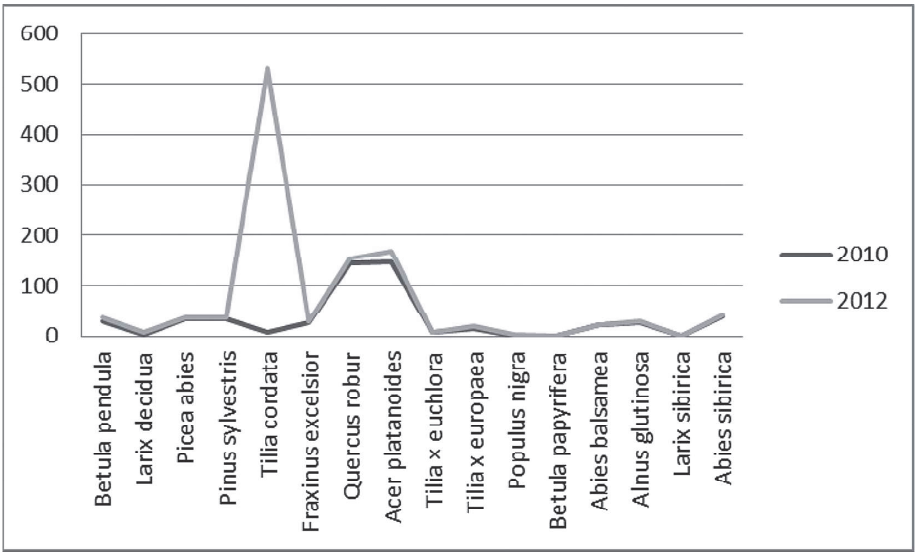


Tabel 1. Hariliku pärna (Tilia cordata), hariliku saare (Fraxinus excelsior) ja hariliku tamme (Quercus robur) isendite osakaal parkides./ The percentage of small-leaved lime (Tilia cordata), European ash (Fraxinus excelsior) and English oak (Quercus robur) trees in the parks.



*Tabel 2. Hariliku tamme (*Quercus robur*) kõigi isendite ja vanade isendite arvu võrdlus parkides. / The number of old English oaks (*Quercus robur*) compared to all English oaks in the parks.*

Lisaks selgus, et alusandmetena kasutatud dendroloogiliste inventeerimiste andmetel on kaks kitsaskohta. Kuigi dendroloogilise inventeerimise eesmärgiks on saada ülevaade pargi puistu üldisest seisukorrast üksikpuu tasandil, siis restaureerimisprojekti jaoks tehtud dendroloogilisel inventeerimisel ei ole alati vaja kogu parki üksikpuu tasandil inventeerida ning on tavapärane, et osa pargist, eelkõige sarnase üldilmega perifeersed osad, inventeeritakse eraldistena. See aspekt võib olla olulise tähtsusega kogu pargi puistu liigilise osakaalu hindamisel. Teise kitsaskohana ilmnes, et osa isenditest ei ole liigi täpsusega määratud. Näiteks lehiste puhul on tabelisse kantud *Larix sp*., mis tähendab seda, et täpne info lehiste liigilise osakaalu kohta inventeerimistulemustes puudub. Teises etapis võeti tähelepanu alla eraldistena inventeeritud pargiosad. Tehti 17 pargi lisainventeerimine, mille käigus inventeeriti sama metoodika alusel eraldised üksikpuu tasandil ning vajaduse korral täiendati puudulikke inventeerimisandmeid liikide täpse määramisega. Tulemuste võrdlemisel hinnati lisainventeerimise vajadust. Selgus, et suurte sama liiki puid sisaldavate eraldiste puhul on liigilise osakaalu erinevus märgatav, seda eriti nende liikide puhul, mille osakaal on pargis suur. Tabelis 3 on esitatud Räpina pargi puistu osakaalu andmed ilma eraldisteta ning koos eraldistega. Suur erinevus torkab silma hariliku pärna (*Tilia cordata*) puhul, mis on ka pargi põhipuuliik. Samuti on märgatav erinevus hariliku tamme (*Quercus robur*) puhul. Teiste liikide puhul on erinevus väiksem. Samas tuleb arvestada, et ainuüksi põhipuuliigi selgitamine ei ole liigilise osakaalu puhul määrav, vaid oma osa mängib ka selle protsentuaalne ülekaal, mistõttu annab eraldiste inventeerimine üksikpuu tasandil olulist lisainfot.



Tabel 3. Räpina pargi puistu liikide osakaal enne (2010) (ilma eraldisteta) ja koos lisainventeerimisega (2012) (koos eraldistega). Tabelis on ära toodud andmed ainult nende liikide kohta, mille puhul lisainventeerimine andis uut infot. / The percentage of various species in the stands of trees in Räpina Park previously (2010) (without allocations) and together with the additional inventory (2012) (with allocations). The table only includes data on those species for which the additional inventory provided new information.

