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Foreword

THE IDEA to organize the First International Conference on Garden Archaeology was born at the Twenty-eighth Conference of the European Association of Archaeologists (EAA), which took place in Budapest at the turn of August and September 2022. This event also hosted the first session devoted to the archaeology of historical gardens, organized out of the initiative of Brian Dix and Geert Vynckier, with the participation of the author at the final stages. The success of this session prompted the organizers to explore the possibility of arranging an independent event that would bring together researchers interested in ancient garden structures. The initiators of this project proposed a series of conferences, and my suggestion that Poland be the venue for the inaugural event was accepted.

This choice was no coincidence as Krzyżtopór Castle management had been planning for several years to engage in an extensive interdisciplinary study of the former garden space, as depicted in Erik Dahlberg's renowned plan. The conference organizers intended the results of the deliberations to set the direction of research in Krzyżtopór. It was also proposed to draft a universal document to serve as a methodological model for historical garden research. While the latter idea was ultimately not realized, the goal of the conference was achieved: study results presented during the three-day discussions have provided a solid foundation for future research at Krzyżtopór and may serve as a reference point for other scholars and projects.

Garden archaeology is a relatively new field that is developing rapidly. While it is grounded in fundamental excavation principles, it also embraces interdisciplinarity and uses innovative measurement and computer techniques, as well as modern forms of social communication. Garden archaeology is most often conducted in public spaces, often ones of museum character. This carries responsibilities related to research, discipline and respect at the historic spaces where works are conducted, and also forces researchers to engage in pro-social activities. Garden archaeology is practised in places with a rich historical background and a strong memory of specific events and figures. It is therefore essential to demonstrate sensitivity and cultural awareness. The discipline not only draws on material evidence connected with the activities of historical figures, but also attempts to capture their personalities, preferences, and often deeply hidden passions. This is arguably the most attractive aspect of this refined, sophisticated and subtle area of research.

This conference was possible thanks to the dedication of the management at Krzyżtopór Castle, the Krzyżtopór Castle Association, and the Iwaniska

municipality authorities, as well as the National Heritage Institute, which received a grant from the Ministry of Culture and National Heritage. However, the conference's impact and wide appeal were primarily determined by the participants themselves, whose contribution cannot be overstated. Researchers from fourteen countries registered to participate, enabling the development of a comprehensive programme. They not only presented the achievements to date, but also indicated the possibilities for the development of garden archaeology and ways of managing its potential. Conference presentations outlined the results of research projects at key sites in royal and magnate residences, as well as provincial manor houses. Discussion also covered a range of techniques supporting archaeological research as well as a variety of innovative solutions drawing on English pragmatism, French subtlety, Italian finesse, Iberian imagination, German reliability, Scandinavian effectiveness, creative enthusiasm from the Benelux, and the flair of the Slavs.

At the close of the conference, I conveyed my gratitude to those involved on behalf of the Organizing Committee, expressed hope that the event would continue regularly, as well as wished everyone further success in their research and promotion of its results. I invite you to consider the presentations carefully and reflect on their content. It is my belief that this publication will spark a wide-ranging discussion and provide a platform for the exchange of ideas and experiences, contributing to the development of garden archaeology as an attractive field of study.

Krzyżtopór, 18 June 2025

Brian Dix, FSA – international expert in the archaeology and conservation of historic gardens, parkland, and other designed landscapes, providing analysis, assessments and advice for management plans and related purposes together with carrying out other research and fieldwork, especially for restoration schemes. Projects range from Russia to Romania, including excavations in Belgium, France and Luxembourg in addition to involvement at many British sites. He teaches and lectures widely at universities and other institutions, including in USA. Previously Chair of the former English Heritage Historic Parks and Gardens Advisory Panel and current Chairman of the International Conservation Board of the Muskauer – Park Mużakowski UNESCO World Heritage Site since 2005. He was awarded the Decoration of Honour Meritorious for Polish Culture (odznaka honorowa „Zasłużony dla Kultury Polskiej") in May 2025.

Brian Dix

Archaeology, accuracy and authenticity in historic garden reconstruction

Archaeology is an important aid in the accurate reconstruction of historic gardens by identifying precise details of former layout, including the dimensions of earlier paths, steps and terraces as well as the nature of flowerbeds and other aspects of design. Experience at British sites, most notably in King William III's Privy Garden at Hampton Court Palace, shows that it is most effective when working as part of a multidisciplinary team.

THERE ARE VARIOUS WAYS in which historic gardens can be presented to the public. All involve a fundamental management decision concerning exactly what it is that we are trying to present. Is it historical authenticity and integrity? Is it an impression of what we think was there? An evocation of a past experience? Or a modern invocation of what we perceive as its former spirit?

Each has a place and all these approaches have been applied at some time or other (fig. 1). Occasionally, several ways have been adopted at different times in the same garden where changing perceptions have brought about some form of renewal.

Ideally, every instance of change or intervention should be accompanied by archaeological investigation to identify what historical features might survive, assessing their significance and value as well as state of preservation and vulnerability. The presence of such remains and other traces should be taken into account in any proposals for change. At best, the potential for damage should be avoided or at least mitigated by ensuring appropriate protection; or, failing that, by adequate archaeological excavation and proper documentation, involving scientific examination in addition to other forms of analysis and recording.

