

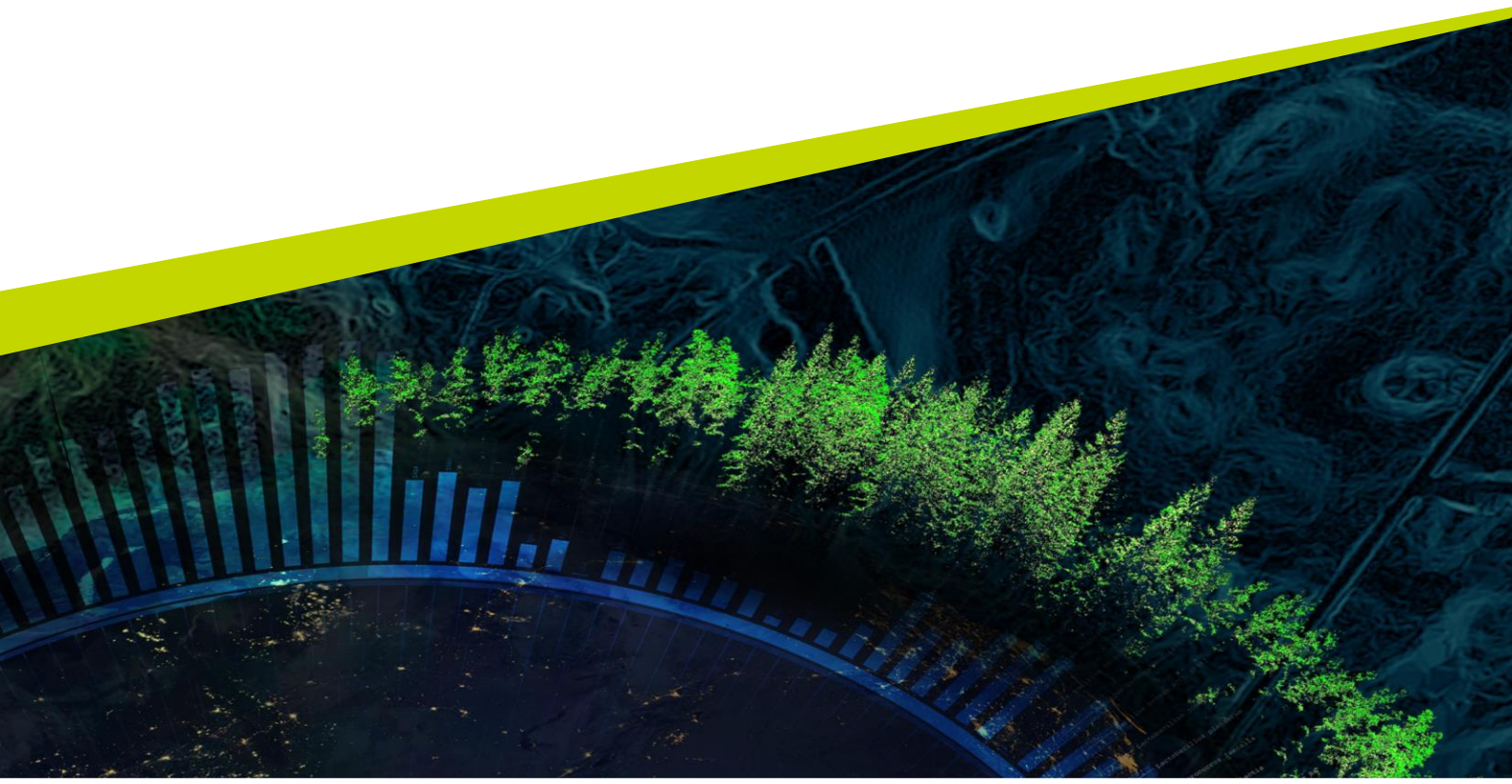


Protection of Cultural Heritage in Forestry

– a Case Study in Southern Sweden

Mareen Schlätel

Master's Thesis • (30 hp)
Swedish University of Agricultural Sciences
Southern Swedish Forest Research Centre
Alnarp, 2021



Protection of Cultural Heritage in Forestry – a Case Study in Southern Sweden

Mareen Schlätel

Supervisor: Prof. Dr. Jörg Brunet, Swedish University of Agricultural Sciences,
Southern Swedish Forest Research Centre

Supervisor: Prof. Dr. Michael Rode, Leibniz University Hannover, Institute of
Environmental Planning

Examiner: Prof. Dr. Ola Eriksson, Swedish University of Agricultural Sciences,
Department of Forest Resource Management

Credits: (30 hp)

Level: A2E

Course title: **Master's thesis in Biology**

Course code: **EX0986**

Place of publication: **Alnarp**

Year of publication: **2021**

Keywords: cultural heritage, protection, forest management, Sweden, Tranemåla

Swedish University of Agricultural Sciences
Southern Swedish Forest Resource Centre

Publishing and archiving

YES, I/we hereby give permission to publish the present thesis in accordance with the SLU agreement regarding the transfer of the right to publish a work.

NO, I/we do not give permission to publish the present work. The work will still be archived, and its metadata and abstract will be visible and searchable.

Affidavit

Hereby, I assure that I have written this work independently; have not used other than the indicated sources and aids; every aspect of work, that have been taken literally or analogously from other sources, are marked as such and that this work, in this or a similar form, has not been presented to any examining board other than the stated above.

Hannover, the 30th of August 2021

Mareen Schlätel

Abstract

Intensive forestry in Sweden exerts high pressure on forest ecosystem services. This includes the cultural heritage of forests. Where today, timber production dominates as a primary use, the forest had very diverse functions a few decades ago. Since these elements are often present but hardly known or visible, this can lead to a conflict of use between forestry and cultural preservation. A place where this contrast between past diverse use and current forestry dominated use exist is Tranemåla in Blekinge county in the South of Sweden.

The aim of this work is to make this diverse past use of Tranemåla visible again and to reconcile forest management and the visibility of cultural history. For this purpose, a qualitative survey was carried out in the area, mapping the cultural-historical elements. Fifteen different types of cultural relics were recorded during the mapping, including stone walls, tar valleys, torps, stone ovens, and boundary stones among others. In addition, comparison with historical maps made it possible to visualize the evolution of the landscape over the last 200 years. In particular, the development of roads and stone walls that have been built over the years to make the land more accessible became visible through the comparison.

Based on this, recommendations for action are made for the forest management plan, policy and maintenance and restoration. The recommendations focus on the integration of the results into the Forest Management Plan and the protection of the elements during forestry work, for example through colorful markings. The results of this work will be used by the Tranemåla Foundation, which owns and manages the area, to restore and maintain the cultural historical elements.

Keywords: cultural heritage, protection, forest management, Sweden, Tranemåla

Table of Contents

Abstract	4
List of Tables	6
List of Figures	6
List of Abbreviations	6
1. Background.....	7
1.1. Introduction and Problem Definition.....	7
1.2. Forestry and Cultural Heritage in Sweden.....	8
1.3 Key Questions and Objective.....	11
1.4 Tranemåla and Tranemålastiftelsen	12
2. Materials and Methods.....	15
2.1 Methods Background Research	15
2.3 Delineation of Survey Area and Methodology Field Work.....	17
2.4 Classification and Evaluation of Cultural Assets in Forests	19
3 Results.....	23
3.1 Background Research Cultural Heritage in Tranemåla	23
3.2 The Cultural Assets of Tranemåla.....	25
3.3 Evaluation of Cultural Assets in Tranemåla.....	34
3.3.1 Historical Classification	34
3.3.2 Spatial Distribution of Cultural Assets	45
4. Recommendations and Discussion.....	54
4.1 Maintenance and Protection Recommendations.....	54
4.2 Project Prioritization.....	60
4.3 Discussion.....	62
5. References	64
Acknowledgments.....	68
Appendix	69

List of Tables

Table 1 Assignments of Names 1994 map and this survey and explanations	20
Table 2 Cultural Assets of Tranemåla (Sources Photos by the Author)	27
Table 3 Maintenance and Restoration Recommendations for the Cultural Assets of Tranemåla	57

List of Figures

Figure 1 Location of Tranemåla in Sweden	12
Figure 2 Tranemåla aerial view with location of the Tranemåla estate house	13
Figure 3 Tranemåla Naturvärden och Kulturlämningar med Hydrologin by Roland Offrell .	16
Figure 4 Detail cut legend of the map “Tranemåla Naturvärden och Kulturlämningar med Hydrologin” (in Swedish)	19
Figure 5 Skogens pärlor Map of Tranemåla and surroundings	24
Figure 6 Overview of the surveyed are in Tranemåla	26
Figure 7 Comparison to map from 1827	35
Figure 8 Map over Tranemåla from 1827 with current property borders in black.....	36
Figure 9 Comparison to map from 1915.....	38
Figure 10 Map over Tranemåla from 1915 with current property borders in black	38
Figure 11 Comparison to map from 1949.....	40
Figure 12 Map over Tranemåla from 1949 with current property borders in black	40
Figure 13 Comparison to map from 1973.....	42
Figure 14 Map over Tranemåla from 1973 with current property borders in black	42
Figure 15 Comparison to map from 1994	44
Figure 16 Distribution of stone walls in Tranemåla with Photos.....	46
Figure 17 Distribution of paths and roads in Tranemåla with Photos.....	47
Figure 18 Distribution of meadows, oak rondel and potato cellar in Tranemåla with Photos	48
Figure 19 Distribution of meadow and alley trees in Tranemåla with Photos	49
Figure 20 Distribution of torps in Tranemåla with Photos.....	51
Figure 21 Distribution of tar valleys, wells and stone ovens in Tranemåla with Photos	52
Figure 22 Distribution of boundary stones, stone bridges and stone bases in Tranemåla with Photos.....	53

List of Abbreviations

CEs Cultural Ecosystem Services

ESs Ecosystem Services

1. Background

1.1. Introduction and Problem Definition

Rising global demands of timber-based products and increasing calls for cultural and natural historical protection of forests increase the competition for land use (JAKOBSSON et al. 2021; FOLEY et al. 2005). This competition in land use can inhibit a forest's ability to provide ecosystem services (ESs) (SANDSTRÖM et al. 2011). In Sweden, for-profit oriented timber production, often in combination with clear-cuts, increases this pressure on the forests (LODIN & BRUKAS 2021). Ecosystem services are described by the MILLENNIUM ECOSYSTEM ASSESSMENT (PROGRAM) (2005) as “the benefits people obtain from ecosystems”. There are four different types of ecosystem services: Provisioning, Regulating, Supporting and Cultural.

When discussing the cultural heritage of a forest, cultural ecosystems services (CESs) are the corresponding ecosystem service. CECs are the “nonmaterial benefits people obtain from ecosystems”. Amongst others, they can be experienced through recreation or aesthetic experiences and cultural heritage values are included since the maintenance of historically shaped landscapes is valued by many cultures (MILLENNIUM ECOSYSTEM ASSESSMENT (PROGRAM) 2005).

BROCKERHOFF et al. (2017) state that CECs, while being an important part of the vital ecosystem services, are generally under-researched. They attribute this due to the intangible nature and thus difficult evaluation of many CESs but also state, that it is vital to research common CES between different stakeholders of an area to avoid land use conflict. While national surveys have their place, different stakeholders cannot be considered which increases the need for more local projects to guarantee the fulfilment of local needs (HAAREN et al. 2019).

Recent studies have shown, that the concept of ecosystem services (ESs) can help to put a tangible value to the multitude of benefits nature provides for humans and alleviate conflicts of interest (SACHER 2020; HERMES et al. 2020). The focus has been on recreational and aesthetical values which is also a recommended approach by ALBERT et al. (2015) due to non-uniform mapping standards.

To create clear and actionable plans to avoid land use conflicts, it is essential to identify the cultural heritage of an area in order for it to be protected. The cultural heritage of an area becomes visible and tangible through heritage assets that are remnants of human activity in the landscape (PARVIAINEN 2015; MARNTELL & WÅGBERG 2005). Using an example region, a methodology is developed in this work that can be used for this evaluation of cultural relics.

1.2. Forestry and Cultural Heritage in Sweden

In Sweden, forests and forestry have a high level of significance. Just under 1 % of the world's commercially used forest areas are in Sweden, but 10 % of the globally traded timber, pulp and paper is provided by the Scandinavian country (ROYAL SWEDISH ACADEMY OF AGRICULTURE AND FORESTRY 2015). Around 27 Mio hectares of Sweden are covered by forests, which makes up around 67 % of the total land area (ENANDER 2005).

While anthropological impact on forests was the strongest in the past 150 years, especially concerning forest structures and species composition due to profitable forestry operation (NILSSON 1997), data suggests that the human influence on the vegetation in Southern Sweden dates as far back as 1000 years ago (LINDBLADH et al. 2000). Swedish forests are young, the first forest in Southern Sweden developed 10,000 years ago on geologically young soils, only between 15,000 to 10,000 years old (ENANDER 2005).

The Forestry Act in Sweden was implemented in 1903, but it only delineated rational forest management to regulate private forested land and was still heavily production oriented. The main purpose was to ensure regeneration after fellings to secure future yields (ÖSTLUND et al. 1997). This production-oriented forestry continued throughout most of the 20th century with advancements in technology increasing yields. The modernization of forestry practices in Sweden during the 1970s where chains-saws and horses were replaced with forestry machines, had an immense impact on the forested landscapes, and thus cultural heritage relics in forests (ENANDER 2005). Yearly surveys by the Swedish Forest Agency on recent felling sites prove these impacts, where 15 % of relics were seriously damaged (SKOGSSTYRELSEN 2021a). Only in 1993, the Forestry Act considered the multiple purposes of forests such as recreation and nature conservation and through an updated version from

1998, every owner was obliged to formulate forestry and environmental goals for their property (NYLUND 2009).

Internationally, the revision of the Forestry Act from 1993 is also known as “The Swedish Forestry Model”, often referring to a particularly sustainable way of forest management. Recently however, criticism of this model has become louder, stating that it mainly prioritizes the economic benefits of sustainability and not sustainable forest management because of the value of the forest itself (LINDAHL et al. 2017). In the Swedish Forestry Act, § 30 in particular, deals with the protection of cultural heritage relics in the forest during forests operations. While there is no general protection of relics younger than 1850 through § 30 section 7:17 it is mandatory to avoid damage to these relics and also to remove trees that interfere with them, if the trees are not biotope trees (SKOGSSTYRELSEN 2020).

Another legislation that affects cultural heritage in forests is the Historic Environment Act. In 1988 the Swedish National Heritage Board published the Historic Environment Act which aims at the protection and conservation of Sweden’s cultural heritage (SWEDISH NATIONAL HERITAGE BOARD 2021). Through this legislation, many ancient monuments that are at least 100 years old are automatically under protection. The monuments must be directly related to past human activity and be permanently abandoned. Among others, these include remains of homes, remains of working life and standing stones (Chapter 2 Ancient monuments) (SVERIGES RIKSDAG 2021).

While the Historic Environment Act is concerned with artifacts of higher significance that are directly related to human life, a regulation in the Swedish Environmental Act deals with artifacts that are categorized under general biotope protection, which are listed in Annex 1 of the regulation (RIKSDAGSFÖRVALTNINGEN 2014).

Forests and their ecosystem services (ESs) and especially their recreational value play a valuable role in the Swedish society today (HEMSTRÖM et al. 2014). Allemansrätten, the Right of Common Public Access to roam around freely in the country is deeply anchored in Sweden and used by many citizens for recreation, especially in forests (SWEDISH ENVIRONMENTAL PROTECTION AGENCY 2021c).

The first state-wide forest inventory was completed in 1929 but it was focused on growth and standing volumes of current forests (NYLUND 2009). Mappings dealing with the recording of inventories of cultural relics throughout Sweden were carried out throughout

the 20th century. Here, the focus was often on inventory while the history of development through human use was not the focus of the work (GREN 2000). The yearly survey by the Swedish Forestry Agency mentioned above plays a vital part in documenting the cultural heritage in Swedish forests, but it is focused on recent felling sites and the damages that occurred during forest operations (SKOGSSTYRELSEN 2021a).

Surveys of the effects of historical land use on the landscapes in Sweden were carried out as early as 1937 when Lars Tirén published his study “Forestry historical studies in the Degerfors district of the province of Västerbotten” where he evaluated changes such as past forest fires and the uses of the Swedish forests before industrialization (TIRÉN 1937). Many of his findings from almost 100 years ago are still valid today and he used innovative methods which influenced forestry research for decades, especially his findings in regards to the effects of past human uses on the forest (ÖSTLUND & ROTURIER 2011). However, he was biased by the production-oriented trends of his times that came with the industrialization of forestry in Sweden which needs to be taken into consideration when using his work.

A recent attempt at surveys regarding cultural heritage in Sweden in connection with past human use have been carried out in Västernorrland in Mid-Sweden through the study by MARNTELL & WÅGBERG (2005) where cultural remains such as boundary marks, sites for charcoal burning or house foundations have been surveyed, among others. Here the surveying was carried out in order to raise awareness about the relics and to protect them during forest operations. A similar study for Southern Sweden was not found.

Internationally, the previous land use of a forest is often used to understand the current state of the forest. Often experts from different disciplines, such as ecology, geography, forestry, and anthropology, are consulted. The “Forestry and our Cultural Heritage” Conference held in Sunne, Sweden in 2005 is where these different disciplines came together to discuss the topic thoroughly (MINISTERIAL CONFERENCE ON THE PROTECTION OF FORESTS IN EUROPE 2005). The in Sweden commonly used definition of cultural heritage included all traditions and values that have been taken over from past generations, either material or immaterial, including ancient monuments (ARONSSON 2005).

It can be said that even though there is a strong background of research on cultural relics in forest landscapes in Sweden, there is still a need to effectively implement this research and protection on a small scale. A methodology that addresses smaller areas may be useful here.

1.3 Key Questions and Objective

The overarching aim of the thesis is to fill a gap in research on how to handle the land use conflict between production interests and the protection of cultural heritage in Sweden. This is done by providing an example of land surveying for cultural heritage and providing recommendations for action in forest management plans and forestry policies to protect these historical assets. The protection and conservation measures are intended to make the cultural assets visible and to retell and represent the history of the place.

Ideally, the results of this work will contribute to provide knowledge about the cultural heritage of the area for current and future generations. This is done by surveying an example area.

The recommendations for action are derived from a historical and spatial classification and the potential impairment from forestry of the cultural-historical elements recorded during the mapping process. The ambition is that this methodology can then be used for the evaluation and protection of forest sites of cultural and historical importance in other Swedish forests.

Derived from the previous chapters are the following research questions for this thesis:

- What is the approach in Sweden to the protection of cultural-historical assets in forestry?
- Which cultural/natural-historical assets can be found and are they impaired by forestry?
- How can the found cultural assets be classified and valued historically and contextually?
- Which steps can be taken in the forestry practice to protect and maintain these assets and tell the historical development of the place?