Kokkuvõte ja diskussioon

Eesti ajalooliste parkide dendroloogilised inventuurid on käsitlenud parkide liigilist mitmekesisust. Parkide kaupa on koostatud põhjalikud nimekirjad pargis kasvavate puittaimeliikide kohta. Nende andmete põhjal saab hea ülevaate kõigist parkides kasvavatest liikidest. TTÜ maastikuarhitektuuri õppetooli projekti eesmärgiks oli liikide proportsionaalse esinemise uurimine. Nimelt ei anna liikide nimekiri, kus ei ole infot selle kohta, kui palju ühe või teise liigi isendeid pargis kasvab, tegelikult õiget ülevaadet pargipuistu üldilmest, mille määrab leht- ja okaspuu- ning põõsaliikide vahekord. Seetõttu jääb pargipuistust kui tervikust ekslik mulje.

Tänaste parkide puistu liigilise osakaalu andmete võrdlus ei anna tegelikku pilti ajaloolise pargi puistu koosseisust. Seetõttu on oluline, et analüüsitaks just vanade puude liigilist koosseisu ning alles nendele tulemustele tuginedes saab teha pädevaid restaureerimisotsuseid.

Senised tulemused viitavad sellele, et eri piirkondade parkide puuliikide valikut on mõjutanud nii kohalikud kasvutingimused kui ka kliima ja mullastik. Seetõttu on vajalikud suuremamahulised, Eesti kõiki piirkondi hõlmavad uuringud, mis võimaldaksid koostada restaureerimisprojektide jaoks tarvilikke liikide nimekirju. Seni aga tuleks enne restaureerimisprojekti koostamist teha liigilise osakaalu uuring, mille tulemusi saaks uusistutuste planeerimisel kasutada. Samas tuleb arvestada, et sajand tagasi sissetoodud liikidest on osa osutunud invasiivseks, kuid invasiivsuse probleemistiku uurimine[15] on alles algusjärgus. Nende teemade kompleksne uurimine võimaldaks välja töötada mitmeid aspekte arvestavaid lahendusi, mis aitaksid ajalooliste parkide hooldamist, taastamist ja säilitamist korraldada võimalikult autentselt. Samas saab tänapäevaseid tehnilisi võimalusi ära kasutades andmete kogumist ja läbitöötamist kiirendada, mis omakorda võimaldab saada kiiremaid tulemusi ning lahendada ajalooliste parkide probleeme enne, kui on hilja. Kindlasti ei saa käesoleva uuringu tulemusi kanda üle kõigile Eesti ajaloolistele parkidele, kuid nende tulemuste põhjal võib öelda, et liikide osakaalu uuringud annavad olulist infot restaureerimisel tehtavate otsuste langetamiseks. Puistu liigilise osakaalu uurimiseks saab kasutada dendroloogiliste inventuuride andmeid, kuid suuremate eraldiste puhul tuleb teha üksikpuu tasandil lisainventuur.

Uuringu tulemusi on tutvustatud rahvusvahelistel konverentsidel[16] ja rahvusvahelistes teadusajakirjades.[17] Uuringu teise etapi läbiviimist 2012. aastal toetas Keskkonnainvesteeringute Keskus.

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Kirjandus

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- **Mihkelson, H.** (2010). Eesti 18.–19. sajandi regulaarpark. Pargi ja maastiku suhe: magistritöö. TTÜ Tartu Kolledž, Tartu.
- **Nurme, S.; Nutt, N.; Hiob, M.** (2009). Baroque park in Estonia. – Landscape & Ruins planning and design for the regeneration of derelict places. 23rd-26th september 2009, Genova.
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- **Nutt, N.; Nurme, S.; Hiob, M.; Salmistu, S.; Kotval, Z.** (2013). Restoring manor parks: exploring and specifying original design and character through the study of dendrologous plants in Estonian historical manor park. – *Baltic Forestry*. Vol. 19 (2).
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- **Sinijärv, U.** (2012). Kunst ja loodus pargis. Kujunduslike ja liigikaitseliste eesmärkide ühendamine parkide restaureerimisel ja hooldamisel Saare maakonna looduskaitsealuste parkide näitel: doktoritöö. Eesti Kunstiakadeemia, Tallinn.
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Dendrological Authenticity of Estonian Manor Parks

Nele Nutt

According to the Ministry of the Environment, there are 540 parks, stands of trees and arboreta in Estonia that are under conservation, of which approximately 450, or more than two-thirds, are manor parks. More than half the manor parks (ca 270) are also architectural monuments. Therefore, most Estonian parks are historical parks, that are already 150 years old and regarding which issues related to restoration are increasingly topical. One of these issues is the requirement based on Article 12 of the Florence Charter – that the species of trees, shrubs, plants and flowers to be replaced periodically must be selected with regard for established and recognised practice in each botanical and horticultural region, and with the aim to determine the species initially grown and to preserve them.