This is precisely how I became involved in garden archaeology over thirty-five years ago. I was asked to assess the potential archaeological impact of a scheme to refresh the appearance of an historic garden that had been recreated half a century earlier.[1]

The so-called "Great Garden" at Kirby Hall in the English Midlands enjoyed the reputation of being one of the finest gardens in the country at the end of the seventeenth century but like the adjacent mansion fell into disuse and disrepair, eventually becoming a grass field bounded by the remains of terraces around two sides. It was the site of pioneering garden archaeology in the 1930s after the ruined house was taken into state guardianship.[2]

At the time, the terrace walls were partially reconstructed and the parterre was laid out in quarters following discovery of the original kerbs. The new garden was planted attractively but anachronistically with rose beds set within an outer border of hedges. A later generation of curators would consider the arrangement inappropriate and want to replace it with a design that better reflected the site's history and was more suited to the architectural setting.

This was the context of my involvement. However, rather than being a mere evaluation exercise, I saw that archaeological techniques could not only provide the means to increase understanding of what had gone before but might also contribute to a more accurate re-creation of the original form of the garden.

Instead of various small trial holes, or sondages, a more comprehensive series of trenches and area excavations were opened up over a period of time to reveal the garden's development and its probable appearance at the end of the seventeenth century.[3] In addition to reprofiling the terraces and showing where statues and seats had been, the work revealed the inaccuracy of the previous reconstruction of the garden-quarters through differences between the modern setting-out and the archaeological evidence of their original construction.

New excavation also showed how detail had been lost during clearance in the 1930s, to the extent that whilst iron nails survived from the fixing of a wooden framework for *gazon coupé* they were too few and dispersed to preserve the historical pattern. Accordingly, the pattern of cutwork in the parterres together with the central statues have been copied from elsewhere, although the form and general nature of the garden is close to what it would have been (fig. 2).

In addition to demonstrating the "how," archaeology questions the "why," which may not always be answered by documents. At Kirby Hall, for example, there is no written record of a canalised stream that is still evident outside the Great Garden. A sluice controlled the flow in order to provide a higher level of water where the canal crossed the main gardens and sunlight would cause its surface to shimmer. The adjacent banks and streambed were specially strengthened to prevent erosion when the extra volume of water was released.[4]

By contrast, a contemporary letter detailing Queen Elizabeth I's visit to Kenilworth Castle in the middle of England in 1575 provides a vivid description of the garden, including measurements of some of the features and identification of the subjects depicted in sculpted panels that

1 The following case studies are all places where I have been involved in fieldwork projects.

2 Dix 2013.

3 Dix et al. 1995.

4 Dix et al. 1995, 341-3.

decorated the sides of a central fountain basin.[5] Archaeological excavation relocated the foundations and confirmed the accuracy of the dimensions provided by the historical account, suggesting that other information concerning the layout and planting could also be trusted.[6] The garden has been reconstructed by English Heritage on the basis of surviving details linked to the letter's description, and analogies with contemporary illustrations of similar built features. It includes the various plants that were mentioned, arranged according to known historical practice (fig. 3).

At Bolsover Castle, also managed by English Heritage, the results of geophysical survey combined with excavation at the junction between paths showed that there had been only a single circuit when the garden beside the Little Castle was originally laid out in the early seventeenth century.[7] Planting seems to have been confined to the edges between the path and enclosing walls, leaving a large area of grass in the centre with only a fountain in its midst. Perhaps this is not surprising as the garden and rooms set in the wall appear to have been largely used for entertainment, such as the performance of an extravagant masque when the king and queen visited in 1634.

Consideration of the original setting and the relationship between different garden components suggested by their physical remains enables us to form an idea of how such places may have been experienced in the past. Such impressions can be compared with historical accounts where they are available. Documentation in some form survives for many sites, ranging from expenditure accounts and other records to visitors' descriptions in letters, diaries, etc., and also including visual representations in paintings and other drawings and engravings.[8]

By showing what was actually built, archaeology is a useful check upon the accuracy of any surviving contemporary plans, views and other illustrations, which may sometimes show the aspirations of owners rather than what was really achieved, or was indeed achievable. Whilst there is a rich store of material ready to use, part of the archaeologist's contribution should be to assess its status and value.

Apart from confirming historical evidence, archaeological observation may challenge accepted history. For instance, the stratigraphical succession revealed by excavation may suggest a different sequence of site development, placing individual events earlier or later than previously thought.[9]

It is no longer sufficient therefore to regard archaeology as merely corroborative evidence, where excavation is simply a mechanical process of observation and record, however technically excellent such work may be. Rather, it should be thought of as a parallel form of commentary that needs to be accorded at least equal weighting with other lines of enquiry. It may even be argued that it should be given greater credence because it shows the former reality of a particular situation. However, there can be difficulties in interpreting what is undoubtedly primary evidence, especially where the remains are fragmentary and open to a variety of explanations.

Such shortcomings may be answered to varying extent by other forms or

5 Goldring et al. 2014, 231-87, in particular 275-9. Cf. Goldring 2013.

6 Dix et al. 2013a; Dix et al. 2017.

7 Dix 1995a, 1995b, 1996.

8 Cf. Dix 2012, 151-4.

9 See, for example, A. Gołembnik in this volume.

sources of evidence, as for example in English Heritage's reconstruction of the East Parterre at Witley Court in the West Midlands.[10] It was laid out originally as part of a major garden make-over in the third quarter of the nineteenth century. While careful excavation detected where thin box edging had once defined flower borders and other decorative beds, our knowledge of the types of plants displayed in them relies upon the lists and descriptions of colour effects published by the contemporary gardening press. However, neither that information nor the archaeological evidence tell us where groups of individual plants were bedded out, so that today they are fitted into a plausible but imaginary scheme (fig. 4). Between them, the two complementary forms of evidence highlight deficiencies of knowledge and thereby reveal the basis and extent of conjecture in the modern reconstruction.