1.4 Tranemåla and Tranemålastiftelsen

Tranemåla estate was selected as the survey site to showcase an example of an area that was visibly historically influenced and to fill a research gap of how to resolve the land use conflict between production interests and the protection of cultural heritage.

The area was selected because it was known from preliminary research that remaining cultural relics could be expected here and the size of the area increased the chance of finds. This expected number and diversity of different relicts should then also enable transferability of this method for evaluation and protection of forest sites of cultural and historical importance in Sweden.

Tranemåla estate 1:6 is a former farm estate in community of Karlshamn in Blekinge county in Southern Sweden (s. Figure 1 and Figure 2). It consists of the main building, a traditional mansion from the first half of the 19th century and multiple barns and other outbuildings (TRANEMÅLASTIFTELSEN 2007). The total land area of the estate consists of 254,7 ha (ROOTH 2018).



Figure 1 Location of Tranemåla in Sweden (Source: own map created with esri ArcGIS and Collector, altered with Photoshop)

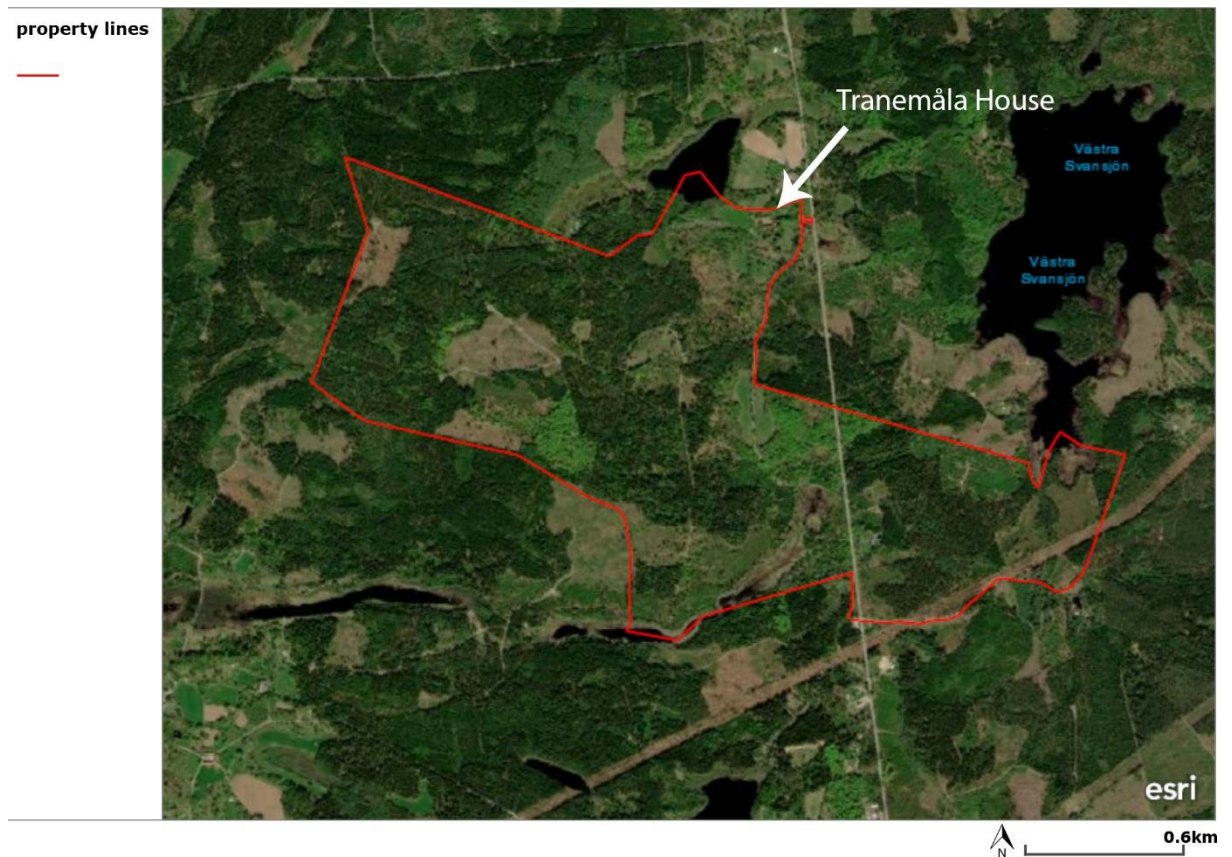


Figure 2 Tranemåla aerial view with location of the Tranemåla estate house (Source: own map created with esri ArcGIS and Collector, altered with Photoshop)

Tranemåla is located circa 20 km north of the city of Karlshamn. The climate is temperate and the annual average temperature reaches 8 °C and the annual precipitation is 600 mm (SMHI 2021)

The estate lies 135 m above sea level and approximately at 56.36 degrees latitude and 14.77 degrees longitude (MAPCOORDINATES 2021). The survey area is mostly flat with little variation in form of small hills. Located in the north of Blekinge county, Tranemåla lies at the southern border of the Boreonemoral Zone according to the Nordic Council of Ministers from 1984 (ROBERGE et al. 2020).

With the 2018 management plan, the majority of the forest consists of *Picea abies* (60 % of standing volume) and *Pinus silvestris* (18 %) and different deciduous species, mainly oak with 5 % and beech and birch with 8 % each (ROOTH 2018).

The management is divided into different classes. Firstly, production classes that consist of areas with general environmental considerations (i.e. 5 – 15 % retention) and areas with

enforced environmental considerations (i.e. 20 – 25 % retention). Secondly, nature conservation classes with either active conservation management (e.g. spruce removal) or no management areas (i.e. swamp forest) (ROOTH 2018).

The area comprehends 252.8 ha of total land, of which 229.3 ha are being used as productive forest, and 1.9 ha of total water surface (ROOTH 2018).

The timber supply amounts to ca. 44,000 m³sk and is supposed to reach 48,300 m³sk with the planned measures by 2027. The proposed felling measures will amount to ca. 13,000 m³sk, with thinning and conservation cuts accounting for 6,300 m³sk and final fellings for ca. 6,700 m³sk, which represents 85 % of the total regrowth during that time period (ROOTH 2018).

No area of the forest is protected under any biotope protection or Natura 2000. However, two small key biotopes in form of an old oak and an area classified with high natural values by the Swedish Forest Agency can be found on the property and the majority of the area is protected under the water protection area of Långasjön lake in Blekinge (ROOTH 2018). Out of the productive forest land, 9.2 % are set aside as a Nature Conservation area and 2.9 % is left untouched (ebd.)

A special feature of the area is Holländarevägen, which runs through the area. In the 1800s this street was the last bit of homeland Swedish emigrants, mainly from Småland, saw of their homeland on their way to Karlshamn to get to the North America. Besides this historically important, rather brief use, Holländarevägen was mainly used as a trade and country road between farms and villages before the paved asphalt road Norra Holländarevägen was built (MATHIASSEN 2021).

Tranemålastiftelsen is the private foundation the property belongs to, and works under the supervision of the county of Blekinge's government (TRANEMÅLASTIFTELSEN 2007). The foundation was established after the last private owners (Erik and Ebba Larsson and Thure Rignell) of the property had died and there were no heirs. The foundation's objective is the promotion and funding of forestry research, particularly in regards to biological and ecological concerns (ebd.). They work in line with the previous owner's ecological view on forestry and promotion of scientific research. Through this it was possible to conduct this study in the area. The forestry work is carried out by the Swedish forestry company Sydved.

2. Materials and Methods

2.1 Methods Background Research

At the beginning of the work, background information about the area was collected. This was done firstly through conversations with Jörg Brunet, who, as part of the Tranemåla Foundation, knows the area very well. In addition, maps were examined and two preliminary in-person inspections of the study area took place.

The first visit was conducted on the 12th of December 2020 to decide whether this will be the site for the purpose of this thesis and a second, more in-depth, visit was carried out on the 8th of March 2021 where it was possible to get an idea of the type of cultural assets, the roads and the time that was demanded to carry out the fieldwork. During this field visit, a large portion of the paths in the area were walked which helped to get an overview of the estate.

The map that served as a basis for this project is the map “Tranemåla Naturvärden och Kulturlämningar med Hydrologin” (English: Tranemåla Nature Value and Cultural Monuments with Hydrology) by Roland Offrell (Figure 3 Tranemåla Naturvärden och Kulturlämningar med Hydrologin by Roland Offrell). For simplified readability, this map will be referred to below as “1994 map by Roland Offrell”. The only available version of the map for background research was the picture below. A larger printed version of the map (circa DIN A0) can be found at the Tranemåla house. To understand the area in preparation for the field work the map was translated. In addition to this map, Jörg Brunet provided further maps from 1994 that depicted the areas with broadleaf forest and ecological and aesthetical values of the area, these are not depicted here since they only served as orientation of the area.

Furthermore, he provided maps of the area from different years which play a role when it comes to the historical classification of the cultural assets (3.3.1 Historical Classification).



Figure 3 Tranemåla Naturvärden och Kulturlämningar med Hydrologin by Roland Offrell

From studying the map above and conduction a general overview of the area by using the Swedish Skogsstyrelsen Skogens Pärlor (Swedish Forest Agency Forest Pearls) (SKOGSSTYRELSEN 2021b) maps, it was possible to gain an understanding of the type of area and the dimensions. It was also possible to get an understanding of the occurrence of historical relics in the area. An in-depth remote sensing survey was not carried out since the survey area and the types of relics are too small for this kind of method.

2.3 Delineation of Survey Area and Methodology Field Work

Following the preliminary surveys of the area, detailed surveys took place to map the cultural relics in the area. This detailed mapping is necessary to get an accurate picture of the condition of the relics and their location.

The field work was carried out between the 15th and 27th of March 2021 while staying at the Tranemåla mansion, which was kindly offered by Tranemålastiftelsen. This period was chosen since it was too late in the year for snowfall to cover up any of the features of interests but too early for vegetation to take over and cover them.

The delineation of the survey area simply consists of the property boundaries of Tranemåla 1:6 which can be seen in Figure 2 above.

In order to answer the research questions, various data must be collected in the field. This had to be done to identify cultural relics and determine how they may be compromised by forestry operations. To collect the data in the field, the ESRI “ArcGIS Collector” application was used. GIS applications are an established tool in landscape planning and the acquisition of local data for it (KEMPA & LOVETT 2019). Using a base layer of the area, the elements were mapped in the shape of point, polygon, or line layers. This was sufficient since the elements that were to be mapped all fitted into one of these categories. Using the attachment function in “ArcGIS Collector”, photos of the elements were taken and connected to the respective elements. The photo documentation is vital to ensure that it is possible later to trace exactly which cultural assets are still existent, in which condition they are and what damage, if any, is present. The assets were located on the map via GPS using a tablet device during the field work with the “ArcGIS Collectore” application.

Since the 1994 map was only available in a pixel-based image and not as a GIS compatible file, the 1994 map was overlaid with the GIS map used for the survey in a simple Photoshop overlay. This map and the GPS function on the ESRI “ArcGIS Collector” were sufficient for orientation in the field.

During the time in the field, an interview and tour of the area with the forestry manager of Tranemålastiftelsen, Olle Mathiasson, was conducted on the 17th of March 2021 (MATHIASSON 2021). Mr. Mathiasson has been working on the area for many years and has in depth knowledge of the cultural assets and their location in the area. He is the expert in

the area and knows it better than any other person. Especially since he has worked with the history of the area in the past, his advice was very helpful. During the interview it was possible to get a better and broader understand of the area and during a circa two hours walk Mr. Mathiasson was so kind to show cultural assets in the area that would have been extremely hard to find without his help and also gave his assesment of the development of the place.

After the survey presumed, the collected data was cleaned. Adjustments were made whenever it improved the readability of the map, e.g., when the ends of two stone walls overlapped or stone walls and roads overlapped on the map due minor inaccuracies of the GPS during data collection. Afterwards, the different point, polygon and line layers were grouped into different categories, based on the 1994 map. For improved readability of the ESRI maps, north arrows were added in a simple Photoshop edit. Whenever this was done, it is noted with “altered” in the image caption.

2.4 Classification and Evaluation of Cultural Assets in Forests

The classification for cultural assets used for this thesis is based on the 1994 map of the area by Roland Offerell. The differentiations for cultural assets he used for the area are described as “kulturlämningar” (cultural relicts) (s. Figure 4 Detail cut legend of the map “Tranemåla Naturvärden och Kulturlämningar med Hydrologin” (in Swedish)).

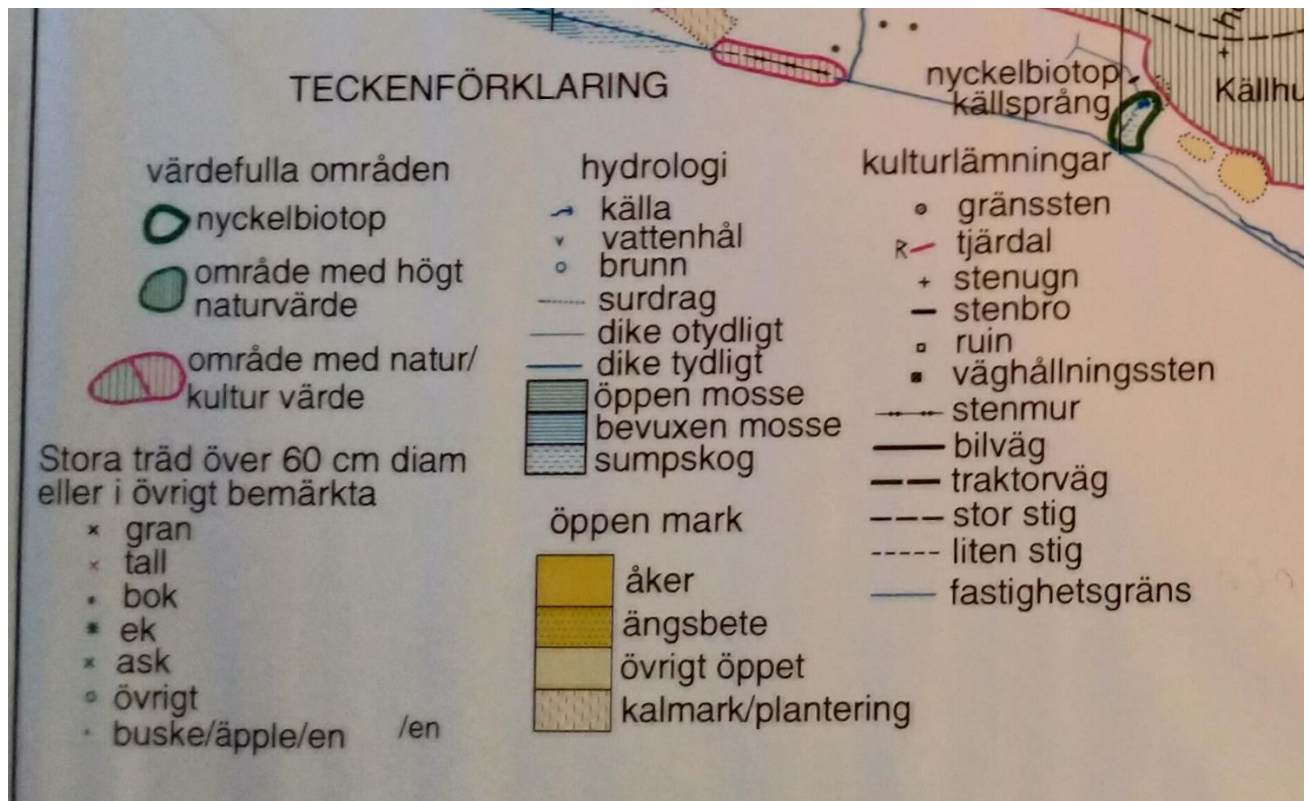


Figure 4 Detail cut legend of the map “Tranemåla Naturvärden och Kulturlämningar med Hydrologin” (in Swedish)

Because some of the cultural assets could not be found during this survey and for reasons of simplifications, the classification had to be adapted for the purpose of this thesis. In addition to his description of cultural relicts, he listed aspects like fields (åker) and forest meadows (ängsbete) which are also relicts of human activity in the area and accounted as such in this thesis. Offerell's mapping of trees with a diameter of over 60 cm was not repeated for this thesis since it would have exceeded the scope of work. The same goes for the hydrology aspect of the 1994 map.

Table 1 Assignments of Names 1994 map and this survey and explanations

Name 1994 map	Name used in this survey	Explanation (if change applicable)
Gränssten/boundary stone	Boundary stone	-
Tjärdal/tar valley	Tar valley	-
Stenugn/stone oven	Stone oven	-
Stenbro/stone bridge	Stone bridge	-
Ruin/ruin	Torp Stone base	The term torp is used whenever a small metal sign marks the presence of a torp/former torp. The term stone base was used when there were no metal signs marking a torp or a clearly visible past use but a stone base was clearly visible.
Vägnållningssten/road stone	-	No road stones were found during the survey.
Stenmur/stone wall	Stone wall	-
Bilväg/car road Traktorväg/tractor road	Road drivable Road not drivable	The names "road drivable" and "road not drivable" were chosen since it was not possible to determine whether the roads were suitable specially for cars or tractors.
Stor stig/large path Liten stig/small path	Path	The designation of just path was chosen since it seemed sufficient for the purpose of this study.
Brunn/well	Well	-
-	Alley trees	Since an extensive survey of the trees like for the 1994 was not suitable for the scope of this work, the alley trees were surveyed.
-	Meadow trees	s. explanation for Alley trees above
Monument/monument	Oak rondel	The oak rondel is not further specified in the 1994 map and since it represents such a unique feature of the area, a focus was put on it during this work.
-	Potato cellar	s. explanation for the Oak rondel above
-	Stone pile	Stone accumulations or piles created to prepare fields for cultivation (ANDERSEN & NYHLÉN 2011) are not further described in the 1994 map and are simply marked as "areas of natural and cultural values." Since this designation is rather spongy, it was omitted in this work and the designation "stone piles" was used.

The names of the assets that were not particularly surveyed for the 1994 map but were classified in this study are the alley tree, stone piles, meadow trees, the oak rondel and the potato cellar. After a discussion with Jörg Brunet, it became clear that the garden surrounding the house should not be discussed further in this work, as previous scientific work has already dealt with the subject of the restoration of the garden in great detail (ERICSSON 1994).