The interest in parks and their dendrological flora has been apparent in Estonia for a long time. This is proven by the large number of dendrological inventories that have been compiled. However, a survey of the relative proportions of species in the arboreta is still not available, although this could be of help in drawing up the selection of species for restoration projects. This article introduces a project initiated in 2009 by the Department of Landscape Architecture at the Tallinn University of Technology, which deals with researching the species-based compositions of the stands of trees in historical parks.

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Võtmesõnad: dendroloogia, ajalooline mõisapark, puistu liigiline osakaal.
Keywords: historical manor parks, examples of dendrologous species.

Curriculum vitae

Name: **Nele Nutt**

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Education

2017	Tallinn University of Technology PhD external student
2004 - …	Estonian University of Life Sciences PhD student (Landscape Architecture)
2013 - …	Tartu University, MSc student (Sociology)
2001 - 2002	Estonian Academy of Arts, Tallinn Restoration School
2000 - 2004	Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences, Master of Science in Natural Sciences (Landscape Architecture)
1999 - 1999	Hämepolytechnic, Lepaa Institute of Holticulture (Landscape Architecture)
1996 - 2000	Estonian Agricultural University, Institute of Environmental Protection, BSc (Landscape Architecture)

Language competence/skills

English	Productive skills B2, receptive skills C1
Spanish	A2
Russian	B2

Special courses

2001	General course in restoration, Estonian Academy of Arts.
2007	HTHT.TK009 Tests and evaluation, University of Tartu.
2007	HTHT.TK.010 Didactics of University, University of Tartu.
2007	HTHT.TK.026 Problem-based Learning in Higher Education, University of Tartu.
2016	P2AV.TK.793 MOOC - Why, Whom and How?, University of Tartu.
2016	FLEE.02.132 Terminology, University of Tartu.
2016	MTAT.TK.006 About Programming, University of Tartu.

Professional employment

2017 - …	Tallinn University of Technology, School of Engineering: Tartu College of TTÜ, Lecturer.
2005–2016	Tallinn University of Technology, Tartu College of TTÜ, Lecturer.
2005–2016	Tallinn University of Technology , Tartu College of TTÜ, Other staff.
2003–2015	Artes Terrae LLC; Landscape Architect.
2000–2003	Environmental Protection Institute; Landscape Architect.

R&D related managerial and administrative work

2016 - …	Estonian Landscape Architects' Union, member of managing committee
2016 - …	Head of the working group for the Professional Standard of Landscape Architect
2016 - …	Tallinn University of Technology member of the curruiculum Board
2004 - …	Estonian Landscape Architects' Union, active member
2012 - 2014	Landscape architecture, member of the Commission
2010 - 2012	Member of the working group for the Professional Standard of Landscape Architect
2010 - 2012	Member of the working group for the Professional Standard of Architect
2005 - 2010	Tallinn University of Tartu College Council member
2005 - 2009	Estonian University of Agriculture and a member of the Council of the Institute of the Environment
2005 - 2010	Member of the Scientific Council of the Estonian Agricultural Museum
2005 - 2014	The National Heritage Council of Landscape Architecture at the Expert Council member
2004 - 2006	Estonian Landscape Architects' Union, member of the board
2003 - 2013	Artes Terrae LT member of the board
2001 – 2005	Estonian Cultural Endowment County member of the expert group

Research activity

Field of research

DENDROFLORA ON HISTORIC PARKS AND RESTORING PROBLEMS - Restoring Manor Parks: Exploring and Specifying Original Design and Character through the Study of Dendrologous Plants in Estonian Historic Manor Parks. The severity of the problem of invasive woody plants in parks. Their distribution and viability.

THE VILLAGE STRUCTURE AND VILLAGE RESTORATION - Development process of the village structure. Working-out the village plan-structure classification what based to the historic development. Village restoration.

GENTRIFICATION FROM A SOCIALIST TO INCLUSIVE PERSPECTIVE - This project provides an analysis of the conditions necessary for gentrification in the post-socialist district, describes the process of gentrification, and tries to assess the current developmental stage of the gentrification process.

A THEORETICAL-METHODOLOGICAL APPROACH TO LANDSCAPE – The perceivable landscape. The general objective of the research is to identify the operating mechanisms of landscape as an object. To analyse the landscape as a semiosphere based on Lotman's theory of the semiosphere, for the purpose of finding the attributes of a semiosphere that are present in the landscape; to analyse the landscape as memory with the goal of identifying the attributes and operating mechanisms characteristic of memory based on Tulving's theory of memory; to analyse how landscape, as memory, stores reminiscences and when and how they become accessible to people.