The replanting of former flowerbeds and other cultivated areas will always be conjectural. It does not simply involve a theoretical approach but also practical measures to reinstate the original concept. Herein lies opportunity: the ability to experiment with different arrangements as might be suggested by contemporary historical gardening manuals or other directions; the possibility to test a range of horticultural techniques; and ultimately, the chance to assess their effect and efficacy.

Such disciplined study applies as much to the re-creation of the original spatial concept of parkland as to the reconstruction of a small flowerbed. In each instance, we can increase our understanding and appreciation of past methods in addition to reintroducing authentic elements.

10 Dix 2011.

Whilst much historic parkland contains evidence for regeneration and later fashioning of an earlier framework, the ideas behind its formation and the reasons for subsequent change can be rediscovered, interpreted, and preserved with thoughtful maintenance and renewal. The identification of relict trees based upon estimates of their age is often compared with earlier mapping in order to reconstruct the original design, but the more precise details provided by field evidence of lost planting is generally less explored. Used in conjunction with surviving historic trees, it is possible to test and establish details of spacing and other patterns of setting out, particularly where the remains of previous tree-positions are still visible in the land surface.[11]

Hollows and other depressions created by the removal of individual trees, or low mounds formed when stumps have been left to rot, may be revealed by the shape of the ground or places where different levels of fertility have encouraged distinct types of vegetation to grow (fig. 5). Susceptibility or resistance to parching in dry weather may further distinguish old tree-holes from their surrounding but since the observer on the ground is often too close to discern the wider pattern, they are best viewed from above, sometimes from a nearby roof but usually from higher altitude. Aerial photography is helpful in identifying surviving features and showing them in their wider context.[12] Light detecting and ranging, or LiDAR imagery may likewise show subtle traces that are not easily visible at ground level, including overgrown path alignments in addition to old tree sites. As with all such information from remote sensing, the details should be checked in the field.

11 Cf. Dix 2016, 96-7.

12 Winton 2014.

Analysis of these features and their careful recording by metrical survey can reveal abandoned layouts in intricate detail. The location of flowerbeds, ponds and other water features may be preserved along with former tree sites. Their recording has become an important part of several restoration schemes in the UK, providing a guide for accurate relocation and helping to understand the way in which planting was carried out. In particular, the use of electronic distance measurement and plotting by GPS (Global Positioning System) have enabled former tree-positions to be identified and reinstated after felling and ground levelling.[13]

Modern digital recording can also help to rediscover the principles and spirit of the original design, revealing the hidden spatial geometry that holds many individual compositions together and showing how views were managed, often with the shape and appearance of trees and open spaces being carefully crafted. By considering the vegetational history of a place in relation to past economic and cultural trends, as well as in the context of previous ownerships, we should be able not only to identify distinct episodes or phases of development but also to assess their relative significance. Using these findings, we can suggest appropriate ways to manage, preserve, and restore individual parts.[14]

Restoration has been described as a reworking and reinterpretation of history. Choosing the period or moment to which a garden or landscape should be restored presents a number of philosophical dilemmas. Many places have never stopped changing, being continually developed to reflect the new ideas, fashions, and whims of successive owners as well as their architects and other designers. At the same time, separate parts of an estate and its grounds may have been treated differently in terms of management and maintenance, causing them to age at different rates. Each site is unique but most will have experienced some sort of alteration during their lifetime.

Archaeological techniques are essential for understanding the extent to which the original design has been changed by identifying how its component parts may have been maintained or modified. Their proper investigation will not only show what survives but also indicate how reliable such evidence can be. It follows that short-lived and unfinished gardens, especially ones largely unaffected by later disturbance, provide better-quality information than sites that have a long history or are still in use.[15]

Forgotten sites often contain important construction details that disclose contemporary historical trends in design, as at Lyveden in Northamptonshire, England, where a series of gardens begun in the mid-1590s were left incomplete after their owner died ten years later.[16] Archaeological recording of the canals in the part of the site intended to be a moated orchard revealed the moment when work stopped. Digging of the final arm of the canal was abandoned, leaving behind the ramp that had been used to extract spoil on its way to be dumped to create a snail-mount, which still remains nearby in partially formed state. The close-dating of remains such as these can help to identify and interpret similar types of sites that may not be so well documented.

13 E.g. the Long Water Avenue and other historic rows in Home Park at Hampton Court. See: Watkins and Wright 2007, 275-7.

14 See, for example, the work at Wrest Park, Bedfordshire discussed by John Watkins in this volume.

15 Obviously this is a generalisation and there will always be exceptions.

16 Dix 2012, 170-3.

Mounts and other substantial earthworks such as raised banks of terraces survive because in most cases their bulk discouraged removal. Indeed, some features actually used existing earthworks, as at Marlborough in Wessex, where an earlier prehistoric mound that later served as a medieval castle was converted into a garden feature. It formed a vantage point for viewing the series of formal gardens that were laid out around its base.[17]

The regular arrangement of many Renaissance gardens and the style of those they inspired have left a series of ordered sites that are especially suitable for examination using archaeological methods. Geophysical survey is especially effective in recovering details of such formal layouts, sometimes corroborating information gleaned from contemporary views and confirming the accuracy of historical surveys in addition to being used to target archaeological excavation economically and effectively.[18] In certain situations, ground-penetrating radar can be additionally useful in differentiating the relative depth between individual features and parts of their make-up, thereby indicating successive phases of development.