A helpful guide to gain an understanding of cultural heritage in Swedish forests was the book “Kulturmiljövård i skogen” (English: Heritage conservation in forests) by OLSSON (1992), published through the Swedish Forestry Agency. In this work, historical features like trees with traditions, bridges, boundary stones and paths and roads are described, among others (ebd.). This detailed description in an official basic work of the Swedish Forestry Agency also confirms the value of these elements that also can be found in Tranemåla. Since it was already evident from the preliminary inspections that the condition and type of finds would be very individual and that many elements only occurred in single digits numbers, strict quantification of the assets was not carried out. Thus, a purely qualitative analysis of the area was conducted, which also corresponds to the objectives of this work. A categorical assessment of damage to cultural relics, as is the case, for example, in the inventory of the Swedish Forest Agency (SKOGSSTYRELSEN 2021a), was not carried out because it was difficult to weigh the severity of damage and reversibility. Instead, damage was noted and documented photographically in order to be able to identify it later on.

A similar survey, even though at larger scale, was carried out by MARNTELL & WÅGBERG (2005) where they mapped cultural heritage in order for it to be protected (s. chapter 1.2). The classification was adapted to the type of site (Mid-Sweden) and here too, a GIS system was used to record the results of the mapping.

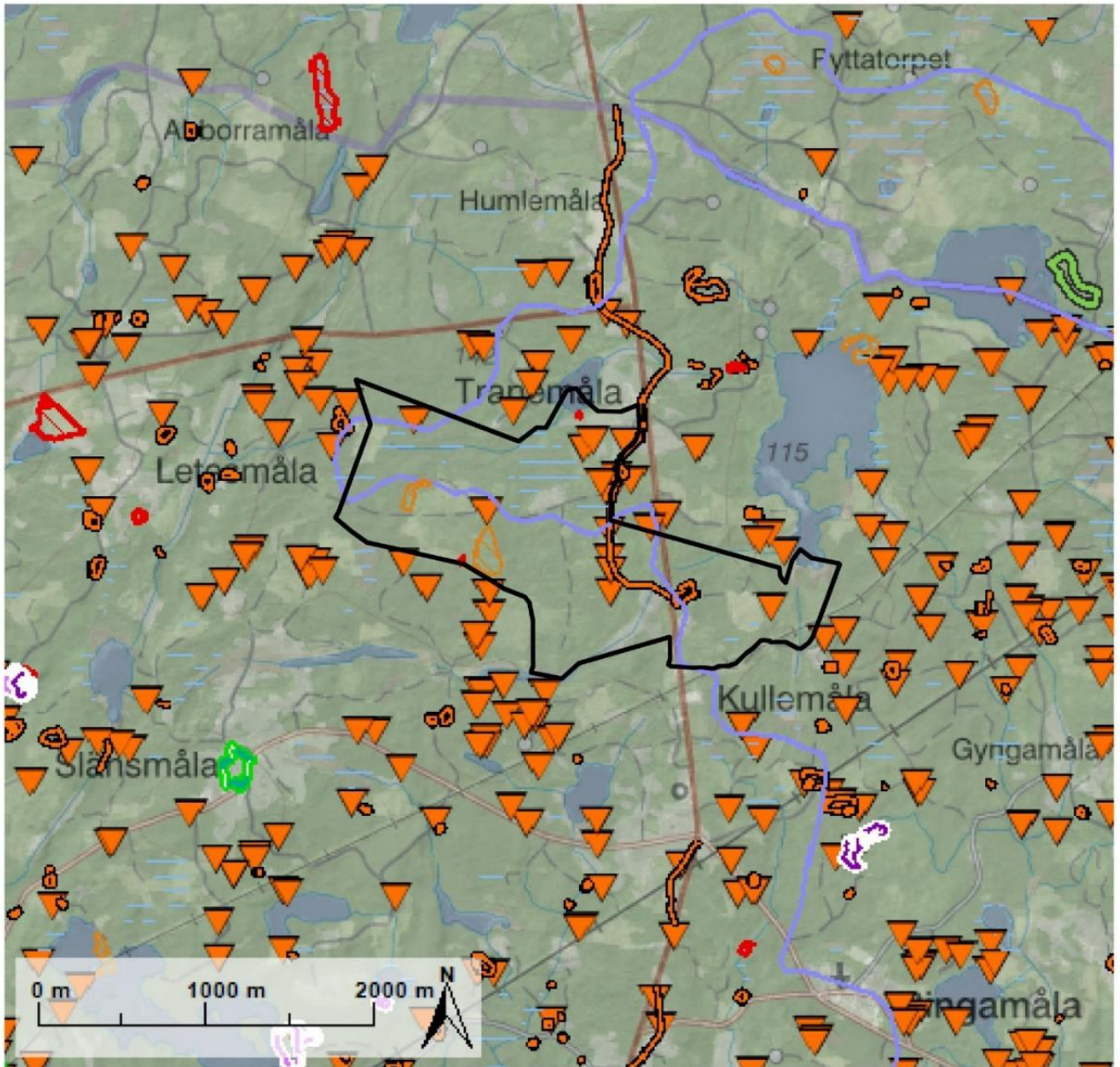
To gain an understanding of the development of cultural assets in the area the results of this survey are compared to historical maps of Tranemåla. To depict a course of time, five comparisons are made with maps from 1827, 1915, 1949, 1973 and the most recent map with cultural assets from 1994 by Roland Offrell, the map that served as a basis for this thesis. None of the maps but the one from 1994 are specified for cultural or historical values but regular or economical maps. However, these also serve to better understand the

historical development of the area. All but the map from 1994 are derived from the Swedish Land Survey Agency digital archives (HISTORISKA KARTOR | LANTMÄTERIET 2021). The historical maps are modified with today's property lines to simplify orientation and are sometimes enlarged to the area of interest, so the features are more visible. This too is marked with the word "altered" in the image caption. The unmodified and original versions of the historical maps can be found in the Appendix.

3 Results

3.1 Background Research Cultural Heritage in Tranemåla

A common source used in Sweden for identifying locations of cultural and historical importance is the Skogens Pärlor (English: Pearls of the Forest) file provided by the Swedish Forestry Agency (SKOGSSTYRELSEN 2021b). On the map below (Figure 5), this can be seen for Tranemåla and the surrounding area. The cultural-historical importance of the entire and surrounding area becomes clear. However, there are less locations of interests within the property borders of Tranemåla than outside. The property boundaries are marked with a black line. Holländarevägen is marked in orange as a cultural-historical relic, which's history is described in chapter 1.4 Tranemåla and Tranemålastiftelsen. Furthermore, especially in the vicinity of Holländarevägen many cultural relics (orange triangle) can be found, particularly through this map the cultural-historical value of Holländarevägen is once again emphasized. What is missing however, are the other many cultural relicts that can be found within the Tranemåla property lines. Due to the missing entries in the Skogens Pärlor map, the results of this work gain further importance.



Koordinater (mittpunkt N 6246072.6325 Ö 485914.79965)

Kartprojektion SWEREF99 TM © Lantmäteriet, 109-2011/2037

From the Forest Agency register

- Property boundary
- Clearcut
- Case
- Reindeer husbandry
- Swamp forest
- Ancient/cultural relics
- Forest and history
- Key biotope
- Natural value
- Biotope protection
- Conservation agreement
- Nature reserve
- Natura 2000 Habitat
- Natura 2000 Birds
- National Parks
- Watercourse with risk area
- Instable with steep slope
- Possible canyon
- Steep slope
- Area with risk of landslides

Executed final fellings

- 2011-2014
- 2006-2010
- 2000-2005
- 1969-1999
- Year missing
- Requested fellings
- Property boundary

Basic data is taken from the Forest Agency register

Figure 5 Skogens pärlor Map of Tranemåla and surroundings (Source: <https://kartor.skogsstyrelsen.se/kartor/>, altered)

3.2 The Cultural Assets of Tranemåla

The following map (Figure 6) shows an overview of the cultural historical assets found in Tranemåla which are further described in detail in Table 2.

The following different elements could be identified in Tranemåla. The various driveable and not driveable roads and paths that crisscross the entire area, with special attention to Holländarevägen, which runs first from north to south and then, after a bend in the middle of the area, from west to east. Paths that can only be walked are shown in green, while roads are shown in dark blue (driveable) and dark blue dashed (not driveable).

Along many of the roads or paths there are stone walls, which are in various states. They are shown in orange dashed lines on the map.

The pastures that are directly around Tranemåla House and south of the House, east and west of Holländarevägen. They are shown as polygons in light green on the map. In the pasture directly south of the house are two features that are unique to the area. The oak rondel (polygon dark green) and the potato cellar house (polygon purple).

At the entrance to the house there is an avenue lining the driveway (dark green points). Around the house on the pastures there are old willow trees (light green points).

On the borders of the area (purple solid line) there are eight boundary stones (orange points) that mark the area.

Along small streams and former drainage ditches there are a total of twelve different stone bridges (medium blue points).

In the area there are four different torps (brown points), along roads. Often near the torps there are wells to be found (light blue points). Stone bases, which could be identified as such, but where it was no longer obvious what purpose they served, are shown as pink points on the map. Olle Mathiasson's help was especially valuable in locating the stone foundations and stone ovens. There are three stone ovens in the area (red points), which were used here for flax drying (MATHIASSON 2021). The three tar valleys in the area are marked as purple dots on the map. Two individual elements are the large stone pile (crimson point) in the south of the area and the gate (dark purple point) that marks the entrance to a torp in the east of the area. As "Other" (gray points) are marked the oak key biotope between lake Tranesjön and Tranemåla house and a former location of a stone bridge.

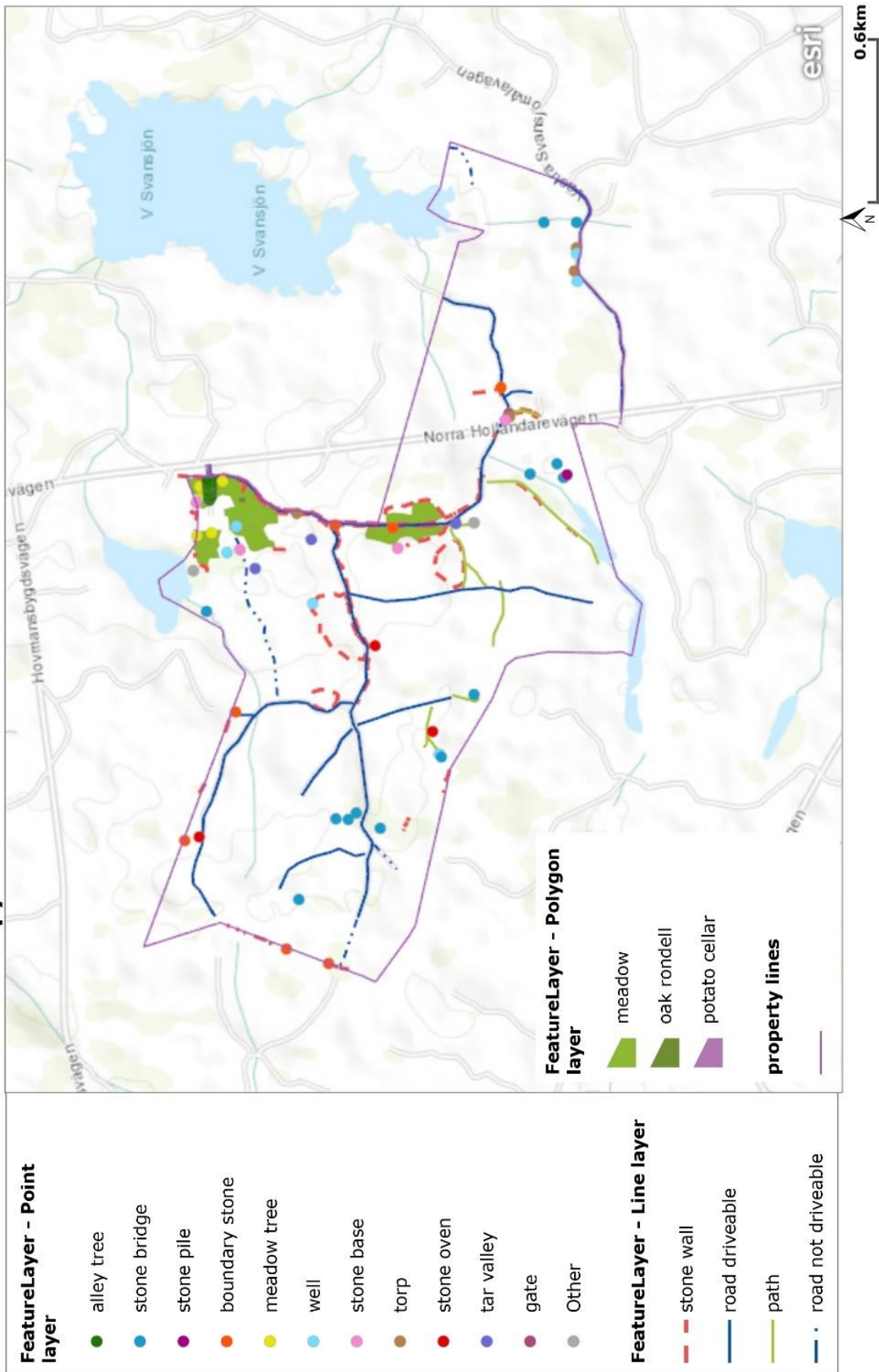










Figure 6 Overview of the surveyed area in Tranemåla (Source: own map created with esri ArcGIS and Collector, altered)




Table 2 includes an example picture and a description on the general status of the cultural assets throughout the area. The objects are described in more detail and common damages are listed and the photo serves for better understanding. Thus, the assignment of the individual elements is made possible. Also, the number or length of the elements is listed in the left column under the name.




Table 2 Cultural Assets of Tranemåla (Sources Photos by the Author)



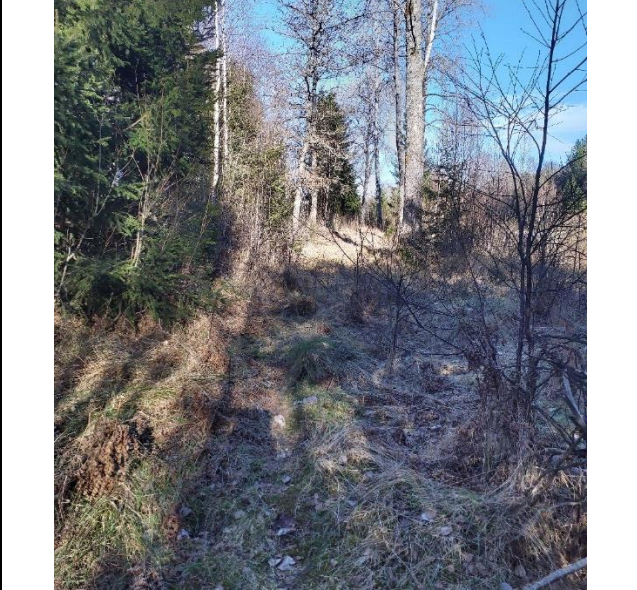
Name and Number or length of surveyed assets	Picture	Description
<p>Alley trees</p> <p>Number: 18 Alley trees lead up to the Tranemåla house.</p>		<p>The alley trees lie on the driveway road towards the estate house behind a stone wall framing two meadows. They are in a varying condition with some larger branches that have (partially) fallen. The trees have a circumference of 130 cm – 240 cm, so different age stages can be concluded.</p>
<p>Stone bridges</p> <p>Number: Twelve stone bridges were surveyed in the area.</p>		<p>The stone bridges are often barely visible. Often overgrown with small trees and shrubs, always covered in moss. Sometimes single stones are missing, or the bridge consists of a few big rocks, lying in the watercourse.</p>


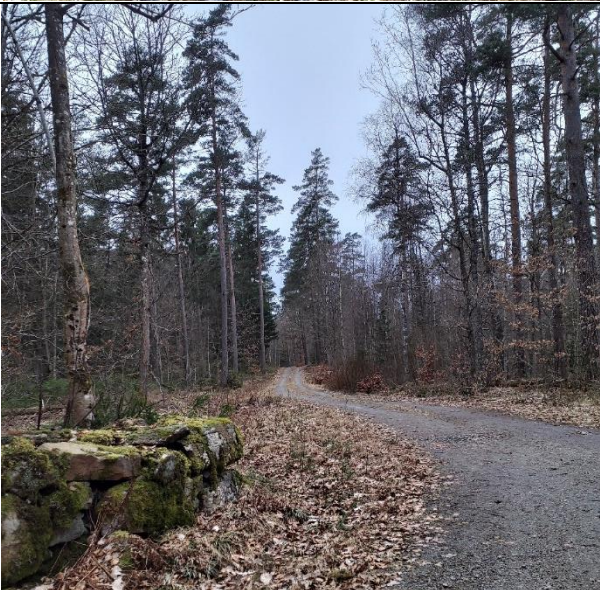
<p>Stone pile</p> <p>Number: The one significant and large pile (s. picture to the left) can be found northeast of lake Långasjögl.</p>		<p>Smaller stone piles can be found throughout the area, often overgrown with moss or single shrubs. They are located close to former agricultural fields where the stones needed to be removed to be able to use the land for crop production. For the purpose of this study it would have been out of scope to map all these smaller stone piles.</p>
<p>Boundary stones</p> <p>Number: Eight boundary stones can be found.</p>		<p>Boundary stones can be found in the surveyed area with one stone missing where a location is marked on the map from 1994 by Roland Offrell. Usually, the stones have a low visibility but sometimes they are marked with colored plastic poles to increase visibility. Often the stones are crooked and former inscriptions are not visible anymore. The stones are often overgrown with a layer of moss.</p>
<p>Meadow trees</p> <p>Number: Six Meadow trees were found on the meadow around the house, excluding the oak rondel.</p>		<p>Meadow trees can be found on the meadows surrounding the estate's house. Some of them are visibly at a late succession state with dead or hollow branches. They add a meadow typical character for a former farmhouse estate.</p>

<p>Wells</p> <p>Number: Six</p>		<p>The former wells that were found in the area were barely visible, overgrown with shrubs. Often the stones were falling apart, barely marking a well. Next to one torp east of Norra Holländarevägen.</p>
<p>Stone bases</p> <p>Number: Five</p>		<p>Stone bases can be found in five different locations in the area. The category was chosen because in these cases, it was not possible to determine what these bases were used for in the past or which structures were built on them. They are overgrown with shrubs and small trees and often the stones not in their original positions.</p>
<p>Torp</p> <p>Number: Four</p>		<p>All of the found torps were marked with small metal signs. Three of the torps were in a ruin state or barely visible. As seen in the picture, they are overgrown with moss, shrubs, and small trees. The most eastern torp has been rebuilt and restored or has been kept in shape over the years. It is not used by the Tranemåla foundation; however it is marked with a Tranemåla metal sign.</p>

<p>Stone ovens</p> <p>Number: Three</p>		<p>Two of the three found stone ovens were in a good condition and it was visible that they used to be ovens. These two were found with the help of Olle Mathiasson during his visit. The third oven, which was marked on the 1994 map, was barely visible as an indentation in the ground with the stones overgrown by fern and moss.</p>
<p>Tar valleys</p> <p>Number: Three</p>		<p>All of the three found tar valleys were marked on Roland Offrells 1994 map. The one closest to the estate house was visible due to medium height tree stumps which marked the valley. The other two were barely visible and not marked.</p>
<p>Gate</p> <p>Number: One gate next to a torp.</p>		<p>The gates present a unique feature in the area, in front of the torp close to Norra Holländarevägen. Today, the gate only consists of four vertical beams marking the entrance to the torp. The connecting elements are not existent anymore.</p>