Honours & awards

2017, Nele Nutt, Ministry of Education and Research and University of Tartu

2017, Nele Nutt, Ministry of Culture

2014, Nele Nutt, Cultural Endowment of Estonia

2013, Nele Nutt, Cultural Endowment of Estonia

2012, Nele Nutt, Estonian Landscape Architects' Union

2012, Nele Nutt, National Foundation of Civil Society

2012, Nele Nutt, Cultural Endowment of Estonia

2011, Nele Nutt, Estonian Landscape Architects' Union

2010, Nele Nutt, Estonian National Culture Foundation

Thesis supervised

Mariliis Mieler, Master’s Degree, 2013, (sup) Nele Nutt, Rasmus Kask. Miljööväärtuste määratlemine tuginedes relativistlikule väärtusteooriale Kihnu näitel [Defining milieu in Kihnu through the relativistic theory of value], Tallinn University of Technology.

Liisiu Lehari, Master’s Degree, 2012, (sup) Nele Nutt, Rasmus Kask. Väärtuste diskursus miljööväärtuslike külade teemaplaneeringutes [The Discourse of Values in Thematic Plans of Milieu-Valuable Rural Areas], Tallinn University of Technology.

Olga Beloglazova, Master’s Degree, 2012, (sup) Nele Nutt, Mart Hiob. Ehitusliku miljööväärtuse käsitlemine maapiirkonnas Värska valla näitel [Die Behandlung erhaltenswerter Bebauungsgebiete auf dem Land am Beispiel des Kreises Värska], Tallinn University of Technology.

Liisi Preedin, Bachelor's Degree, 2012, (sup) Nele Nutt. Alatskivi maastikukaitseala maastikumuutuste analüüs [The landscape change analysis of Alatskivi landscape preserve]. Tallinn University of Technology.

Olga Bassova, Bachelor's Degree, 2012, (sup) Nele Nutt. Väikeparkide hoolduskavad. Vara, Reola, Vesneri ja Kriimani parkide näitel [Maintenance plans for the small parks on the examples of Vara, Reola, Vesneri and Kriimani parks]. Tallinn University of Technology.

Piret Pallase, Bachelor's Degree, 2012, (sup) Nele Nutt, Ilme Mäesalu. Mõisakalmistud maastikus [Manorial cemeteries in landscape on the example of Viljandi County]. Viljandimaa näitel. Tallinn University of Technology.

Helena Tuvike, Bachelor's Degree, 2012, (sup) Nele Nutt. Aktsioonikunsti lugu Eestis [The story of happening and installation art in Estonia]. Tallinn University of Technology.

Oksana Bogdanova, Bachelor's Degree, 2012, (sup) Nele Nutt. Lahemaa Võhma küla asustusajalooline ülevaade [Lahemaa Võhma historic overview of the settlement history]. Tallinn University of Technology.

Liina Ratas, Bachelor's Degree, 2011, (sup) Nele Nutt. Kukulinna mõisa pargi hoolduskava [Maintenance plan of Kukulinn manor park]. Tallinn University of Technology.

Mariin Kangur, Bachelor's Degree, 2011, (sup) Nele Nutt. Altja küla asustusajalooline ülevaade [Historic settlement of village Altja]. Tallinn University of Technology.

Triin Saarepuu, Bachelor's Degree, 2011, (sup) Nele Nutt. Autentsed puuliigid Hummuli, Kiidjärve, Kuremaa, Räpina, Unipiha ja Õisu mõisa pargis [Authentic tree species in Hummuli, Kiidjärve, Kuremaa, Räpina, Unipiha and Õisu manor parks]. Tallinn University of Technology.

Liisu Lehari, Bachelor's Degree, 2010, (sup) Nele Nutt, Kadri Tüür. Maastikumärgid Koguva külas [Landmarks in Koguva village]. Tallinn University of Technology.

Alvar Schasmin, Bachelor's Degree, 2009, (sup) Nele Nutt, Ilme Mäesalu. Hävitatud kalmistud [Destroyed cemetaries]. Tallinn University of Technology.

Piret Palm, Master's Degree, 2009, (sup) Nele Nutt, Kalev Sepp. Eesti looduskaitsealuste parkide puittaimestik 19. - 21. sajandil [Dendroflora of Estonian parks under nature protection in period of 19th to 21st century]. Estonian Agricultural University.

Annika Palu, Bachelor's Degree, 2009, (sup) Nele Nutt. Tööstushoonete taaskasutusest maailmas ja Eestis: Tartu Pärmivabrik [Industrial Buildings Renewal in the World and in Estonia: Tartu Pärmivabrik]. Tallinn University of Technology.

Kadi Markna, Bachelor's Degree, 2009, (sup) Nele Nutt, Heiki Kalberg. Linnaruumi tihendamist mõjutavad tegurid Tartu linna üldplaneeringu põhjal [Factors that influence town densification on the basis of Comprehensive Plan of Tartu]. Tallinn University of Technology.