Mapping the archaeological detail and examining the spatial relationships between the different elements can provide insight into the ways in which a garden was created. In addition to showing the details and order of construction, from how the ground was prepared to the final surface finishing, the excavated evidence can be analysed to establish the geometry and mathematical principles which underlie the design. In many instances, the accuracy and precision of the original setting-out is immediately apparent, perhaps by being based upon a modular framework or grid, or using repeated formulae.

Sometimes temporary survey points or reference markers can be identified, providing clues about the builder's methods, as was the case at Witley Court, where a mirror symmetry was planned around a common axis. Perpendicular lines were struck from a baseline and various angles established to fix the arrangement of opposing or paired settings.[19] Most procedures were practical and empirical, and could be achieved using cord-and-peg methods. The reconstructed designs of cutwork at Kirby Hall and in the roughly contemporary Privy Garden at Hampton Court Palace were marked out using these traditional methods.

Form and proportional dimensions were paramount rather than absolute measurement. Mistakes could generally be concealed by "best fit," largely unnoticeable in the final appearance but still recognisable in the archaeological record.[20]

The value of much excavated evidence lies in its ability to demonstrate authentic detail.[21] This can relate as much to wider layout and form as to the original nature and appearance of individual components. The top and bottom of steps, for example, may indicate former surface levels as well as the relative height between them, while the slant of their foundations and gradient of any surviving superstructure can provide an accurate guide to the original angle of the slopes that may have surrounded them (fig. 6).

Similarly, the style and layout of paths may indicate a potential hierarchy of importance, ranging from broad, soundly built, well-drained main routes to

17 Dix 2022.

18 Cole et al.1997; Dix 2019a. See further the contributions in this volume by Neil Linford, Tomasz Herbich and Miroslav Dejmal et al.

19 Dix 2011, 56-7.

20 Cf. Dix 2011, 57 and accompanying note.

21 Dix 1999; Dix et al. 2013b, 290-5.

subsidiary side-walks and lesser ways, which might be of smaller size and neither as well constructed nor finished, and sometimes differently surfaced using materials of distinct colour and texture. It may be possible, therefore, to identify specific routes along which different narratives and imagery could be presented.

The controlled dissection of former paths and those still being maintained can indicate their history of repair and other upkeep in addition to showing how they were originally constructed. Sometimes this conforms to historical guidance and comprises a careful build-up from coarse material at the base to finer top dressing with several layers rammed down or "tamped" in between. Other paths may be less well-founded and rest directly on top of ground that was levelled up with building rubble or other material.

Individual paths were often built with a camber to facilitate drainage, allowing water to run off into purposely built gutters and drains or simply to soak into the earth. Drainage channels have been found beneath the walkways in the Great Garden at Kirby Hall.[22] The paths there were surfaced or "dressed" with a thick layer of chippings: small angular stones that would rub together to make a crunching sound when stepped upon. At the same time, the walker's feet would sink slightly below the surface, completing the sensual experience. It did not matter if footprints were left behind since they were easily erased by sweeping or raking loose stones after their maker had exited the garden.

While the discovery of such details can enhance our understanding of how a garden may have been experienced, it is not always practical or desirable to reconstruct the previous effect. Modern footfall may be expected to be many times greater than formerly, resulting in increased maintenance due to heavier wear and damage to the fabric. Moreover, grit and dust attached to shoes can be carried into adjacent buildings, where they may grind into historic surfaces, damaging marble and other stone floors in addition to wooden floorboards.

Another potential problem concerning path reconstruction relates to provisions for disabled access. Loose gravel surfaces are notoriously difficult to negotiate for wheelchair users and their carers. Indeed, where material slumps or erodes to create greater depth, for example at the base of a slope, manoeuvring becomes impossible. Solutions range from using different but anachronistic paving to laying resin-bound gravels which mimic the colour and appearance but not the texture of the original surface.

Sometimes an historical precedent can be relevant. At Osborne House, the home that Queen Victoria and Prince Albert created on the Isle of Wight in the mid-1840s and now managed by English Heritage, the pathways in the Pavilion Terrace Garden were initially paved using "coloured imitation lava" (cf. fig. 7). This was presumably an artificial substance made by bonding granular material with asphalt or a bituminous substitute to form a hard solid mass with a smooth even surface when laid or rolled out.[23] It is not known if traces were found during any previous archaeological excavation in the garden since the results remain unpublished. However, a related type of material from later in the nineteenth century has been discovered during recent investigation in the castle gardens at Gaasbeek in Belgium.[24]

22 Dix et al. 1995, 317-21.

23 Turner 2012, 28. Cf. Elliott 2000, 82-3.

24 See Geert Vynckier in this volume.

The proper identification of related samples is a question for a chemical laboratory. In this instance, it seems that the most appropriate one would be the kind used for testing highway engineering and allied materials. Archaeology increasingly relies upon a multi-disciplinary approach to its findings. Material analysis frequently involves specialists from a wide range of fields, sometimes including physicists and geneticists who are at the forefront of developing new dating methods in their respective fields or in human biology and ancestry. More commonly, however, the garden archaeologist turns to the palaeobotanist and soil scientist for technical assistance.

Soil chemistry and biological data may indicate how individual soils were enriched or otherwise enhanced, with remains such as phytoliths, pollen and seeds along with plant macrofossils contributing to the wider picture. In exceptional circumstances, like in the case of root cavities preserved at Pompeii and other Vesuvian sites, we can identify where specific plants grew and detect the contours of the beds or rows in which they were planted.[25] More commonly, small pits, occasionally containing *in situ* pots, will denote patterns of planting but learning what was being grown requires written and visual sources.