<p>Others</p> <p>One key biotope surrounding an old oak.</p> <p>One former location of a stone bridge that is no longer existent.</p>		<p>The old large oak northwest of the house and close to Lake Tranesjön. Key biotopes are used by the Swedish Forest Agency to protect areas with natural values, often representing old-growth structures that no longer exist in the surrounding environment (SKOGSSTYRELSEN 2021c).</p> <p>The second feature marked as “Others” is south of the southwestern meadow along Holländarevägen. In the 1994 map this was marked as the location of a stone bridge. However, this stone bridge is no longer existent.</p>
<p>Stone walls</p> <p>Total length: The total length of the walls amounts to 12,367 kilometers.</p>		<p>Stone walls represent the bulk of cultural assets in the area. They vary extremely in condition, from neatly stacked and visible as a stone wall, to all stones jumbled up and barely recognizable as a stone wall. Often, they are overgrown with trees and shrubs or damaged through forestry operations or trampling.</p>
<p>Meadows:</p> <p>Number and Total Area: There are five meadows around the Tranemåla house and south of it. The total area amounts to 24,1 ha.</p>		<p>Grazing meadows can be found around the house and further south along Holländarevägen. In the past these cleared areas were used for crop farming (ANDERSEN & NYHLÉN 2011).</p>

<p>The oak rondel</p>		<p>The oak rondel south of the estate is a signature cultural asset of Tranemåla and not typical for the area. A small table made from an old millstone is the centerpiece on top of the rondel.</p>
<p>The potato cellar</p>		<p>The potato cellar is another unique feature of the Tranemåla estate. The small building is located southwest of the house. The house itself is in good shape. However, it is slightly hidden away by some surrounding trees and shrubs.</p>
<p>Paths</p>		<p>Smaller paths that can not be passed with cars can be found throughout the entire area. In many instances it is visible that the paths have not been used much during the past. They are overgrown by shrubs or smaller trees.</p>

<p>Roads not driveable</p>		<p>Roads that are not passable via car can be found especially connected to passable roads or as an extension of them. It is visible that very little maintenance of these not driveable roads has been taken place. Like the paths, they are overgrown with shrubs or tree trunks have fallen over, as it can be seen in the photo on the left.</p>
<p>Roads driveable</p>		<p>Driveable roads are spread out through the survey area. They are maintained well enough so that they can be passed by car. No shrubs or trees are growing over the roads and the road surface is even.</p>

3.3 Evaluation of Cultural Assets in Tranemåla

3.3.1 Historical Classification

To compare the maps with this survey, the result map is modified with numbers to show the locations of point of interest. For the sake of completeness, it should be mentioned that there is also a map of the area from 1774, which was intended to clarify the land ownership situation between Tranemåla and Swansiömåla south of Lake Svansjön. However, since no other landscape features are noted on this map, it does not play a role in the historical classification of cultural-historical features. The map can be found in the Appendix.

1827

The oldest extensive and still existing map of the Tranemåla area is the “Laga skifte” land redistribution map below (Figure 8) from 1827 from the archive of the Swedish Land Surveying Agency (HISTORISKA KARTOR | LANTMÄTERIET 2021). Principally, areas that are marked with a large “B” on the 1827 map nowadays belong to Tranemålastiftelsen. Elements that were already noted on the 1827 map are noted with numbers in Figure 7 below.

The house of Tranemåla estate (1) is clearly marked on the map from 1827, even though the layout of the buildings has changed since then. Surrounding the buildings are cleared areas (2) that were used for agriculture and cattle farming and are now only used for cattle farming in the summer months. The historically most relevant feature is the Holländarevägen (3), a former regional road for trade, also used by Swedish emigrants from Småland to get to the large ports of The Netherlands and from there on further west to North America during the 19th century. Further similarities are two meadows (4) lying east and west of Holländarevägen south of the Tranemåla house. These can also be found in the 1827 map, however with more rocks marked on the perimeter of the field which has now been cleared of stones. Also seen on the 1827 map is a path enclosed by stone walls leading westward (5). Presumably these walls were for the purpose of keeping cattle on track when herding them from one pasture to another (ANDERSEN & NYHLÉN 2011).

Generally, it can be said that many elements of Tranemåla were already existent around 200 years ago and partly even further back. Further backdating is not possible here due to

a lack of further map material. Especially the courses of paths, already existing walls and pastures and fields are to be emphasized. It should also be noted that the main boundaries of Tranemåla have not shifted significantly since at least 1827, which further emphasizes their historical significance as a testimony of the land reform (Laga Skifte) in the area (HELMFRID 1961).

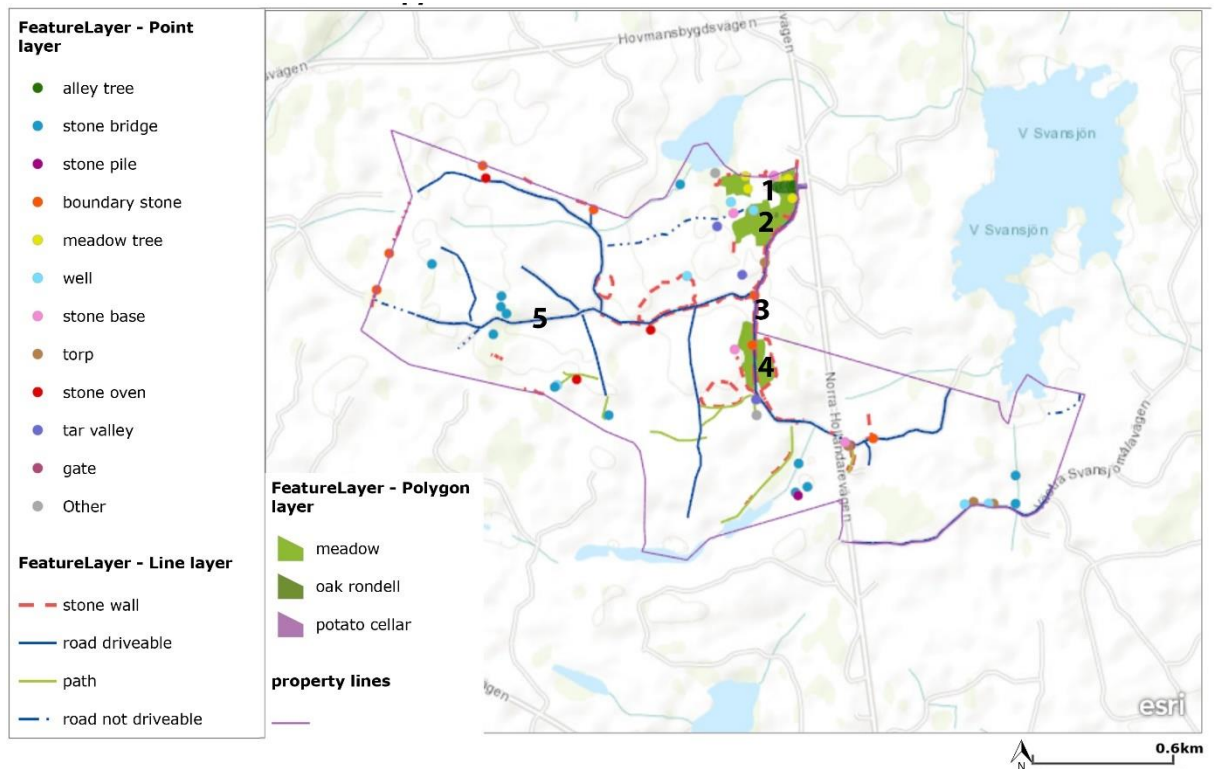


Figure 7 Comparison to map from 1827 (Source: own map created with esri ArcGIS and Collector, altered)

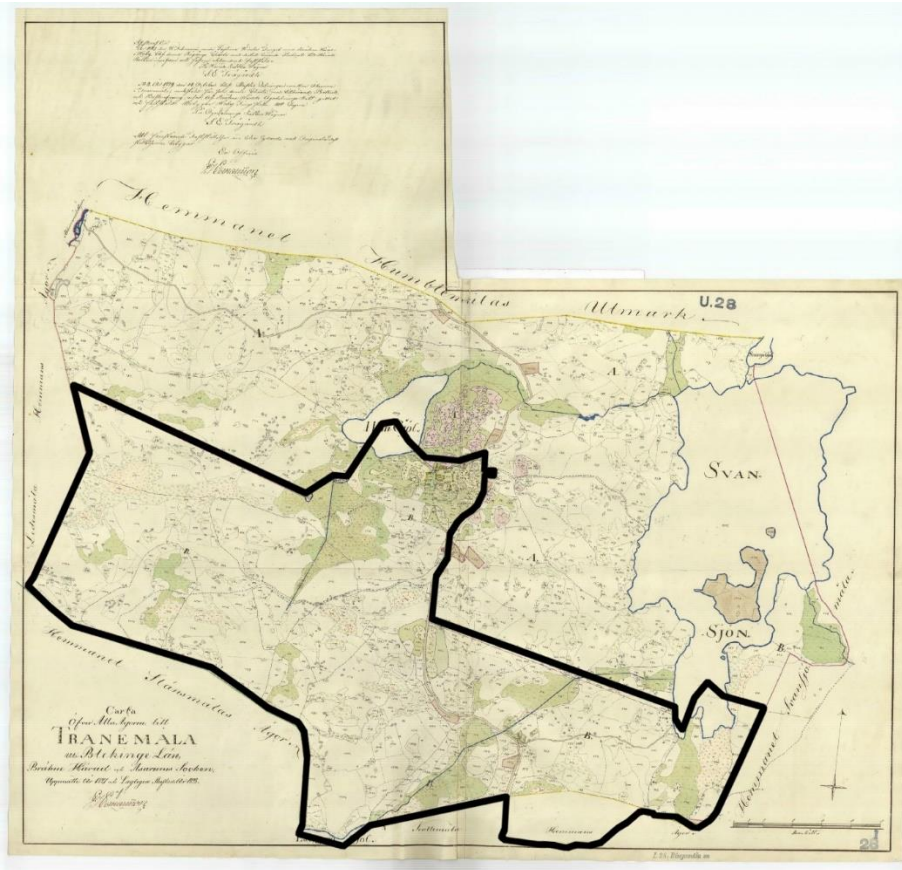


Figure 8 Map over Tranemåla from 1827 with current property borders in black (Source: (HISTORISKA KARTOR / LANTMÄTERIET 2021), altered)

1915

The second comparison is held with a map from 1915 (Figure 10). This very detailed map shows differentiated uses like pastures, mowed meadows and open but uncultivated land such as swamps.

In Figure 9 the similarities of different features are depicted. The meadows for hay production (1) around the house are clearly visible in the 1915 map marked with green. The yellow areas indicate crop fields for food production (2, 3, 4, 5, 6, 7 and 8). At this point in time, anything that could possibly be transformed into arable land through drainage, was transformed (ROBERGE et al. 2020). At the time, the cattle were grazing in the forest (KARDELL 2012), indicated by the white areas on the map. It can be seen here, that around 1915, the amount of crop fields was at a historical maximum. In comparison to the 1827 map, mowed meadows have disappeared since the management was not profitable.

All the stone walls of these areas are still existent today. Today they are either cleared and still used for cattle in the summer months (e.g., 5) or used for forestry experiments like in

area 2. Historically, the stone walls around arable lands were first used to keep the cattle outside the fields. When independent cultivation of food was no longer profitable in the course of modernization of the food industry, it can be assumed that the animals were then kept inside the walls for grazing.

Areas that were also free of trees in 1915 but do not have any surrounding stone walls areas 6, 7 and 8. It can be assumed that these were fences with wooden fences at the time to keep the cattle of the arable land. These areas are marked as a yellow area in the 1915 maps which indicate farmland. Still existent drainage ditches, stone bridge and a stone pile in area 8 further prove more intense activity here. It can be assumed that the large stone pile in the south of the survey area resulted from clearing these areas for agricultural use (ANDERSEN & NYHLÉN 2011)

Further notable are the roads (9) that were already clearly marked on the 1915 map. On the roadside there are still either complete (e.g., Holländarevägen) or partial walls today. These roads lead to the areas surrounded by walls to either get to the farmland or herd the cattle from one pasture to another.

An increased demand for timber due to the establishment of steam saws and a rising demand for pulp took place in Sweden around 1890, around 25 years before this map was published (NYLUND 2009). This higher demand for timber and subsequent fellings is not visible in this map since most areas are forested.

Many elements that are still visible today can be found in the map from 1915 with more clear distinction than in the 1827 map. Elements like former crop fields surrounded with stone walls notably hint at intense anthropogenic activity in the area circa a hundred years ago.

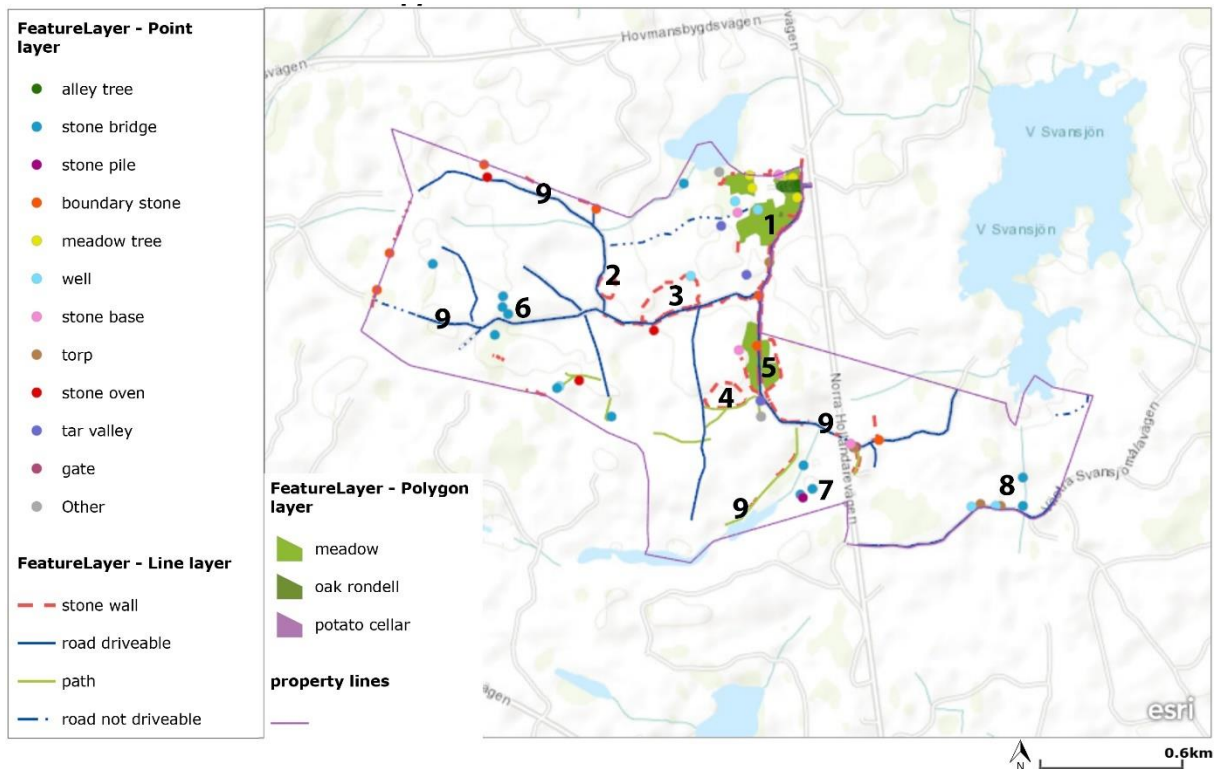


Figure 9 Comparison to map from 1915 (Source: own map created with esri ArcGIS and Collector, altered)

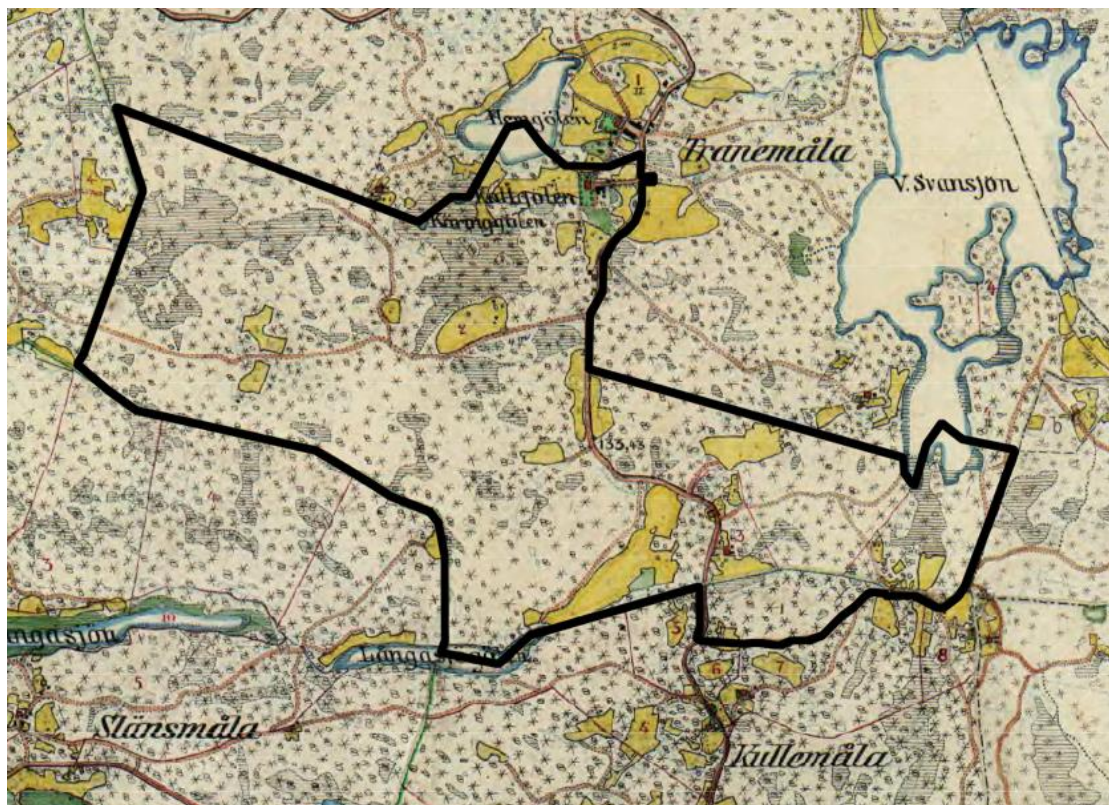


Figure 10 Map over Tranemåla from 1915 with current property borders in black (Source (HISTORISKA KARTOR | LANTMÄTERIET 2021), altered)

1949

The map from 1949 from the general national map series (Figure 12) of Sweden depicts very clearly the development in the area that has happened since 1915. An extensive legend simplifies the readability of the map (s. Appendix). In Figure 11 the differences and developments are marked by numbers. This map has symbols (a large K or R) for buildings of cultural historic value and tar valleys in its legend, but the symbols do not appear on the area of the Tranemåla estate.