Kristian Nigul, Bachelor's Degree, 2009, (sup) Nele Nutt. Mähe aedlinna areng ja iseloom. [The development and character of Mähe garden suburb]. Tallinn University of Technology.

Miina Kruusmägi, Bachelor's Degree, 2009, (sup) Nele Nutt. Asustuse ajalooline analüüs ja väärtuslik kultuurmaastik Kõrgessaare asulas, Hiiumaal [Analysing landscape history and valuable cultural landscapes of Kõrgessaare village, Hiiumaa]. Tallinn University of Technology.

Katri Soonberg, Master's Degree, 2008, (sup) Nele Nutt. Mõisaparkide restaureerimine Eestis - lähenemised ja printsiibid. Estonian Agricultural University.

Elulookirjeldus

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Sünniaeg ja -koht: 18.03.1969, Tartu

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Hariduskäik

2017	Tallinna Tehnikaülikool, ekstern-doktorant
2004 - …	Eesti Maaülikool, maastikuarhitektuuri eriala doktorant
2013 - …	Tartu Ülikool, sotsioloogia eriala magistrant
2000 - 2004	EPMÜ loodusteaduste magister maastikuarhitektuuri erialal
1999 - 1999	Hämepolytechnic, Lepaa Institute of Holticulture
1996 - 2000	EPMÜ bakalaureuse kraad maastikuarhitektuuri erialal

Keelteoskus

Eesti keel	emakeel
Inglise keel	produktiivsed oskused B2, retseptiivsed oskused C1
Hispaania keel	A2
Vene keel	B2

Täiendusõpe

2001	Restaureerimise põhikursus, Eesti Kunstiakadeemia.
2007	HTHT.TK009 Testid ja teadmiste kontrollimine, Tartu Ülikool.
2007	HTHT.TK.010 Kõrgkoolididaktika, Tartu Ülikool.
2007	HTHT.TK.026 Probleemõppe võimalused kõrgkoolis, Tartu Ülikool.
2016	P2AV.TK.793 MOOC - miks, kellele ja kuidas?, Tartu Ülikool.
2016	FLEE.02.132 Terminoloogia alused, Tartu Ülikool.
2016	MTAT.TK.006 Programmeerimisest maalähedaselt, Tartu Ülikool.

Teenistuskäik

2017 - …	Tallinna Tehnikaülikool, Inseneriteaduskond, Tartu kolledž, lektor
2005 - 2016	Tallinna Tehnikaülikool Tartu Kolledž, Maastikuarhitektuuri õppetooli hoidja, lektor
2014 - …	Eesti Maastikuarhitektide Liit, koordinaator
2005 - 2014	Artes Terrae OÜ, maastikuarhitekt-planeerija
2003 - 2005	Artes Terrae OÜ, tegevjuht, maastikuarhitekt
2000 - 2003	Keskkonnakaitse Instituut, Maastikuarhitektuuri Büroo, maastikuarhitekt

Teadusorganisatsiooniline ja -administratiivne tegevus

2016 - …	Eesti Maastikuarhitektide Liidu eestseisuse liige
2016 - …	Maastikuarhitekti kutsestandardite uuendamise töögrupi juht
2016 - …	Tallinna Tehnikaülikooli õppekava “Tehiskeskkonna kujundamine” programminõukogu liige
2004 - …	Eesti Maastikuarhitektide Liidu asutajaliige
2012 – 2014	Maastikuarhitekti kutsekomisjoni liige
2010 – 2012	Maastikuarhitekti kutsestandardite väljatöötamise töögrupi juht
2010 - 2012	Arhitekti kutsestandardite väljatöötamise töögrupi liige
2010 - …	MTÜ Eesti Maastikuarhitektuuri Keskus juhatuse liige
2005 – 2010	Tallinna Tehnikaülikooli Tartu Kolledž nõukogu liige
2005 – 2009	Eesti Maaülikooli Põllumajandus- ja keskkonnainstituudi nõukogu liige
2005 - 2010	Eesti Põllumajandusmuuseumi teadusnõukogu liige
2005 - 2014	Muinsuskaitse nõukogu juures asuva Maastikuarhitektuuri ekspertnõukogu liige
2004 - 2006	Eesti Maastikuarhitektide Liidu juhatuse liige
2003 - 2013	Artes Terrae OÜ juhatuse liige
2001 - 2005	Eesti Kultuurkapitali Tartumaa ekspertgrupi liige

Teadustegevus

Teadustöö põhisuunad ja teadusprojektid

Loodusteadused ja tehnika; 4.1. Arhitektuur ja tööstusdisain

AJALOOLISTE PARKIDE DENDROFLOORA JA RESTAUREERIMISE PROBLEMAATISTIK. Ajalooliste parkide konserveerimine, restaureerimine, rekonstrueerimine ja hooldus. Dendrofloora, puistu liigilis-vanuseline koosseis, puistu autentsus. Invasiivsete liikide problemaatika, levik ja elujõulisus ajaloolistes mõisaparkides. Sustainable Historic Park Management and Development in Finland and Estonia 2009–2012 projekti raames koostatud trükised "Pargiterminite seletussõnaraamat" ja "Parkide hoolduskavade koostamise juhend". Keskkonnainvesteeringute keskuse rahastatud projekti 3-2_7/40-4/2011 "Looduskaitsealuste parkide dendrofloora uuringud" projektijuht.