The size and depth of an individual flowerbed or border, together with the nature of its infilling, may suggest the sorts of plants it could have contained. Associated species of land snail and other microfauna can be a further indicator for the type of vegetation and soil conditions.

At a larger scale, molluscan evidence from Vallery in modern Burgundy, France shows how water-engineering in the mid-sixteenth century enabled a walled garden to be created in the valley bottom below an adjacent Renaissance chateau. However, the ground was still too damp for ornamental planting and its elaborate decoration was formed using inert materials.[26]

Different coloured earths and varieties of stone together with crushed and pulverised brick and tile often survive where they were incorporated into *broderie* and other ornamental designs. Their distribution provides a guide to the original background colouring. Restoring the fabric to its previous state can add to our understanding of earlier effects. In some instances materials were brought in from several sources, as in the gardens at Witley Court where their designer had a preference for particular rock types (cf. fig. 4).[27] A suitably qualified geologist should be able not only to identify their provenance but also to comment upon modern supplies or the source of the nearest equivalent if the original material is no longer available to replenish or refresh the design.

Similarly, some of the exotic sea shells and coral previously used to decorate grottoes and other structures have become endangered species which are now protected from farming. It is therefore necessary to substitute a close relative for repairs or other restoration works.[28] Adapting to climate change is another cause of adjustment, apart from obvious concern about the implications for buried archaeology.[29] Some tree species are especially challenged not only by drought or increased wetness but also by pests and disease. Their replacement has the

25 Cf. Jashemski 1979, chapters 10-14; De Caro and Jashemski 2013.

26 Dix 2012, 155-62.

27 Dix 2011, 60. Cf. Evans 2014, chapters 8-9.

28 Cf. Dix 2022, 125-6.

29 Dix 2019b.

potential to alter the historical vegetation pattern and palette in parks and gardens with concomitant aesthetic loss of the inherent sensory experience.

Many of these issues are rightly a primary concern for site owners and property managers but they also affect the interests of a wide range of specialists whose expertise may be critical or at the very least beneficial in finding an effective solution.

In my experience, the most successful projects have been those involving collaboration with different experts and where archaeology has been given equal weighting with other disciplines. Projects benefit from the pooling of thought, where alternative perspectives offer a range of insights, often questioning facts and other evidence in ways that a single-minded or more narrowly focussed investigator might not always consider.

A good example of the effectiveness of a team-based approach is the restoration of King William III's Privy Garden of 1701-02 at Hampton Court Palace in West London (fig. 8). It is a useful model suitable for similar situations and easily adaptable to local circumstances.[30]

A disastrous fire at Hampton Court in 1986 led to major restoration of the south side of the palace, including cleaning the façade in addition to refurbishing the rooms which looked out into the king's "privy" or private garden. The monarch would have found the garden unrecognisable, however. It had been replanted since his time, covering up its original form and obscuring the intended view. It was widely felt that it needed to be brought back into harmony with the palace and in 1991 the Historic Royal Palaces Agency, which is responsible for the property, began a four-year major project to restore the early eighteenth-century garden, which was almost complete when the king died on 8 March 1702.[31]

Archaeology was an integral part of the scheme, which also involved historical and horticultural research in addition to the design and engineering work necessary to rebuild the garden.

A research and design team was formed under a central project director, Dr Simon Thurley, who was the Curator at the time. He was delegated to take executive decisions within the framework of a previously agreed budget, thereby removing the constant need to refer to higher committees, which were nevertheless notified about progress. It was equally important to keep the general public informed about what was happening, especially as a formal, more open layout of the new garden would replace a hitherto popular secluded area. Public consultation involved putting the proposals before local residents, councillors and other officials as well as specialist interest groups in addition to promoting the project through exhibitions, videos and other media.

The project team met regularly at fixed intervals and at times in between according to programme needs or if special issues arose. Progress was reported and discussed. Debate was always lively and sometimes heated. Still, it ensured close integration of documentary and other archival research with the archaeological evidence, helping to develop idea about the garden's creation, planting and functioning. It raised new questions for archaeology, in addition to identifying where investigation should be prioritised in order to enable swift transition to the stage of making reconstruction drawings

30 Thurley 1995a.

31 Cf. Thurley 1995b, on which the following paragraphs are largely based.

or blueprints. It was particularly important, for example, to ascertain the original levels within different parts of the garden together with the original terrace profiles.

The core research and design team included landscape architects, historians and archaeologists. It was made up of in-house staff and external specialists drawn from other organisations or working as freelance consultants. Their diverse skills provided an interdisciplinary approach, offering expert advice on historic planting as well as other specialised input. Other specialists were brought in as the project progressed, such as a subgroup of experts on sculpture and its conservation to advise on statuary or engineers and architects to work with the building contractors. Quantity surveying, tendering contracts, and accountancy services were all handled by the Historic Royal Palace Agency's own technical and administrative staff.

However, it was first essential to establish the feasibility of restoring the Privy Garden. An initial assessment of the documentary record showed it to be remarkably complete for the period when the garden had been originally designed and constructed. The potential survival of physical remains was also investigated as part of the evaluation process.[32] Whilst the boundaries of the garden remained more or less intact, together with other features such as the central fountain basin and terraces with some of their original steps, all had been modified or renewed to some extent. Similarly, although contemporary trees appeared to be present among the later replanting, they had vastly outgrown their intended size and were in poor health.