The meadows surrounding the house (1) were still not connected with each other like they are today. Since they were separated it can be assumed that the southern field was used by the inhabitants of the torp directly south of the Tranemåla main house. One of the biggest developments is the road Norra Holländarevägen (2) running straight through the area and dividing it in two parts. It also crosses the historically significant Holländarevägen. The former pastures marked with a 3 are still clearly used for agricultural purposes and not forestry in 1949. The same goes for the fields marked with a 4, which are not distinctly visible as open field anymore today.

A feature not marked as a cultural heritage but that should still be mentioned here is the electricity supply line that runs through the forest in the north western corner of the area. While it can not necessarily be classified as a cultural historic feature, it is still evidence of anthropogenic activity and technological advancements in Sweden. Roads marked with a 6 have been developed or extended since the map of 1915, presumably for forest operations.

Finally, it is to say that the map from 1949 shows much more similarities with today's conditions than the former maps. Even if there are no entries of cultural historic features, a development of anthropogenic activity is still visible. The largest difference are pastures and fields that are still marked as open landscape in this map while they are mostly overgrown by trees or rewetted nowadays.

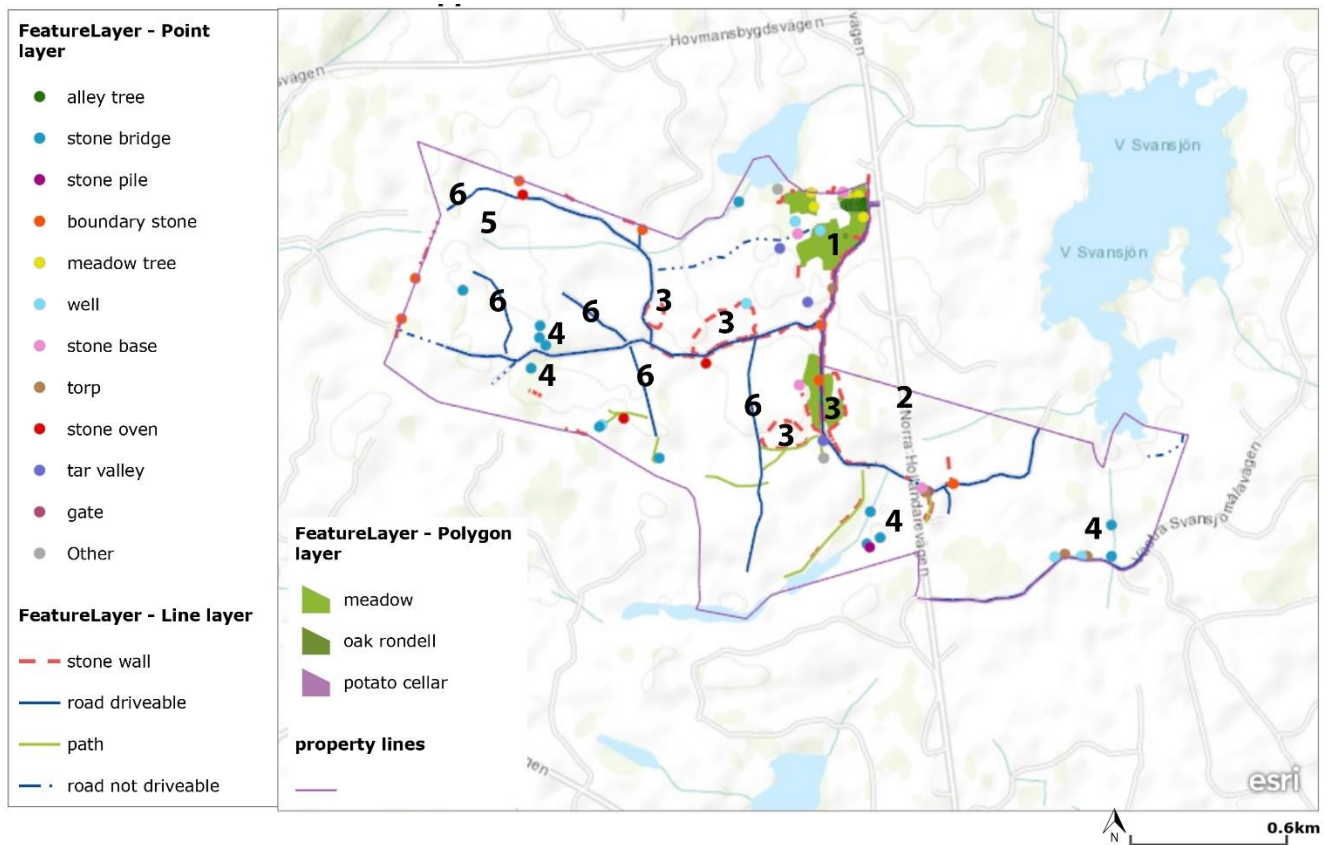


Figure 11 Comparison to map from 1949 (Source: own map created with esri ArcGIS and Collector, altered)

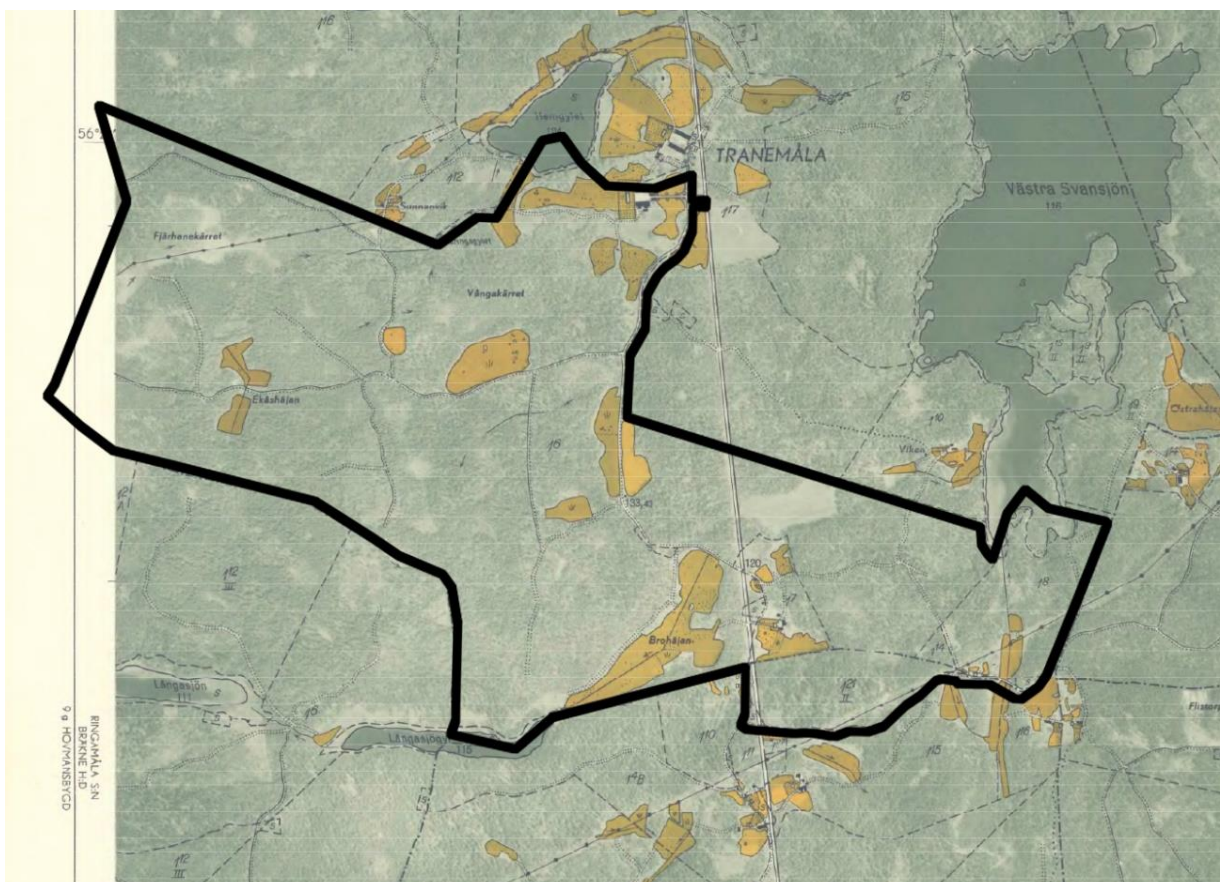


Figure 12 Map over Tranemåla from 1949 with current property borders in black (Source (www: (HISTORISKA KARTOR / LANTMÄTERIET 2021)

1973

In the map of 1973 from the general national map series of Sweden (Figure 14) some changes in the landscape that have taken place since 1949 are illustrated. Not counting the 1994 map by Roland Offrell this is the most recent map used in this work to depict the development of the area. Like the map from 1949, this map has symbols (a large K or R) for buildings of cultural historic value and tar valleys in its legend, but the symbols do not appear on the area of the Tranemåla estate on this map either.

In Figure 13 the comparisons to the map from 1973 can be seen. The open fields (1) that are still open today and used as cattle pastures are marked as such in the 1973 map. In contrast to these still open fields, three other pastures (2) surrounded by stone walls are not marked as open field anymore, presumably letting get overgrown or used for forestry purposes. The same goes for formerly open areas not surrounded by stone walls (3) that are not marked as open anymore in the 1973 map. Forest grazing lost its importance after the World War II as forest use gravitated primarily to timber production (ROBERGE et al. 2020). In 1848 forest grazing was banned since it interfered with production goals (cattle eating seedlings and young trees) (NYLUND 2009). While this was already implemented by the time the last map (1949) was published, the effect is just visible in this map. Furthermore, a path (4) connecting the house to the road in the north of the area was established before 1973. It can be assumed that the area in the northwest became more important with the decline of agricultural activity and increase of forestry in the area.

The largest differences to the former map are the once open fields (either surrounded by stone walls or not) that were already overgrown in the 1973 and are still to this day. Through this, the progressive decline of agriculture in the area becomes clear.

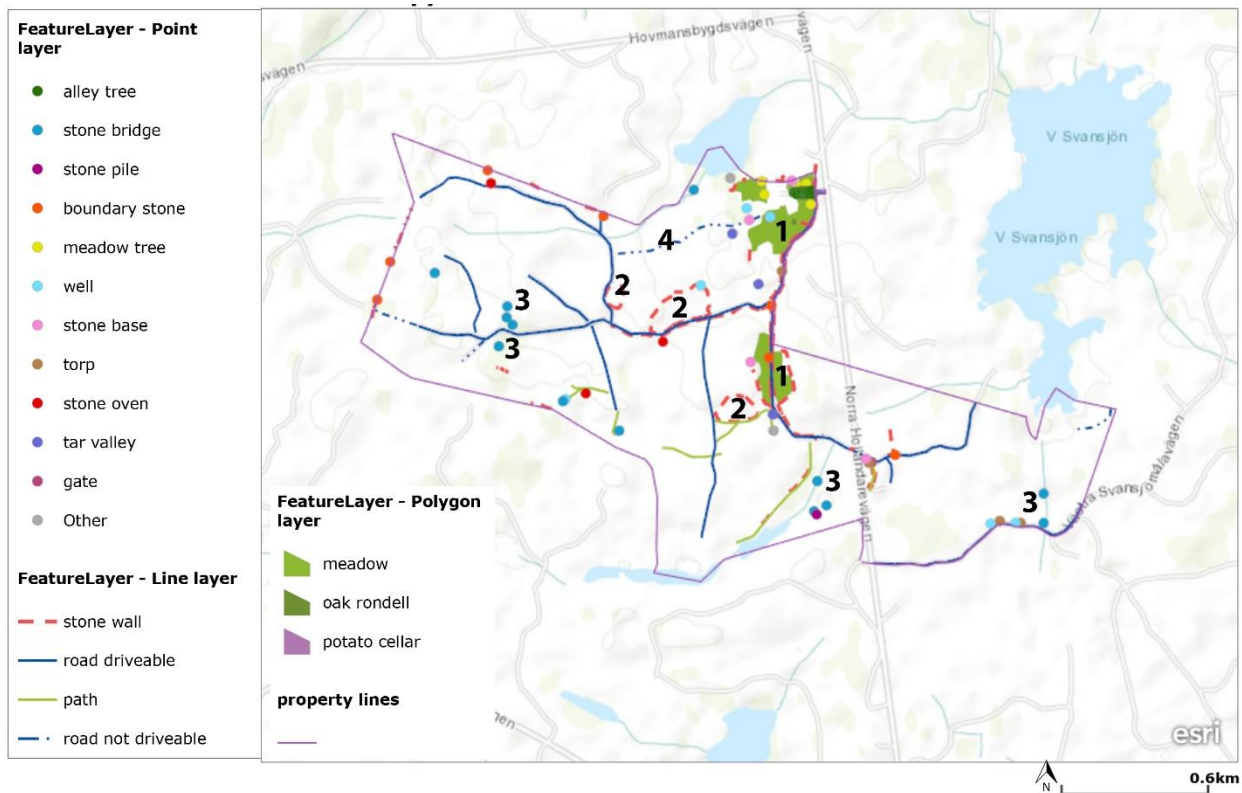


Figure 13 Comparison to map from 1973 (Source: own map created with esri ArcGIS and Collector, altered)

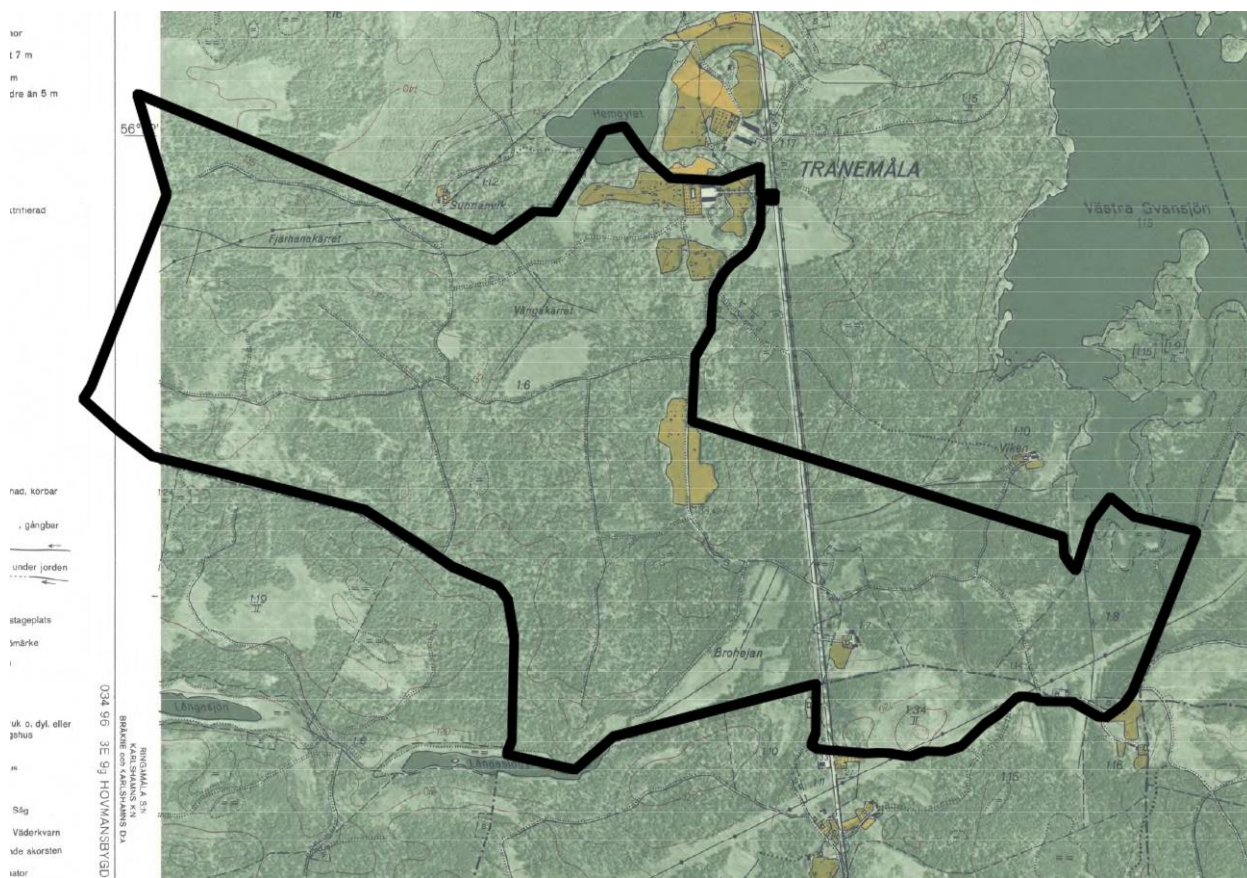


Figure 14 Map over Tranemåla from 1973 with current property borders in black (HISTORISKA KARTOR | LANTMÄTERIET 2021)

1994

This last comparison is concerned with depicting the differences between the findings of this survey and the finding of Roland Offrell from 1994, which also served as a basis for this survey. This classification is less of an historical rating but more of an update of the 1994 map since this is the latest survey of cultural assets of the area. Only some differences were found between the two maps, which are described in the following. To locate the differences, refer to the map below and compare the numbers (Figure 15). For the 1994 map see Figure 3 page 16.

A stone wall (1) in the southwest of the survey area is further east than indicated on the 1994 map. A path (2) that once lead up to the wall does not lead as far anymore as it did 27 years ago. In the 1994 map there is a stone bridge (3) indicated at a path and the path also led beyond the crossing of the water stream. Neither is the stone bridge still there, nor does the path lead beyond the crossing. The location is here marked with a grey point. The path (4) leading away westward from the estate was once marked as a drivable road, nowadays however it is extremely overgrown with shrubs and young trees and even barely passable by foot. At the western property line, a stone (5) that looks like a boundary stone was found here that is not marked on the 1994 map. However, it is not clear whether it really is a boundary stone. A boundary stone (6) that is marked on the southwestern border in the 1994 map was not found. The conditions during the survey were quite swampy and therefore made it harder to navigate the area which might have played into it. In the 1994 map this south warding road and the path (7) connect, but this connection is not existent anymore. In fact, the area is completely overgrown with trees and shrubs.