AJALOOLISTE KÜLADE STRUKTUURIUURINGUD JA RESTAUREERIMINE. Ajalooliste külastruktuuride genees. Külade plaanistruktuuri klassifikatsioon, mis baseerub külade ajaloolisel kujunemisel. Külade restaureerimine. Euroopa Regionaalarengu Fondi rahastatud projekt "Lahemaa rahvuspargi külade arhitektuuri ja asustusstruktuuri uuring".

SOTSIAALSED PROTSESSID JA KESKKONNA RUUMILINE PLANEERIMINE. Postsotsialistlikes piirkondade gentrifitseerumine ja sotsiaalsete protsesside (gentrifikatsioon, stratifikatsioon jt) rolli keskkonna ruumilisel planeerimisel. Kodanikuühiskonna Sihtkapitali rahastatud projekt "Osalusplaneerimine Supilinna teemaplaneeringu koostamisel". Tartu Linnavalitsuse rahastatud projekt "Supilinna ruumiline kujunemine ja miljööväärtuse säilitamine"

TEOREETILIS-METOODILISED PROBLEEMID MAASTIKU KÄSITLEMISEL. Tajutav maastik, maastik kui semiosfäär, maastik kui mälu ja maastik kui mälestus.

Tunnustused

2017, Nele Nutt, Haridus- ja Teadusministeeriumi ja Tartu Ülikooli Sihtasutuse eestikeelse terminoloogia sihtstipendium.

2017, Nele Nutt, Kultuuriministeeriumi loomestipendium.

2014, Nele Nutt, Eesti Kultuurkapital, autoristipendium maastikuarhitektuuri terminite seletava sõnaraamatu koostamiseks.

2013, Nele Nutt, Eesti Kultuurkapital, stipendium ettekandega osalemiseks Dublini AESOP ja ACSP kongressil.

2012, Nele Nutt, Eesti Maastikuarhitektide Liit, Aasta tegu 2012.

2012, Nele Nutt, Kodanikuühiskonna sihtkapital, stipendium ettekandega osalemiseks 15th International Planning History Society Conference São Paulo Brazil.

2012, Nele Nutt, Eesti Kultuurkapital, stipendium ettekandega osalemiseks 15th International Planning History Society Conference São Paulo Brazil.

2011, Nele Nutt, Eesti Maastikuarhitektide Liit, Aasta tegu 2011.

2010, Nele Nutt, Eesti Rahvuskultuuri Fond, Juhan Maiste nimeline stipendium.

Juhendatud lõputööd

Mariliis Mieler, magistrikraad, 2013, (juh) Nele Nutt, Rasmus Kask. Miljööväärtuste määratlemine tuginedes relativistlikule väärtusteooriale Kihnu näitel. Tallinna Tehnikaülikool.

Liisu Lehari, magistrikraad, 2012, (juh) Nele Nutt, Rasmus Kask. Väärtuste diskursus miljööväärtuslike külade teemaplaneeringutes. Tallinna Tehnikaülikool.

Olga Beloglazova, magistrikraad, 2012, (juh) Nele Nutt, Mart Hiob. Ehitusliku miljööväärtuse käsitlemine maapiirkonnas Värska valla näitel. Tallinna Tehnikaülikool.

Liisi Preedin, bakalaureusekraad, 2012, (juh) Nele Nutt. Alatskivi maastikukaitseala maastikumuutuste analüüs. Tallinna Tehnikaülikool.

Olga Bassova, bakalaureusekraad, 2012, (juh) Nele Nutt. Väikeparkide hoolduskavad. Vara, Reola, Vesneri ja Kriimani parkide näitel. Tallinna Tehnikaülikool.

Piret Pallase, bakalaureusekraad, 2012, (juh) Nele Nutt, Ilme Mäesalu. Mõisakalmistud maastikus. Viljandimaa näitel. Tallinna Tehnikaülikool.

Helena Tuvike, bakalaureusekraad, 2012, (juh) Nele Nutt. Aktsioonikunsti lugu Eestis. Tallinna Tehnikaülikool.