A key priority for archaeological investigation was to identify the extent of any buried remains and to determine their nature and condition.

Geophysical prospection was carried out to reveal the original arrangement of steps and planting along the terraces which flanked both sides of the garden. The former topiary was also denoted in places by shallow depressions and changes of surface vegetation, which trial excavation confirmed to have been caused by underlying tree holes. Other small-scale investigation examined key points in the garden identified from historic plans, including path intersections as well as the anticipated locations of former steps and the foundations for statues. Further excavation of narrow circular trenches around the bases of selected trees in the parterre, a preliminary step before transplanting them, revealed the edges of paths and showed that soil-filled trenches had been dug into the natural gravel to form planting beds or borders.

The results indicated a generally good level of preservation with the potential to recover the original form of the garden. The rich archive of contemporary documents detailed its programme of construction, while surviving receipts for shrubs and flowers could be used in conjunction with studies of historical planting design to form a convincing scheme for replacement.

Having safeguarded the historic plant material by taking cuttings to produce clones that could eventually be reintroduced into the garden, the decision was taken to recover the original design by clearing all trees and other surface vegetation. The entire parterre was excavated over a period of eleven months spread over two seasons, starting with the two quarters in the larger northern or upper half of the garden. This meant that spoil could be dumped temporarily in the southern part, helping to reduce the cost

32 Dix and Parry 1995, 79.

of off-site removal. Also, it enabled reinstatement to begin early at the northern end of the garden, which was critical in view of the tight time frame of the overall programme.

Mechanical excavators were used to remove the recently cultivated and root-disturbed soil that trial excavation had previously revealed throughout the garden. The underlying surface was then carefully cleaned by hand, enabling later features to be recorded before attention turned to rediscovering the layout of borders, or *plates-bandes*, from William III's garden.[33] Because his remodelling lowered the ground level, they had been cut into the underlying natural river gravels (fig. 9).

The original flowerbeds comprised trenches up to three feet deep (0.95 m), which had been immediately backfilled so that their sides remained as sharp as when they had been freshly dug. They were filled with deliberately improved soil, which had a high clay content to retain water. Soil microfabric analysis as well as related chemical and botanical studies show that sieved building rubble was added to a dark brown soil sandwiched between two red loams to make it more calcareous and thereby better retain the increase in nutrients derived from other forms of enrichment through domestic waste including bones, shells, coal and ashes.[34]

The excavation results provided much basic information. Features such as statue plinths, drain funnels, and the original rim of the fountain basin demonstrated the relative levels between different parts of the garden. Rediscovered tree holes showed the precise position of topiary along the terraces, where the brick footings for flights of steps pointed to the original gradient of their slopes. Other foundations uncovered along the top of the west terrace established the width of the bower or tunnel arbour that stood there and indicated the size of its portico, which was found to match the dimensions found in a scale drawing of a contemporary frontal and has since been used as the model for reconstruction.

The geometry of the garden was analysed by comparing the measurements of the paths and other features of hard landscaping with information from historical surveys. This showed that an eight-foot (2.43 m) module had been used for setting out. The pattern of evergreens fitted into its framework and other finishing details like the sand alleys and cutwork could be placed with reasonable confidence.

The identification of the actual planting scheme was more problematic. Archaeology was silent and neither the documents nor visual sources provided a full picture. As a result, evidence from other sites of the period has been used in conjunction with information contained in contemporary treatises.[35]

Trials were carried out as an aid to identify suitable varieties of plants and to judge their effect. Much of the new plant material needed to be ordered as early as possible if the reconstructed garden was to be completed on time. This included an estimated 30,000 box plants for edging the *plates-bandes* together with carefully clipped holly and yew trees to set within them and along the terraces. A large quantity of specially grown turf was also required.[36]

The outlines of the *plates-bandes* were reinstated in their original locations by the archaeologists who ensured their accurate positioning in relation to the

33 Dix and Parry 1995.

34 Dix and Parry 1995, Appendix 2.

35 Woudstra 1995.

36 Thurley 1995b, 20-1.

previously recorded remains. As an experiment, the layout of one quarter was initially recreated using sightlines and other traditional techniques, which were found to be quite accurate when checked by modern surveying equipment. The intricate patterns of cutwork in each quarter were most easily laid out using ancient methods of cord and pegs to plot curves and circles from central points. The individual schemes were then painted onto the turf as a guide to cutting out. Whilst much of the hard landscaping was carried out by external contractors, Hampton Court's own gardening staff worked on finishing and replanting the parterre. It was important for them to have this initial experience, since they would be responsible for subsequent maintenance (fig. 10).

Whilst there is inevitably some degree of conjecture in what has been done, *in-situ* re-creation can make a positive contribution to the sense of place of a site. Full-scale reconstruction allows the effects of historic planting schemes to be rediscovered and combined with actual remains to demonstrate how individual places may have been experienced. However, we must be careful to avoid distorting reality. Paradoxically, such closeness to the past emphasises our distance from it. Whilst physical remains suggest proximity and commonality, they nevertheless represent a past that we can never fully comprehend. However, this does not mean we should not make the effort.

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Fig. 1 Full size reconstruction based upon rigorous research, as in King William III's Privy Garden at Hampton Court Palace, is an important way of presenting historic gardens to the public.

Photo: B. Dix



Fig. 2 Archaeology indicated the type of garden that had existed at Kirby Hall in the late seventeenth century but the reconstructed detail is partly conjectural with broderie and statuary copied from elsewhere.