All together the differences between the 1994 map and this survey are not too significant. Since the condition of the stone walls or other cultural features was not noted in the 1994 map it is hard to tell how much has changed in the past 27 years. What is clear, however, is that some small paths that are likely not of importance to forestry have not been maintained.

It should also be mentioned that no comparisons can be made for the area east of Norra Holländarevägen as there is no recent map of this area. There may also have been recent changes due to forestry, especially the latest forestry activities (e.g., clear-cutting directly east of the road) that cannot be directly traced.

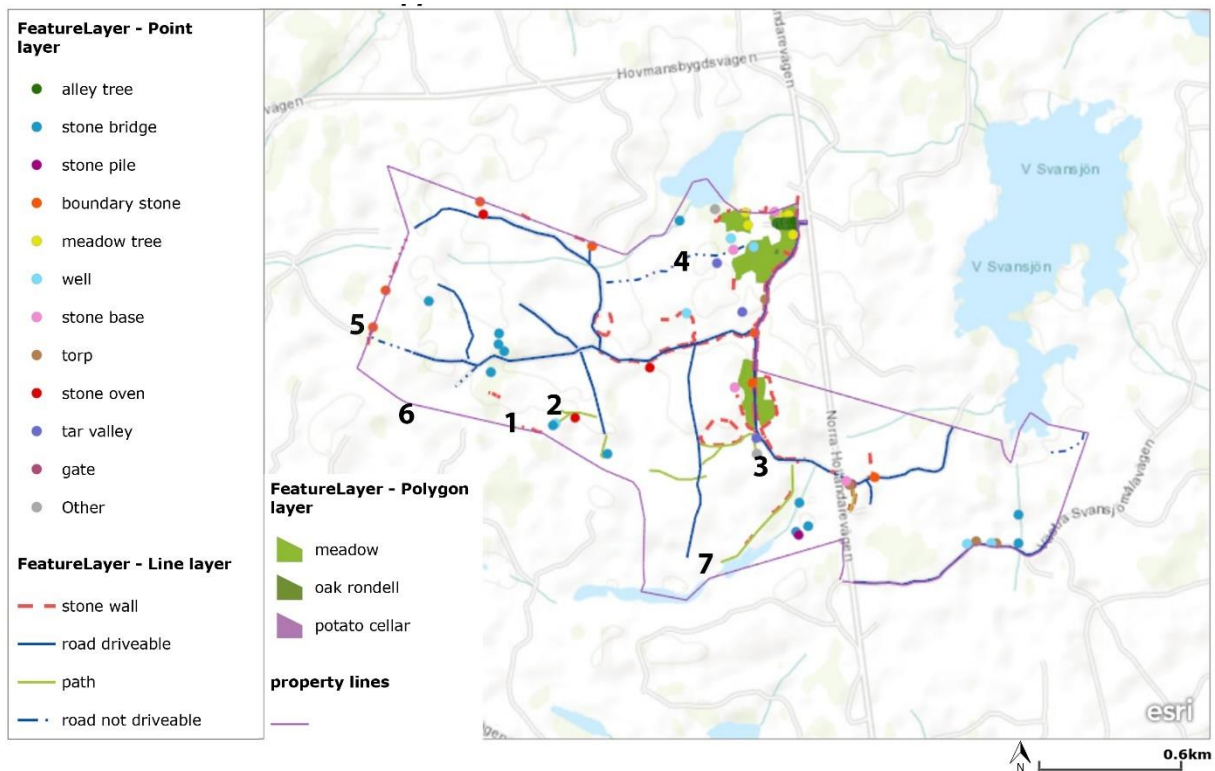


Figure 15 Comparison to map from 1994 (Source: own map created with esri ArcGIS and Collector, altered)

The Tranemåla estate has evolved a lot over the last 200 years. However, it is notable how much of the cultural assets are still preserved to this day. Starting out with the clearing of distinct areas of rocks to use them as pastures or agricultural fields (ANDERSEN & NYHLÉN 2011). The spare stones were then used for stone walls, initially to keep cattle out of crop fields, and later to keep them inside their sown pastures or to mark property boundaries, together with boundary stones. Over time, more open fields have been established together with roads that lead to them to herd the cattle. Here too, stone walls were used as guidance alongside the roads. With the decline of intense agricultural use (NYLUND 2009), the once cleared areas became more overgrown and the stone walls that were once used to herd cattle partially slowly deteriorated over time. Due to this falling intensity of use, roads that were once used are now overgrown.

Cultural assets that are of value but not marked in any of the maps before 1994 are for example the oak rondell as a unique feature of the area. Furthermore, none of the stone bridges, ovens, torps, or tar valleys are marked, even though the maps from 1949 and 1973 have a symbol for buildings of culture historical value and tar valleys in their legends.

To conclude the historical evaluation of the Tranemåla property as it is explained in this chapter, it can be said that the evolvement of the landscape in Sweden can be seen even in this rather small area.

3.3.2 Spatial Distribution of Cultural Assets

To gain a better understanding of the condition of the cultural assets of Tranemåla, the following maps will depict different assets, grouped in one map when sensible. The maps include photos showing typical conditions of the assets or damaged that have occurred over time.

For a more detailed insight, the following link leads to the digital version of the map where every single asset can be manually selected and one or more photos of the asset, as well as the exact location can be found.

<https://gis-slu.maps.arcgis.com/apps/instant/attachmentviewer/index.html?appid=bb23de16895b4c9398183322c361bdfe>

Stone Walls

Stone walls are the most visible and common cultural heritage asset that can be found in Tranemåla, they border the main roads leading away from the manor and can also be found on the property lines, marking them. In addition to that, they surround four former cropfield/pastures west of or bordering Holländarevägen.

In total, the measured length of all stone walls amounts to 12.367 kilometers.

Often it is visible that not much maintenance of the walls has been taken place during recent years. The pictures on the map below (Figure 16) depict three of the most common problems found with the stone walls in Tranemåla. Overfallen branches or tree trunks have damaged the walls and caused a disarray of the stones. In some parts, the impact was so severe that it caused a complete collapse of parts of the wall. Another common problem are trees growing very close to the walls which can cause damage through root growth. Here, the value of the tree must be weighed against that of the stone wall.

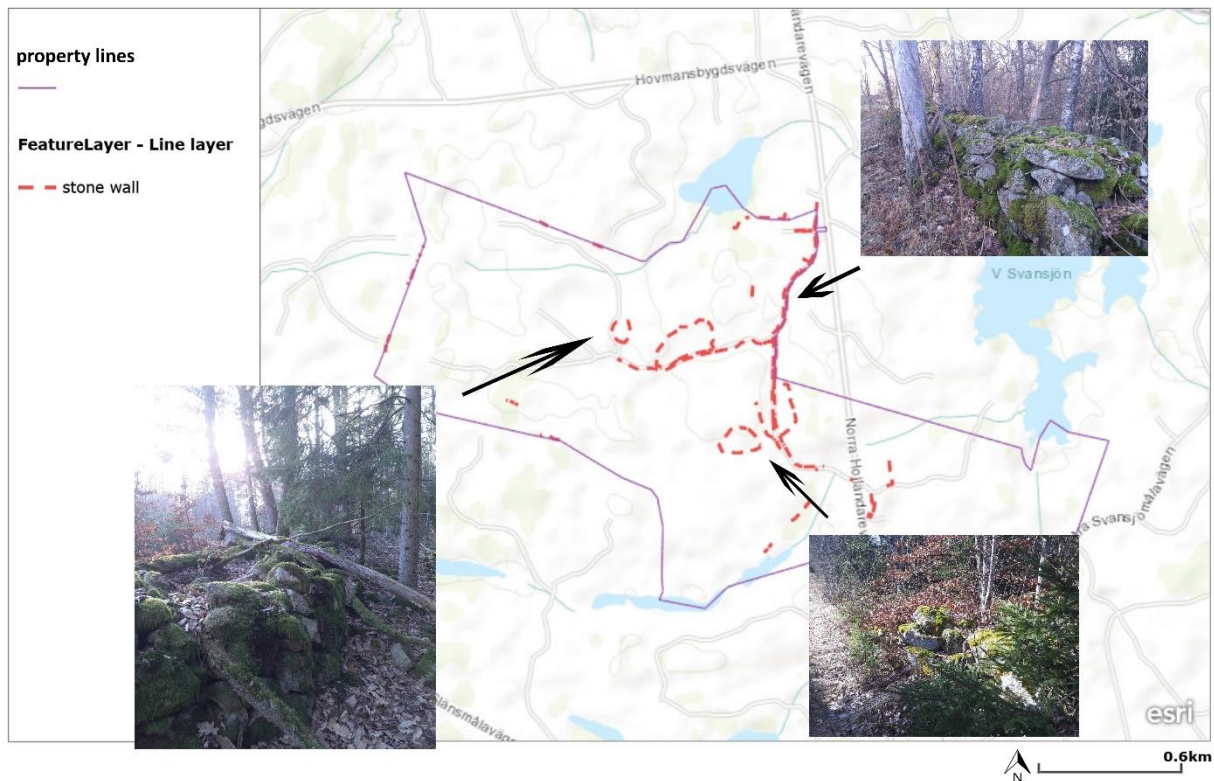


Figure 16 Distribution of stone walls in Tranemåla with Photos (Source: own map created with esri ArcGIS and Collector, altered, own photos)

Roads and Paths

In general, the roads and paths in the surveyed area are evenly spread out over the Tranemåla estate and therefore make everything accessible as it can be seen in Figure 17. The main roads, that are used most often and marked as “driveable” are kept up and are all accessible by car. Some roads that were once driveable are now overgrown with trees and shrubs. This poses a common issue on the roads that are not necessary for access during forestry activities. Some connecting paths are overgrowing as well and it can be hard to use them even by foot. Usually, the road surfacing consists of rubble and pebbles that have been condensed over time. In one case in the east of the area, new road surfacing was applied to improve access for forestry machinery to reach a recent clear-cut in the east of Tranemåla.



Figure 17 Distribution of paths and roads in Tranemåla with Photos (Source: own map created with esri ArcGIS and Collector, altered, own photos)

Meadows, Potato Cellar and Oak Rondel

All the still existent meadows, the potato cellar and the oak rondel are in proximity to the house (Figure 18).

The meadows surrounding the house and south of it are generally in a good condition since they are used for cattle pasture every summer by a farmer from the area. This is generally of advantage to keep the pastures open and have them visible as such. Some large dead tree trunks can be found on the meadow directly south of the house. They do not represent any disturbance and can even be useful by providing deadwood to support higher biodiversity (MARTIN et al. 2021). Cow pastures and forest grazing play a particularly interesting role in Swedish history. Their emergence and disappearance depict the evolution of Swedish forestry in combination with the agricultural use during the 20th century (KARDELL 2012).

Consisting of a near round elevation that is circa on meter above the surrounding ground and bordered with a stone wall to keep the shape, the oak rondel represents a unique feature of the area south of the house. On top of the elevation, circa 10 large oaks and some

upcoming shrubs can be found. A small stairway of stones leads up to the oaks and allows entry to the rondel. In the middle of the oaks, a small picnic table can be found which is made from an old millstone. A fence is surrounding the rondel on the outside of the stone wall to protect the feature from potential damages by cattle.

The potato cellar is a singular building on the meadow southwest of the house. It consists of a small cabin with a ground floor and a cellar that has a door on the side of the house. To enter the ground floor, a main door can be found in the front, framed by two windows. The building is currently used as storage space for old farming machinery. Surrounding the building are several medium sized shrubs that can hinder the view of the potato cellar during the summer month with their foliage.



Figure 18 Distribution of meadows, oak rondel and potato cellar in Tranemåla with Photos (Source: own map created with esri ArcGIS and Collector, altered, own photos)

Alley and Meadow Trees

All alley and meadow trees are directly surrounding the Tranemåla house (Figure 19).

The alley trees consist of a row of trees on the side of the driveway leading up to the main house from Holländarevägen and Norra Holländarevägen. There are 17 trees in total, ten on the northern and seven on the southern side of the road. While they are generally in a good condition and clearly visible as an alley, some fallen down branches and parts of trees are not only visually unpleasant but could be dangerous for people or even cars coming by.

The meadow trees are six trees of medium size spread around the meadows directly surrounding the house. While they are in generally good shape and without any visible large damages, the exact condition could not be determined since the vegetation period had not started yet at the time of this survey.

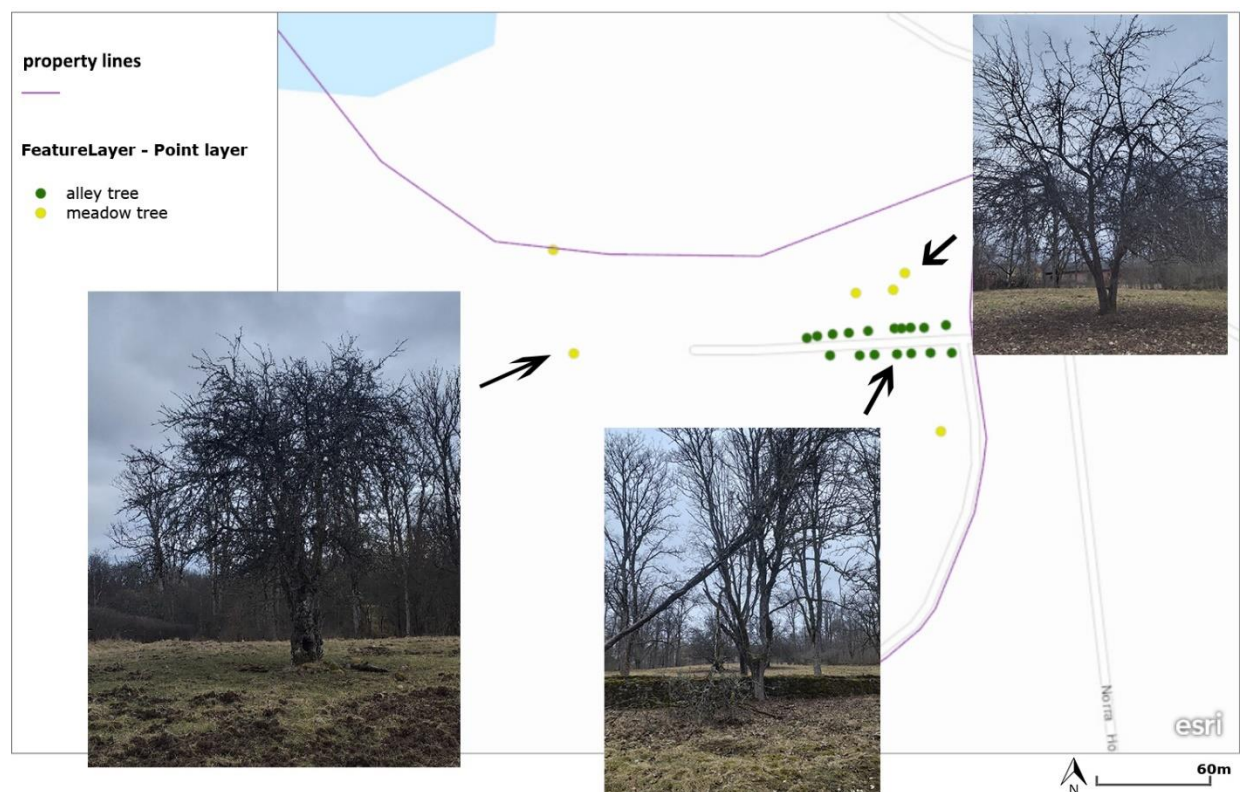


Figure 19 Distribution of meadow and alley trees in Tranemåla with Photos (Source: own map created with esri ArcGIS and Collector, altered, own photos)

Torps

Four different torps were found during the survey (Figure 20). While the easternmost torp is not used by the Tranemåla foundation it is marked with a metal sign as part of the Tranemåla estate. This easternmost torp is still completely intact and inhabitable from what is visible from the outside. The torp west of this in proximity is in a ruin state. While it is marked with a Kullemåla metal sign and therefore not part of the Tranemåla estate, it is still directly next to the estate area and visible from the road the torp is located at.

The third torp can be found northwest at the historical Holländarevägen. It is marked as a torp that is part of the Tranemåla estate with a metal sign. The torp itself is in a ruin state, merely some bricks and an old metal oven and pipe are still there. Surrounding this torp, another stone base and gates marking an entrance can be found.

The fourth torp is located directly south of the Tranemåla main house along Holländarevägen and marked with a metal sign as part of the estate. No stone base, ruin or stones were visible, and the area was also covered in fallen leaves and overgrowing. If it was not for the metal sign and the marking on the 1994 map, nothing would indicate towards the remnants of a torp here.

All in all, it can be said that all but one torp are in a poor state which is to be expected after they have not been in use for an extended period of time.



Figure 20 Distribution of torps in Tranemåla with Photos (Source: own map created with esri ArcGIS and Collector, altered, own photos)

Tar valleys, wells, stone ovens

During the survey three tar valleys, six wells and three stone ovens were found around the estate (Figure 21). Often, they were found either close to each other or a torp which indicates high anthropogenic activity in that specific area. Of course, it was practical to have water access right outside the house. All these features are overgrown with either just moss or covered with shrubs.

For the stone ovens, the condition varied between the stone structure being clearly visible to the stones being completely covered by vegetation like it is the case with the northwestern stone oven. There were no markings to increase visibility during forestry operations.

The wells were visible as small waterholes surrounded by a layer of stones. Partially, they were overgrown by shrubs. Again, there were no markings to protect the wells during forestry operations.

Three tar valleys were found, all of which are marked in the 1994 map by Roland Offrell. The tar valley directly southwest of the estate house is marked as worth protecting through higher tree stubs that frame the tar valley. These markings were absent around the other two tar valleys. Without further markings, the tar valleys are only visible as a small, dry drench in a slope. The importance of the tar valleys for livelihood has already been documented by TIRÉN (1937). The sale of valuable tar was an important source of income for the rural population, which was otherwise heavily dependent on profits from agriculture.

To conclude it can be said that these features were barely visible and sometimes even hard to find. When found, the condition of the features was rather bad and mostly destroyed.



Figure 21 Distribution of tar valleys, wells and stone ovens in Tranemåla with Photos (Source: own map created with esri ArcGIS and Collector, altered, own photos)

Boundary stones, stone bridges and stone bases

Boundary stones, stones bridges and stone bases were found all around the estate with most of them lying in the part west of Norra Holländarevägen (Figure 22).

Six boundary stones were found on the property line of the estate and on Holländarevägen. One boundary stone that was marked on the 1994 could not be found. The boundary stones are mostly marked with red poles to increase visibility during forestry operations. While they are often overgrown with moss on the top they are mostly in good shape and not deteriorating.

Eleven stone bridges were found the area, two of which were found in the eastern part along a drainage drench. In one location where there should be a stone bridge, nothing could be found. Generally, the stone bridges were in a deteriorating state, often barely visible and covered in moss or overgrown with shrubs. Sometimes, the bridge would simply consist of bigger rocks that were placed into the water.