Oksana Bogdanova, bakalaureusekraad, 2012, (juh) Nele Nutt. Lahemaa Võhma küla asustusajalooline ülevaade. Tallinna Tehnikaülikool.

Liina Ratas, bakalaureusekraad, 2011, (juh) Nele Nutt. Kukulinna mõisa pargi hoolduskava. Tallinna Tehnikaülikool.

Mariin Kangur, bakalaureusekraad, 2011, (juh) Nele Nutt. Altja küla asustusajalooline ülevaade. Tallinna Tehnikaülikool.

Triin Saarepuu, bakalaureusekraad, 2011, (juh) Nele Nutt. Autentsed puuliigid Hummuli, Kiidjärve, Kuremaa, Räpina, Unipiha ja Õisu mõisa pargis. Tallinna Tehnikaülikool.

Liisu Lehari, bakalaureusekraad, 2010, (juh) Nele Nutt, Kadri Tüür. Maastikumärgid Koguva külas. Tallinna Tehnikaülikool.

Alvar Schasmin, bakalaureusekraad 2009, (juh) Nele Nutt, Ilme Mäesalu. Hävitatud kalmistud. Tallinna Tehnikaülikool.

Piret Palm, magistrikraad, 2009, (juh) Nele Nutt, Kalev Sepp. Eesti looduskaitsealuste parkide puittaimestik 19. - 21. sajandil. Eesti Põllumajandusülikool.

Annika Palu, bakalaureusekraad, 2009, (juh) Nele Nutt. Tööstushoonete taaskasutusest maailmas ja Eestis: Tartu Pärmivabrik. Tallinna Tehnikaülikool.

Kadi Markna, bakalaureusekraad, 2009, (juh) Nele Nutt, Heiki Kalberg. Linnaruumi tihendamist mõjutavad tegurid Tartu linna üldplaneeringu põhjal. Tallinna Tehnikaülikool.

Kristian Nigul, bakalaureusekraad, 2009, (juh) Nele Nutt. Mähe aedlinna areng ja iseloom. Tallinna Tehnikaülikool.

Miina Kruusmägi, bakalaureusekraad, 2009, (juh) Nele Nutt. Asustuse ajalooline analüüs ja väärtuslik kultuurmaastik Kõrgessaare asulas, Hiiumaal. Tallinna Tehnikaülikool.

Katri Soonberg, magistrikraad, 2008, (juh) Nele Nutt. Mõisaparkide restaureerimine Eestis - lähenemised ja printsiibid. Eesti Põllumajandusülikool.

Publications

1.1. Scholarly articles indexed in the ISI Web of Science database

Nutt, Nele; Hiob, Mart; Kotval, Zenia (2016). Supilinn, Tartu—The Lively Vernacular Against Urban Renewal: A Lefebvrean Critique. Space and Culture, 2, 1−13.

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Nutt, Nele; Hiob, Mart; Nurme, Sulev (2012). The story of "ugly duckling". The run-down slum that survived the socialist system of government has turned to desirable residential area.

Conference presentations

Nele Nutt, Mart Hiob, Sulev Nurme and Sirle Salmistu. Challenge of gentrification in post-socialist city. AESOP-ACSP Joint Congress 15-19 July 2013 Dublin, oral presentation.

Nutt, Nele; Hiob, Mart; Nurme, Sulev. The story of "ugly duckling". The run-down slum that survived the socialist system of government has turned to desirable residential area. 15th International Planning History Society Conference São Paulo, Brazil 15–18 July 2012, oral presentation.

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Hiob, Mart; **Nutt, Nele**; Nurme, Sulev. Best Practice: The Influence of Local Residents on Urban Transformation. Case of the Society of Supilinn, Tartu, Estonia. 14t h IPHS Conference 12-15 July 2010 Istanbul-Turkey, oral presentation.

Nurme, Sulev; **Nutt, Nele**; Hiob, Mart. Estonian Baroque park – talking ruins. 1st Landscape Archaeology Conference: LAC2010 in 26th to 28th January 2010 at VU University Amsterdam, the Netherlands. poster presentation.

Nele Nutt, Mart Hiob, Sulev Nurme (2010) The dendroflora Estonian nature protected parks. Nature Conservation Beyond 2010 May 27-29, Tallinn, 2010, oral presentation.

Nutt, Nele. Mõisa ajakihid ja ruumipiirid maastikus. 21. sajandi park Ida-Euroopas - varemetest uuestisünnini. Eesti Maaülikool. 1.-5. oktoobril 2008. a. Tartu, oral presentation.

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DISSERTATIONS DEFENDED AT TALLINN UNIVERSITY OF TECHNOLOGY ON *CIVIL ENGINEERING*

1. **Heino Mölder**. Cycle of Investigations to Improve the Efficiency and Reliability of Activated Sludge Process in Sewage Treatment Plants. 1992.