Photo: B. Dix



Fig. 3 The spirit of the Elizabethan garden at Kenilworth Castle is evoked by a reconstruction that combines historical description with archaeological evidence of the general layout.

Photo: B. Dix



Fig. 4 Suitable planting at the historical flower beds revealed by excavation of the East Parterre at Witley Court, where the original coloured “gravels” have also been reinstated.

Photo: B. Dix



Fig. 5 Former tree sites denoted by changes in vegetation associated with low mounds and hollows may show where avenues, clumps and other planting once existed.

Photo: B. Dix



Fig. 6 Remains of steps show how changes in level were previously negotiated and indicate the relative heights between different parts of the garden.

Photo: B. Dix



Fig. 7 Modern gravel paths in the Pavilion Terrace Garden at Osborne differ from their historical predecessor, which employed “imitation lava” to provide a more easily traversed smooth surface.

Photo: B. Dix



Fig. 8 The restoration of the Privy Garden at Hampton Court Palace was a multidisciplinary project involving research and collaboration between different experts.

Photo: B. Dix



Fig. 9 The well-preserved outline of the flower beds in the Privy Garden at Hampton Court Palace provided the basis for accurate reconstruction.

Photo: B. Dix



Fig. 10 In addition to providing opportunities for research and experimentation, historical replanting is a useful way to reclaim traditional practices.

Photo: B. Dix

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Dorota Sikora

Archaeology as a source of knowledge about historical gardens – selected examples

Research in garden archaeology provides a valuable source of knowledge on historic gardens, serving as a complementary and verifying tool in relation to information found in archival sources. It offers insights both into the former, often lost, layout of historic green spaces and into their fundamental elements such as garden structures, pathways, and even plantings. In Poland, garden archaeology was incorporated into conservation practice and popularized on a wider scale in the 1990s by Ośrodek Ochrony Zabytkowego Krajobrazu (Centre for the Protection of the Historical Landscape). It was subsequently continued at Krajowy Ośrodek Badań i Dokumentacji Zabytków (National Centre for Research and Documentation of Monuments), where its methodology was significantly developed in terms of techniques for conducting research and documenting results. This article presents examples of its application, with detailed discussion of studies conducted at three sites: the Branicki Garden in Białystok, the Wilanów Garden, and the Podhorce Garden (Ukraine).

RESEARCH IN THE FIELD of garden archaeology is a valuable repository of knowledge about historical gardens, supplementing and verifying information found in archival records. This type of research began to be more widespread in Poland in the 1990s, and it was popularized by the Ośrodek Ochrony Zabytkowego Krajobrazu (Centre for the Protection of the Historical Landscape) (OOZK). The spectacular findings made as part of archaeological research conducted in the Privy Garden at Hampton Court Palace in Great Britain[1] were undoubtedly an inspiration for the evolution of this form of historic garden reconnaissance.

In the 1990s and later, the initiative to conduct research into garden archaeology was pioneered by OOZK, which was later transformed into the National Centre for Research and Documentation of Monuments (KOBiDZ). This research encompassed the Branicki Gardens in Białystok and Choroszcz, the Wilanów

1 Dix and Parry 1995, 79-118.

Garden, the monastery garden in Jędrzejów, the Muskau Park, the palace park in Mysłakowice, the castle garden in Oporów, and the garden at the Pidhirtsi (Podhorce) Castle in Ukraine. The scope of works varied depending on the specific nature of objects studied, and results provided valuable information on a range of topics, including:

- the historical spatial layout of gardens or parts thereof;
- the location, scale and form of garden structures and sculptural elements that no longer exist, including pavilions, fountains, cascades, stairs, retaining walls, fences, gates, bridges, pedestals for sculptures, and sometimes the sculptures themselves or their pieces;
- building materials used in the past;
- the historical function of the gardens and it has changed over time;
- the terrain and its diversity (slopes, escarpments, ramps, terraces);
- the historical vegetation (e.g. the extent of flower beds, parterres, and the placing of trees);
- the former course and width of paths, the shape of squares, the form of their edges and the types of surface;
- the course and form of the embankments of ponds and canals;
- elements of garden furnishings (e.g. flower pots and benches);
- historical technical infrastructure (e.g. components of historical water supply systems);
- extensions and reconstructions of gardens, as well as periods of their degradation.

The data obtained during archaeological research has enhanced our general knowledge about the objects studied, their history, form and materials used. In some cases, together with archival sources, it has become the starting point for the preparation of documentation for their protection and conservation.

The beginnings of research in the field of garden archaeology

Archaeological research into historic gardens has been conducted in Poland for a considerable time, although initially the primary objective was to locate vestiges of former settlements or relics of buildings that no longer exist[2] rather than to gain knowledge about compositional solutions or materials used in garden design. For instance, in 1957, an archaeological dig was carried out in the castle and park complex in Oporów (under the direction of Mirosława Gajewska and Jerzy Kruppé), during which fragments of brick and stone walls were unearthed in the present-day courtyard in front of the castle, along with a cobbled surface that was found to be significantly below the currently used level of the garden. Since the 1960s, research has also been conducted in the garden of the Palace of the Bishops of Kraków in Kielce to determine the location and forms of buildings that no longer exist.[3] In turn, from 1984 to 1986, archaeological research was carried out in the historic park in Puławy and its surroundings (at the behest of the voivodeship conservator of monuments in Lublin). The results of this research included the identification of the historical water supply system from the nearby Włostowice, encompassing the course of the seventeenth-century water installation and its technological solutions. The investigation also revealed the presence of sedimentation and distribution tanks, in addition to

2 Adamczyk 1991; "Informator Archeologiczny. Badania 1967," 333-334; "Badania 1968," 389; "Badania 1969," 415. After: Kola 2011, 132.