Five stone bases were surveyed on the Tranemåla estate. This category was chosen when no other categorization was possible. These bases were often found near other points of interests like stone ovens. The bases were mostly overgrown with low vegetation.

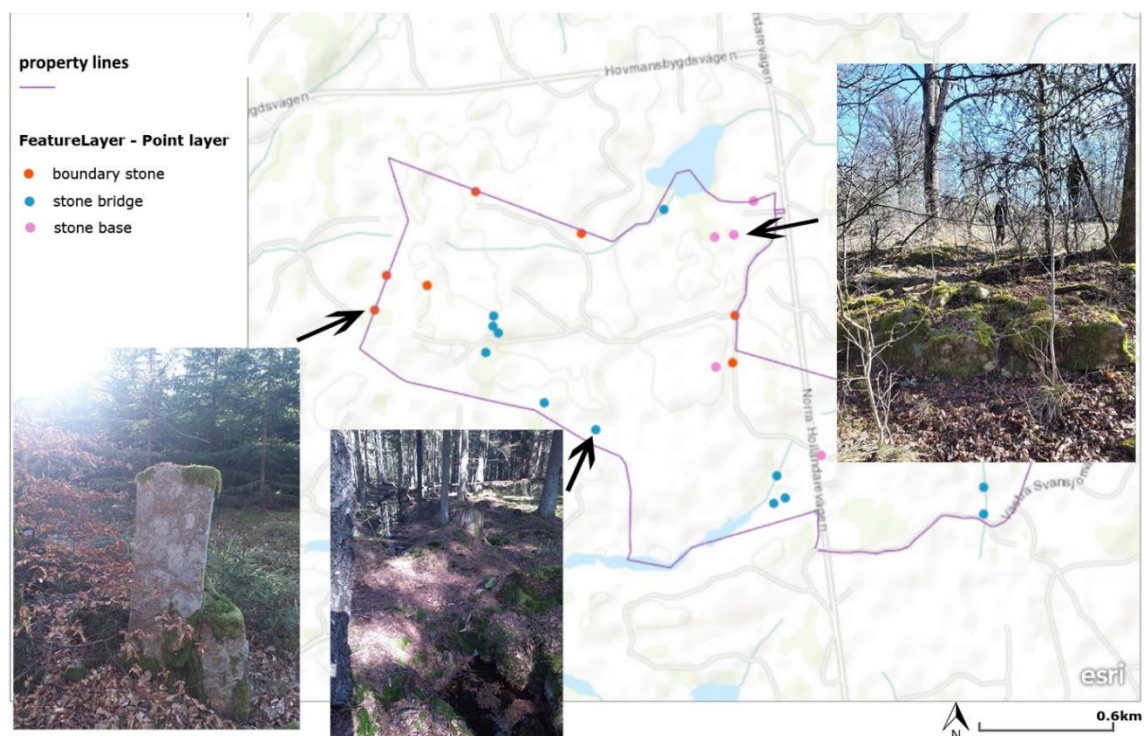


Figure 22 Distribution of boundary stones, stone bridges and stone bases in Tranemåla with Photos (Source: own map created with esri ArcGIS and Collector, altered, own photos)

4. Recommendations and Discussion

4.1 Maintenance and Protection Recommendations

Due to the deregulated nature of forestry practice on private land in Sweden (PARVIAINEN 2015), a positive attitude of the forest owner towards the protection of cultural heritage is of great advantage when it comes to the preservation of cultural relics. This is the case in Tranemåla.

Many of the cultural heritage relics in Tranemåla are covered and protected through Swedish legislation.

Historical artifacts of higher rank in Tranemåla are protected by the Historic Environment Act (1988:950) (SVERIGES RIKSDAG 2021). In Tranemåla, this concerns the Holländarevägen, which is significant due to its historical position as an emigration route (MATHIASSEN 2021). Furthermore, protected under this are the torps and potato cellar and the tar valleys, stone ovens and wells, since these relics are directly linked to historic human settlement and work life (SVERIGES RIKSDAG 2021).

Artifacts that are not directly linked to past human settlement and work in Tranemåla but fall under general biotope protection are protected through Annex I of a regulation in the Swedish Environmental Act. However, this legislation is only concerned with relics in open landscapes and not in forested areas. For Tranemåla this means that the oak rondel, the alley trees and the stone walls around pastures and meadows are protected under the Environmental Act since these artifacts are found in the open landscape (RIKSDAGSFÖRVALTNINGEN 2014).

The Swedish Forestry Act aims to avoid damage cultural relics through § 30, even if there is no general protection for artifacts created before 1850 (RIKSDAGSFÖRVALTNINGEN 2014). Damage during forestry operations should be avoided and trees, that are damaging the relics should be removed if they are not biotope trees. For Tranemåla this concerned especially the stone walls in the forest with trees growing very close to them (s. chapter 3.3.1 and 3.3.2)

While many relics are protected through Swedish legislation (Historic Environment Act (1988:950) (SVERIGES RIKSDAG 2021), § 30 in the Swedish Forestry Act

(SKOGSSTYRELSEN 2020) and Annex I of Swedish Environmental Act (RIKSDAGSFÖRVALTNINGEN 2014)) there is a lack of appropriate control over protection here, and during forestry operations this issue often falls behind (ARONSSON 2005). The following recommendations should help to implement this protection, so that the relics can be maintained.

The following recommendations have been developed in two different areas:

- Policy and Governance Recommendations
- Maintenance and Restoration Recommendations On-Site

Policy and Governance Recommendations

The direct and most immediately impactful tool for the adaption of cultural heritage protection in forestry practice is the forest management plan. In the case of Tranemåla, the Swedish forestry company Sydved is managing the forest operations (ROOTH 2018). It is vital that all structures worthy of protection are incorporated in the next revision of the forest management plan. If such places occupy a certain area, they can then also be classified as Nature Conservation Management (Swedish: naturvårdande skötsel) and then eventually be brought in for FSC® certification (SVEASKOG 2021).

The Swedish Forest Agency puts a special focus on the protection of forest history when assigning Nature Conservation Management areas since the values of production forestry can be conflicting with the preservation of conservation (SKOGSSTYRELSEN 2021d). 1.2 to 2.4 % of the Swedish forest are voluntary set-aside areas for the purpose of nature conservation. In Tranemåla, 9.2 % of the forest area are already set aside as for Nature Conservation (s. 1.4 Tranemåla and Tranemålastiftelsen) (ROOTH 2018). A precise reconciliation and re-evaluation of the already protected areas with the new findings of this work should thus be made.

The majority of Swedish forests are certified under the FSC® or PEFC™ systems with 7.1 mio. ha even being double certified (SVEASKOG 2021). A requirement for certification is the inclusion of conservational and social rules, under which also the protection of historic sites falls, in the forest management plan (ROOTH 2018).

In the current management action plan (s. Appendix for map) some areas in Tranemåla are areas intended for nature conservation (naturvård) and assets like tar valleys and ruins are marked and considered in the planning (ROOTH 2018). Other features like the border stones, stone bridges, stone ovens and stone walls are not yet included in the map. The duration of the current forest management plan is until 2026 which is the latest these new adoptions of including more cultural heritage features should be done. Of course, an early adaption would be ideal.

To avoid future land use conflicts as much as possible, further policy adjustments can be made to protect cultural assets. This can be done, for example, in a separate agreement between Trånemalastiftelsen and Blekinge county. The agreement can contain exact descriptions of the type and location of the cultural assets that should be protected, why they are of value and how they can be protected. A document like this can be used as a reference if land use conflicts should arise in the future if the landownership might change.

Further protection of the cultural heritage can be done through policies like the imposition of a conservational status. In Sweden, valuable landscapes are typically protected as national parks, nature reserves, biotope protection areas or world heritage sites (SWEDISH ENVIRONMENTAL PROTECTION AGENCY 2021b). Since the concerned area of Tranemåla is small in comparison to larger sites like national parks, a classification of the area or parts of it under the Nature reserve or biotope protection area regulation is more realistic.

Areas typically protected under the biotope protection areas are for example, “lines of trees”, “stone piles in agricultural areas”, “stone fences in agricultural areas” and “small stand of trees, bushes or rocks in the midst of a field”, all of which exist in the surveyed area (SWEDISH ENVIRONMENTAL PROTECTION AGENCY 2021a). In this case, a mosaic-like protection structure could be established under which certain areas of the estate are protected under the biotope protection areas and others are left unprotected for other purposes. A mosaic-like policy protection approach would also be of advantage since no area conflicts with timber production could arise because all the areas are clearly delineated.

Maintenance and Restoration Recommendations On-Site

The general idea of the maintenance and restoration approach is to minimize the pace of further decay and damages through forestry operations, these steps are described in the

Maintenance column of the table. The Restoration column describes possible measures that would be more cost and time intensive. A weighing and prioritization of the measures can be found in chapter 4.2 Project Prioritization. In the left column, next to the names of the elements, are the sources from which either the importance of the elements is clear or from which recommendations were taken. Most of the recommendations are based on fieldwork observations. For example, the removal of overgrown trees and shrubs or fallen logs, as recommended for the stone walls, is a fairly straightforward and obvious measure. For other recommendations, such as the restoration of stone walls, specialist literature (in the case of stone walls (ANDERSEN & NYHLÉN 2011) and (FLYNN 2011)) was consulted.

Table 3 Maintenance and Restoration Recommendations for the Cultural Assets of Tranemåla

Name	Maintenance	Restoration
Alley trees (RIKSDAGSFÖRVALTNINGEN 2014)	The (partially) fallen branches and tree parts need to be removed, also for safety reasons.	Seasonal pruning can help keep the trees in shape and health.
Stone bridges (OLSSON 1992)	Due to the small number (twelve) of stone bridges in the surveyed area it would be possible to make the stone bridges visible again with comparable low effort. The trees and shrubs should be removed, as well as the moss.	If possible, the stone bridges could become more visible by professionally restoring them, putting stones in their correct place or adding stones where necessary.
Stone piles (ANDERSEN & NYHLÉN 2011)	Remove surrounding shrubs and trees.	Due to the unstructured nature of stone piles, structural restoration efforts are not necessary.
Boundary stones (OLSSON 1992) (SVERIGES RIKSDAG 2021)	A necessary and simple step to increase the visibility of the boundary stones would be to add a colorful pole to all the stones (as seen in the picture). Not only would this simplify finding the stones but would also help to protect them during forest operations.	In a further step, the stones could be straightened up and the moss and lichen cover could be carefully removed. A very interesting step would be to make the inscriptions visible again on an informational sign which could also contain further information about the area.
Meadow trees	Removal of dead branches to maintain vitality of the trees.	Seasonal pruning to improve the overall shape of the trees. If desired, a more precise determination of the genus of the

		trees could take place during the summer months and labels could be added to the stem.
Wells (SVERIGES RIKSDAG 2021)	Removal of overgrown trees and branches and marking in the form of a colorful pole are indispensable to protect the wells during forest operations.	A thorough restoration of the wells could be of value if increased visibility is desired but a simple arrangement of the existing stones in an original, “well-like” shape would also be valuable to increase visibility and less costly.
Stone bases (ANDERSEN & NYHLÉN 2011)	Removal of overgrown trees and shrubs. Increased visibility through marking with a colorful pole.	If possible, further research could be done to determine what these stone bases have been used for.
Torp (SVERIGES RIKSDAG 2021)	Removal of overgrowing trees and shrubs to minimize further decay of the torps.	An addition of informational signs at the torps with interesting facts edited for a public audience (e.g. dogwalkers and hikers) would be valuable to preserve the historical nature of the area (HÖJER et al. 2009). Further research is necessary for this. A structural restoration for these purposes would likely be very costly and could even take away from the historical character of the area.
Stone ovens (SVERIGES RIKSDAG 2021)	Removal of overgrowing trees and shrubs to minimize further decay of the stone ovens.	Informational signs about the use of old stone ovens to increase visibility,
Tar valleys (SVERIGES RIKSDAG 2021)	Marking with colorful poles and medium height tree stems to protect during forest operation. The marking with high tree stumps that is common practice during forestry operations should take place around those tar valleys that have not yet been marked in this way. The marking in the current forestry action plan, as it is	Informational signs about the history and use of tar valley would be useful to increase the historical visibility.

	already done, is therefore important.	
Gates	Since the gates are directly located by a road it is unlikely that they are overseen during harvesting but it a marking of some sort should still be considered.	Informational signs or inclusions of the gates in the informational sign of the torp (HÖJER et al. 2009).
Others Oak key biotope (SKOGSSTYRELSEN 2021c) Former location of stone bridge	It is essential to maintain the old oak key biotope. Removing of competing trees may be necessary. Without an existing feature, no maintenance can take place.	An informational sign could be installed to inform about the importance of old trees and the protection of key biotopes in Sweden (HÖJER et al. 2009). A restoration of the stone bridge would be possible but far from necessary.
Stone walls (RIKSDAGSFÖRVALTNINGEN 2014) (ANDERSEN & NYHLÉN 2011; FLYNN 2011)	A removal of overfallen trees and branches and overgrowing shrubs is necessary to minimize a natural decay of the stone walls. In addition to this, it would be useful to mark stone walls with colorful bands or poles when forest operations are due. Whenever trees that are growing close to the wall are showing signs of decay, it would be sensible to remove these trees or parts of the trees to avoid further damage of the walls. This has to happen in accordance with the Swedish Forestry Act (SKOGSSTYRELSEN 2020)	A careful removal of trees that are growing too close to the wall where the roots could impact the wall would be useful to minimize natural decay of the walls or slow it down. If desired, the stone walls could be restored with existing stones to give the area a more structured and maintained impression. This, however, would be very costly and time consuming to do for the entire area. To reduce possible damage during forestry operations, forest workers should be informed about the existence of historical stone walls in the area and their cultural value.
Meadows (KARDELL 2012)	No further actions are needed to maintain the meadows as the cattle grazing during the summer months is sufficient to keep the area open.	Removal of dead trees on meadows if desired but not necessary (value of deadwood!).

The oak rondel (RIKSDAGSFÖRVALTNINGEN 2014)	Straighten up stones and clear the steps. Ensure reinforcement of the fence to prevent damage from grazing animals. Protect small millstone table in the middle.	Research further history of rondel and establish an informational sign. Maintain and prune oaks. Possibly adding small chairs to the millstone table to make the table more usable again.
The potato cellar (SVERIGES RIKSDAG 2021)	Removal of surrounding shrubs to enhance visibility of the building.	Further investigations regarding the use of the potato cellar over the years and an informational sign could valorize the building.
Roads and Paths, specifically Holländarevägen (SVERIGES RIKSDAG 2021)	First removal of small trees and shrubs covering the paths and not driveable roads.	Recurring, if possible, yearly, removal of overgrowing trees or shrubs to maintain passability of the roads (by car) and paths (by foot). In the long term, an intact road surface should also be ensured.

4.2 Project Prioritization

Since a complete restoration of cultural assets in Tranemåla is neither feasible nor necessary, the following project prioritization is intended as a guide to help with decision making when it comes to maintenance or restoration projects for Tranemåla, also considering forest operations in the area.

The proposed projects are divided in three categories (Higher, medium and lower priority) and the categorization was done by considering the following aspects: cost (e.g. the cost of material, labor, planning, etc.), time (how much time it would take to realize the respective project) and area (the location within the Tranemåla property), history (when were the features built respectively when were they first noted on a map). Weighing of actual monetary value of the individual assets was not conducted. Helpful guides when weighing these aspects are the books “Stenminnen - De småländska stenmurarna - ett kulturarv” by Ida Andersen and Åsa Nyhlén (ANDERSEN & NYHLÉN 2011) and “Kulturmiljövård i skogen - Att känna och bevara våra kulturminnen“ by Anders Olsson (OLSSON 1992). Also included in the consideration was what elements Olle Mathiasson (MATHIASSON 2021) felt were important or worth highlighting.

Higher priority:

- Mark all with colorful poles to protect during forest operations and ensure maintenance of the individual assets.
- Remove overfallen trees and overgrowing shrubs from stone walls.
- Maintain the oak rondel by removing overgrowth and rubble.
- Restore major damages on stone walls on main roads (drivable roads), e.g., pile up existing stones that have fallen over.

Medium priority:

- Fully restore all the stone walls on main roads (drivable roads).
- Remove trees close to the walls that are showing signs of decay to avoid further damage to the trees. In these cases, it is important to weigh the cultural-historical values of the stone walls and biological values of a tree, especially in the case of old trees.

Lower priority:

- Set up informational signs at all the torps with the history of the torp and the people who lived there.
- Restore all stone walls in the area, add stones where necessary.

4.3 Discussion

Scientific background

The variety of the provision of ecosystem services used to be broader during the past where the people used the forests in different ways than today (PARVIAINEN 2015). These differences in use between then and now were made visible through this work. By utilizing the ecosystem service (ES) approach (MILLENNIUM ECOSYSTEM ASSESSMENT (PROGRAM) 2005), the cultural heritage could be made more tangible and the benefits to people were made clear. Thus, this work gave an example of how the pressure of use in forests (FOLEY et al. 2005) in Sweden can be reduced through actionable plans.

As discussed in the discussion chapter, it takes more than protection legislation to protect cultural relics in forestry, which is confirmed by annual studies by the Swedish Forestry Agency (SKOGSSTYRELSEN 2021a). This work joins a history of recording cultural heritage relics in Sweden and attempts to go beyond mere recording to using the data collected to protect the mapped relics. The objectives and aims of the work were fulfilled in that, based on a mapping, recommendations for the protection of cultural-historical relics were made, thus contributing to the mitigation of conflicts between different fields of interest.

The methodology of this work, which includes background research, mapping using GIS applications, historical and spatial classification, and recommendations based on that research, can be applied to areas of similar size and type of cultural relics. Especially the use of GIS tools to support the preparation of forest management plans should be considered, as a descriptive breakdown of the present situation in the forest can happen. This can be especially useful for private owners of smaller forest areas who do not have expertise in the protection of cultural relics in forestry. More projects like this would need to be implemented so that the protection that exists legislatively can be implemented. Here then this work can serve as an orientation.

Potential Sources of Error in the Study

A categorical assessment of damage to cultural relics, as is the case, for example, with the Swedish Forestry Agency's inventory (SKOGSSTYRELSEN 2021a), would certainly have allowed for a more accurate analysis of cultural relics in Tranemåla. A quantifiable statistical analysis could also have been carried out in this way. Further bias in the study could come from the authors' lack of fluency of the Swedish language which made it difficult to cite primary literature on the historical development, which was only available in Swedish.

Future Prospects

To determine exactly which parts of the stone wall can be restored and how, a detailed examination is necessary, which should be carried out by experts who are familiar with dry stone walls. For this purpose, a detailed map could be created in which all damages are precisely recorded in connection with GPS coordinates, for example, in places where the stones of the stone walls are completely decayed. An expert could then also determine more precisely what costs and time would be necessary to implement a restoration. Furthermore, an in-depth research could take place in which the archives of the foundation are reviewed and possibly existing files of the district or the municipality on the history of the place.