2. **Stellian Grabko**. Structure and Properties of Oil-Shale Portland Cement Concrete. 1993.

3. **Kent Arvidsson**. Analysis of Interacting Systems of Shear Walls, Coupled Shear Walls and Frames in Multi-Storey Buildings. 1996.

4. **Andrus Aavik**. Methodical Basis for the Evaluation of Pavement Structural Strength in Estonian Pavement Management System (EPMS). 2003.

5. **Priit Vilba**. Unstiffened Welded Thin-Walled Metal Girder under Uniform Loading. 2003.

6. **Irene Lill.** Evaluation of Labour Management Strategies in Construction. 2004.

7. **Juhan Idnurm**. Discrete Analysis of Cable-Supported Bridges. 2004.

8. **Arvo Iital**. Monitoring of Surface Water Quality in Small Agricultural Watersheds. Methodology and Optimization of monitoring Network. 2005.

9. **Liis Sipelgas**. Application of Satellite Data for Monitoring the Marine Environment. 2006.

10. **Ott Koppel**. Infrastruktuuri arvestus vertikaalselt integreeritud raudtee-ettevõtja korral: hinnakujunduse aspekt (Eesti peamise raudtee-ettevõtja näitel). 2006.

11. **Targo Kalamees**. Hygrothermal Criteria for Design and Simulation of Buildings. 2006.

12. **Raido Puust**. Probabilistic Leak Detection in Pipe Networks Using the SCEM-UA Algorithm. 2007.

13. **Sergei Zub**. Combined Treatment of Sulfate-Rich Molasses Wastewater from Yeast Industry. Technology Optimization. 2007.

14. **Alvina Reihan**. Analysis of Long-Term River Runoff Trends and Climate Change Impact on Water Resources in Estonia. 2008.

15. **Ain Valdmann**. On the Coastal Zone Management of the City of Tallinn under Natural and Anthropogenic Pressure. 2008.

16. **Ira Didenkulova**. Long Wave Dynamics in the Coastal Zone. 2008.

17. **Alvar Toode**. DHW Consumption, Consumption Profiles and Their Influence on Dimensioning of a District Heating Network. 2008.

18. **Annely Kuu**. Biological Diversity of Agricultural Soils in Estonia. 2008.

19. **Andres Tolli**. Hiina konteinerveod läbi Eesti Venemaale ja Hiinasse tagasisaadetavate tühjade konteinerite arvu vähendamise võimalused. 2008.

20. **Heiki Onton**. Investigation of the Causes of Deterioration of Old Reinforced Concrete Constructions and Possibilities of Their Restoration. 2008.

21. **Harri Moora**. Life Cycle Assessment as a Decision Support Tool for System optimisation – the Case of Waste Management in Estonia. 2009.

22. **Andres Kask**. Lithohydrodynamic Processes in the Tallinn Bay Area. 2009.

23. **Loreta Kelpšaitė**. Changing Properties of Wind Waves and Vessel Wakes on the Eastern Coast of the Baltic Sea. 2009.

24. **Dmitry Kurennoy.** Analysis of the Properties of Fast Ferry Wakes in the Context of Coastal Management. 2009.

25. **Egon Kivi**. Structural Behavior of Cable-Stayed Suspension Bridge Structure. 2009.

26. **Madis Ratassepp**. Wave Scattering at Discontinuities in Plates and Pipes. 2010.

27. **Tiia Pedusaar**. Management of Lake Ülemiste, a Drinking Water Reservoir. 2010.

28. **Karin Pachel**. Water Resources, Sustainable Use and Integrated Management in Estonia. 2010.

29. **Andrus Räämet**. Spatio-Temporal Variability of the Baltic Sea Wave Fields. 2010.

30. **Alar Just**. Structural Fire Design of Timber Frame Assemblies Insulated by Glass Wool and Covered by Gypsum Plasterboards. 2010.

31. **Toomas Liiv**. Experimental Analysis of Boundary Layer Dynamics in Plunging Breaking Wave. 2011.

32. **Martti Kiisa**. Discrete Analysis of Single-Pylon Suspension Bridges. 2011.

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46. **Maija Viška**. Sediment Transport Patterns Along the Eastern Coasts of the Baltic Sea. 2014.

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57. **Endrik Arumägi**. Renovation of Historic Wooden Apartment Buildings. 2015.

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61. **Mart Hiob**. The Shifting Paradigm of Spatial Planning in Estonia: The Rise of Neighbourhood Participation and Conservation of Built-up Areas through the Detailed Case Study of Supilinn, a Historic Suburb of Tartu City, Estonia. 2016.

62. **Martin Heinvee**. The Rapid Prediction of Grounding Behavior of Double Bottom Tankers. 2016.

63. **Bharat Maharjan**. Stormwater Quantity and Quality of Large Urban Catchment in Tallinn. 2016.