A community-based tool for the collection of data regarding cultural heritage relics can be used to support the gaps in data from the Skogens Pärlor map (SKOGSSTYRELSEN 2021b) and link policy with the practical implementation of the protection of cultural heritage. The refinement of the Skogens Pärlor map, for example, by hikers, bear gatherers or hunters in different areas, can be useful here. The more precise is available, the more can be considered for protection. Crowd-sourcing has been a practice in landscape planning for a while and can contribute to the involvement of stakeholders (KRÄTZIG et al. 2019). In addition to that, Swedish studies have found that people want to learn about cultural heritage when spending time outdoors (HÖJER et al. 2009). Thus, a double advantage could arise when people map relics via an app, for example, and then information material can be created from this that other people can learn from.

In conclusion, this work has contributed to protect cultural heritage in forests and the methodology used here can be applied to other areas of cultural heritage protection.

5. References

- ALBERT, C., BURKHARD, B., DAUBE, S., DIETRICH, K., ENGELS, B., FROMMER, J., GÖTZL, M., GRÊT-REGAMEY, A., JOB-HOBEN BEATE, KELLER, ROGER, MARZELLI, S., MONING, C., MÜLLER, F., RABE, S.-E., RING, I., SCHWAIGER, E., SCHWEPPE-KRAFT, B. & WÜSTEMANN, H., 2015: Empfehlungen zur Entwicklung bundesweiter Indikatoren zur Erfassung von Ökosystemleistungen. Diskussionspapier, 53 S., Bonn.
- ANDERSEN, I. & NYHLÉN, Å., 2011: Stenminnen. De småländska stenmurarna - ett kulturarv, Kronoberg: Grodan förlag.
- ARONSSON, M., 2005: Cultural and bio-cultural heritage in Swedish forests. In: Ministerial Conference on the Protection of Forests in Europe (Hrsg.): Forestry and our cultural heritage. Proc Seminar, 13-15 June 2005, Sunne, Sweden. 31–36, Liaison unit, Warsaw.
- BROCKERHOFF, E. G., BARBARO, L., CASTAGNEYROL, B., FORRESTER, D. I., GARDINER, B., GONZÁLEZ-OLABARRIA, J. R., LYVER, P. O., MEURISSE, N., OXBROUGH, A., TAKI, H., THOMPSON, I. D., VAN DER PLAS, F. & JACTEL, H., 2017: Forest biodiversity, ecosystem functioning and the provision of ecosystem services. *Biodivers Conserv* 26 (13): 3005–3035.
- ENANDER, G., 2005: Opening Adresss. Director General of the Swedish National Board of Forestry. In: Ministerial Conference on the Protection of Forests in Europe (Hrsg.): Forestry and our cultural heritage. Proc Seminar, 13-15 June 2005, Sunne, Sweden, Liaison unit, Warsaw.
- ERICSSON, J., 1994: Tranemåla Trädgård. Förr, nu och i framtiden, Alnarp, Sweden.
- FLYNN, B., 2011: The Complete Guide to Building With Rocks & Stone. Stonework Projects and Techniques Explained Simply, 262 S., Ocala: Atlantic Publishing Group.
- FOLEY, J. A., DEFRIES, R., ASNER, G. P., BARFORD, C., BONAN, G., CARPENTER, S. R., CHAPIN, F. S., COE, M. T., DAILY, G. C., GIBBS, H. K., HELKOWSKI, J. H., HOLLOWAY, T., HOWARD, E. A., KUCHARIK, C. J., MONFREDA, C., PATZ, J. A., PRENTICE, I. C., RAMANKUTTY, N. & SNYDER, P. K., 2005: Global consequences of land use. *Science (New York, N.Y.)* 309 (5734): 570–574.
- GREN, L., 2000: Surveying the Cultural Heritage of the Swedish Countryside. Success and Failure during the Twentieth Century. *Current Swedish Archaeology* 8: 51–65.
- HAAREN, C. VON, LOVETT, A. A. & ALBERT, C., 2019: Landscape Planning and Ecosystem Services: The Sum is More than the Parts. In: Haaren, C. von, Lovett, A. A. & Albert, C. (Hrsg.): Landscape Planning with Ecosystem Services. 3–10, Dordrecht: Springer Netherlands.
- HELMFRID, S., 1961: The Storskifte, Enskifte and Laga Skifte in Sweden—General Features. *Geografiska Annaler* 43 (1-2): 114–129.
- HEMSTRÖM, K., MAHAPATRA, K. & GUSTAVSSON, L., 2014: Public perceptions and acceptance of intensive forestry in Sweden. *Ambio* 43 (2): 196–206.
- HERMES, J., ALBERT, C. & HAAREN, C. VON, 2020: und Bewertung der kulturellen Ökosystemleistung Naherholung in Deutschland. *UVP-Report* 34 (2): 61–70.
- HISTORISKA KARTOR | LANTMÄTERIET, 2021: Historiska Kartor | Lantmäteriet. Aufgerufen am 14.05.2021, <https://historiskakartor.lantmateriet.se/historiskakartor/searchresult.html?archive=GEOIN&firstMatchToReturnLMS=1&firstMatchToReturnRAK=1&firstMatchToReturnREG=1&yMin=6245516&xMin=484889&yMax=6247516&xMax=486889>.

- HÖJER, O., ERIKSSON, D., HAMMERSLAND, J., KOLM, A., PETERSSON, T., SCHREIBER, H. & WENNERBERG, S., 2009: Swedish Nature Conservation. 100 Years, 56 S., Stockholm.
- JAKOBSSON, R., OLOFSSON, E. & AMBROSE-OJI, B., 2021: Stakeholder perceptions, management and impacts of forestry conflicts in southern Sweden. *Scandinavian Journal of Forest Research* 36 (1): 68–82.
- KARDELL, Ö., 2012: Cows and Forests: Swedish Environmental History. *Journal of Interdisciplinary History* (43): 275–287.
- KEMPA, D. & LOVETT, A. A., 2019: Using GIS in Landscape Planning. In: Haaren, C. von, Lovett, A. A. & Albert, C. (Hrsg.): *Landscape Planning with Ecosystem Services*. 77–88, Dordrecht: Springer Netherlands.
- KRÄTZIG, S., GALLER, C. & WARREN-KRETZSCHMAR BARTLETT, 2019: Techniques for Participatory Approaches. In: Haaren, C. von, Lovett, A. A. & Albert, C. (Hrsg.): *Landscape Planning with Ecosystem Services*. 437–452, Dordrecht: Springer Netherlands.
- Kulturmiljölag (1988:950) Svensk författningssamling 1988:1988:950 t.o.m. SFS 2019:864 - Riksdagen vom 27.08.2021.
- LINDAHL, K. B., STÉNS, A., SANDSTRÖM, C., JOHANSSON, J., LIDSKOG, R., RANIUS, T. & ROBERGE, J.-M., 2017: The Swedish forestry model: More of everything? *Forest Policy and Economics* 77: 44–55.
- LINDBLADH, M., BRADSHAW, R. & HOLMQVIST, B. H., 2000: Pattern and Process in South Swedish Forests during the Last 3000 Years, Sensed at Stand and Regional Scales. *Journal of Ecology* 88 (1): 113–128.
- LODIN, I. & BRUKAS, V., 2021: Ideal vs real forest management: Challenges in promoting production-oriented silvicultural ideals among small-scale forest owners in southern Sweden. *Land Use Policy* 100: 104931.
- MAPCOORDINATES, 2021: Google Maps Koordinaten finden - Meereshöhe bestimmen - MapCoordinates.net. Aufgerufen am 07.07.2021, <https://www.mapcoordinates.net/de>.
- MARNTTELL, A. & WÄGBERG, C., 2005: Cultural Remains of the Forests – a resource in rural development. In: Ministerial Conference on the Protection of Forests in Europe (Hrsg.): *Forestry and our cultural heritage*. Proc Seminar, 13-15 June 2005, Sunne, Sweden. 82–86, Liaison unit, Warsaw.
- MARTIN, M., TREMBLAY, J. A., IBARZABAL, J. & MORIN, H., 2021: An indicator species highlights continuous deadwood supply is a key ecological attribute of boreal old-growth forests. *Ecosphere* 12 (5).
- MATHIASSEN, O., 2021: Cultural Heritage and Assets of Tranemåla. Unstructured Interview and Guided Tour of the Area, Tranemåla, Blekinge County, Sweden.
- MILLENNIUM ECOSYSTEM ASSESSMENT (PROGRAM), 2005: *Ecosystems and human well-being*. Synthesis, x, 137, Washington DC: Island Press.
- MINISTERIAL CONFERENCE ON THE PROTECTION OF FORESTS IN EUROPE, 2005: *Forestry and our Cultural Heritage*.
- NILSSON, S. G., 1997: Forests in the Temperate-Boreal Transition: Natural and Man-Made Features. *Ecological Bulletins* 46, Boreal Ecosystems and Landscapes: Structures: 61–71.
- NYLUND, J.-E., 2009: *Forestry legislation in Sweden*.
- OLSSON, A., 1992: *Kulturmiljövård i skogen. Att känna och bevara våra kulturminnen*, Jönköping.
- ÖSTLUND, L. & ROTURIER, S., 2011: Forestry historical studies in the province of Västerbotten, Northern Sweden: a review of Lars Tirén (1937). *Scandinavian Journal of Forest Research* 26 (S10): 91–99.

- ÖSTLUND, L., ZACKRISSON, O. & AXELSSON, A.-L., 1997: The history and transformation of a Scandinavian boreal forest landscape since the 19th century. *Can. J. For. Res.* 27 (8): 1198–1206.
- PARVIAINEN, J., 2015: Cultural heritage and biodiversity in the present forest management of the boreal zone in Scandinavia. *Journal of Forest Research* 20 (5): 445–452.
- RIKSDAGSFÖRVALTNINGEN, 2014: Förordning (1998:1252) om områdesskydd enligt miljöbalken m.m. Svensk författningssamling 1998:1998:1252 t.o.m. SFS 2020:640 - Riksdagen. Aufgerufen am 30.08.2021, https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/forordning-19981252-om-omradesskydd-enligt_sfs-1998-1252.
- ROBERGE, J.-M., FRIES, C., NORMARK, E., MÅRALD, E., STÉNS, A., SANDSTRÖM, C., SONESSON, J., APPELQVIST, C. & LUNDMARK, T., 2020: Forest management in Sweden. Current practice and historical background, 96 S. RAPPORT 2020/4.
- ROOTH, H., 2018: Tranemåla 1:6 2018 - 2027 Forest Management Plan, 49 S., Karlshamn.
- ROYAL SWEDISH ACADEMY OF AGRICULTURE AND FORESTRY, 2015: Forests and Forestry in Sweden, 24 S., Stockholm.
- SACHER, P. J., 2020: Wahrnehmung und ökonomische Bewertung waldbasierter kultureller Ökosystemleistungen mit und ohne Erholungsbezug durch die bayrische Bevölkerung, Universität Greifswald. Inauguraldissertation.
- SANDSTRÖM, C., LINDKVIST, A., ÖHMAN, K. & NORDSTRÖM, E.-M., 2011: Governing Competing Demands for Forest Resources in Sweden. *Forests* 2 (1): 218–242.
- SKOGSSTYRELSEN, 2021a: Survey of environmental consideration to cultural heritage. Aufgerufen am 30.08.2021, <https://www.skogsstyrelsen.se/en/statistics/subject-areas/survey-of-environmental-consideration-to-cultural-heritage/>.
- SKOGSSTYRELSEN, 2021b: Skogens Pärlor. Aufgerufen am 16.07.2021, <https://kartor.skogsstyrelsen.se/kartor/>.
- SKOGSSTYRELSEN, 2021c: Nyckelbiotoper. Aufgerufen am 20.07.2021, <https://www.skogsstyrelsen.se/miljo-och-klimat/biologisk-mangfald/nyckelbiotoper/>.
- SKOGSSTYRELSEN, 2021d: Naturvård. Aufgerufen am 17.08.2021, <https://www.skogsstyrelsen.se/bruka-skog/naturvard/>.
- Skogsvårdslagstiftningen gällande regler 1 april 2020 vom 01.04.2020.
- SMHI, 2021: Klimatdata - kartor | SMHI. Aufgerufen am 30.08.2021, <https://www.smhi.se/data/meteorologi/kartor/arsmedeltemperatur>.
- SVEASKOG, 2021: Getting certified. Aufgerufen am 17.08.2021, <https://www.sveaskog.se/en/forestry-the-swedish-way/short-facts/brief-facts-7/>.
- SWEDISH ENVIRONMENTAL PROTECTION AGENCY, 2021a: Biotope protection areas. Aufgerufen am 20.04.2021, <https://www.swedishepa.se/Enjoying-nature/Protected-areas/Biotope-protection-areas/>.
- SWEDISH ENVIRONMENTAL PROTECTION AGENCY, 2021b: Protected areas. Aufgerufen am 20.04.2021, <https://www.swedishepa.se/Enjoying-nature/Protected-areas/>.
- SWEDISH ENVIRONMENTAL PROTECTION AGENCY, 2021c: This is the Right of Public Access. Aufgerufen am 09.06.2021, <https://www.swedishepa.se/Environmental-objectives-and-cooperation/Swedish-environmental-work/Work-areas/This-is-the-Right-of-Public-Access/>.
- SWEDISH NATIONAL HERITAGE BOARD, 2021: Historic Environment Act (1988:950). Aufgerufen am 17.08.2021, <https://www.raa.se/in-english/cultural-heritage/historic-environment-laws/historic-environment-act-1988950/>.
- TIRÉN, L., 1937: Forestry historical studies in the Degerfors district of the province of Vāsterbotten. *Meddelanden från Statens Skogsfors̄oksanstalt*: 67–322.

TRANEMÅLASTIFTELSEN, 2007: Erik och Ebba Larssons samt Thure Rignells stiftelse. Aufgerufen am 09.06.2021, http://www.tranemala.org/program/program_en.html.

Acknowledgments

My deepest thanks to my supervisors Jörg Brunet and Michael Rode for their invaluable advice. Thanks to Emma Holmström for making this thesis possible in the first place. A massive thanks to Olle Mathiasson for the most interesting tour of Tranemåla and to Mary Mathiasson for the provision of fika. A huge thank you to everyone at Tranemålastiftelsen for letting me use their property for the purpose of this work and for hosting me so kindly at the estate's house.

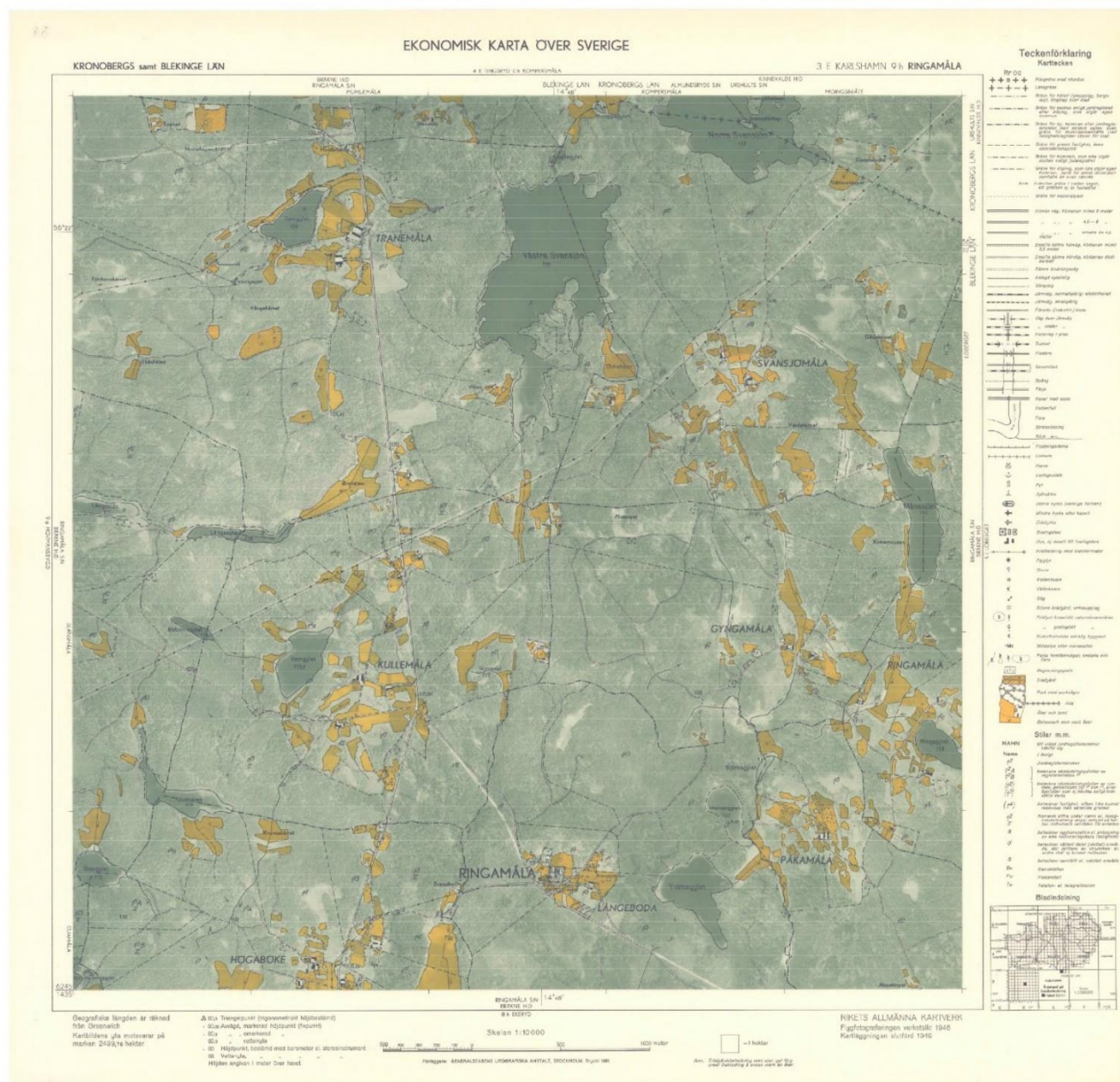
Appendix II: Map over Tranemåla from 1827 (HISTORISKA KARTOR | LANTMÄTERIET 2021)



Appendix III: Map over Tranemåla from 1915 (HISTORISKA KARTOR | LANTMÄTERIET 2021)



Appendix IV: Map over Tranemåla from 1949 (HISTORISKA KARTOR | LANTMÄTERIET 2021)



Appendix VI: Tranemåla_1_6 Åtgärdskarta_2017 (Source: (ROOTH 2018))