3 Tomala 2002.

the discovery of wooden, lead and ceramic pipes which were used to distribute water throughout the garden. Furthermore, the research uncovered stone profiled edges of no longer existing fountains, along with their brick base slabs.[4]

In the 1990s, the method of researching gardens using archaeological techniques was adopted by OOZK, led by the director of the institution, Dr Andrzej Michałowski. The first site selected for this type of survey was the castle park in Oporów. The research conducted there in 1995 under the supervision of Professor Andrzej Kola was aimed at identifying traces of the garden's original formal composition. Despite the lack of spectacular results in these initial pilot studies, it was decided to continue the research of gardens using archaeological methods.

The next site selected for investigation was the Baroque garden at the Palace of the Bishops of Kujawy in Wolbórz.[5] The archaeological survey, commissioned by OOZK, was carried out in 1997 by Maria Żemigała and Emilia Wtorkiewicz-Marosikowa, working under the supervision of Professor Tadeusz Poklewski-Koziełło. Results of this research are of great interest. Stones arranged in rows were discovered, which could have been the edges of the park surface. Further, garden slopes were examined and it was established that they were made of brick rubble. Finally, traces of trees that no longer exist were identified. The archaeological research was accompanied by dendrochronological studies conducted by Dr Tomasz Ważny, which determined that the oldest trees in this area (small-leaved linden trees, *Tilia cordata*) were planted around 1770, which is when the garden in Wolbórz was laid out.

At the end of the 1990s, research was also conducted in the monastery garden in Jędrzejów (under the supervision of Professor Andrzej Kola), again on the initiative of the OOZK. The results have enabled us to ascertain the course of the brick fence surrounding the garden and the location of the foundations of the former gate leading to this part of the monastery complex.

Below, we present selected examples (including the Branicki Garden in Białystok, the Wilanów Garden and the garden in Pidhirtsi) which illustrate the immense importance of archaeological research as a source of knowledge about the historical layout and furnishings of historic gardens. The practical application of this type of research is also emphasized, as it is particularly important in the preparation of conservation documentation related to restoration and subsequent implementation works.

Archaeological research in the Branicki Garden in Białystok

In 1997, archaeological research commenced and continued for several seasons in a notable Baroque garden in Poland – the Branicki Garden in Białystok. According to the originator of this research, Dr Andrzej Michałowski, it was part of a broader research programme aimed at providing the necessary information for the planned restoration of this site. The archaeological survey was therefore accompanied by parallel archival research, as well as a dendrological inventorying and analysis of the garden's composition and its elements. Furthermore, it was also agreed that dendrochronological studies would be conducted on the oldest trees and palynological studies would be performed on

4 Kutyłowska 1989.

5 *Wyniki archeologicznych badań wykopaliskowych ogrodu.*

soil samples taken from archaeological excavations. On behalf of OOZK, I coordinated all of this work[6] in consultation with the International Conservation Council for the Branicki Gardens in Białystok and Choroszcz, whose members included prominent specialists in the field of garden art from Germany, Austria, the Netherlands and Poland: Klaus von Krosigk, Hubert Wertz, Géza Hajós, Robert de Jong and Andrzej Michałowski.

In the initial seasons, the archaeological research in the Branicki Garden was led by Professor Andrzej Kola from the Institute of Archaeology and Ethnology at the Nicolaus Copernicus University in Toruń (1997–2001), and was subsequently continued by local archaeologists associated with the State Regional Museum in Białystok (now the Podlasie Museum). Already in the first year of research, interesting relics of an eighteenth-century garden composition were unearthed, including fragments of a Baroque cascade. This feature was supplied with water from a wall fountain located by one of the garden pavilions (next to the Eagle Pavilion) and channelled into a nearby canal. These relics comprise a brick wall approximately one hundred and thirty centimetres wide, with preserved fragments of sandstone cladding.[7]

In 1998, further relics of garden structures were uncovered, namely the base slabs of four Baroque fountains adorning the garden parterres, located in the central part of the garden. These findings were of paramount importance in identifying the eighteenth-century composition of the Branicki Garden, as they definitively confirmed the location and architectural form of the Baroque fountains, which were previously known only from historical iconography. They also provided valuable information about the technology and materials used in the eighteenth century to build these structures. It was established that the bottom slabs of the fountains were constructed using brick on fieldstone foundations, with lime mortar used for adhesion. According to the inventory of the Branicki Garden dating from 1772, the fountain basins had different bottom coverings. Two of the basins located closer to the palace were made of sandstone, while the two further away were composed of square ceramic tiles. This was corroborated by the findings of archaeological research. Furthermore, archaeologists were able to ascertain the original shape of the terrain in the central part of the Branicki Garden. Prior to the establishment of the garden, the area sloped northwards towards the present day canal, and it was only during the construction of the garden that the land was levelled.[8]

Research carried out in 2001 by Professor Kola's team in the local bosquets also provided valuable information about the Branicki Garden, which was discovered to contain fragments of a water supply system for the garden fountains, made of coniferous wood with iron connectors and measuring approximately fifteen centimetres in diameter. In addition, an eighteenth-century flow well measuring 2.7 x 2.7 metres, along with a wooden structure, was found in one of the bosquets.[9] At the point where the main roads'

6 The results of inventory, research and design work from the first season were published in: *Ogród Branickich w Białymstoku. Badania–projekty–realizacja, 1998*, and *Ogród Branickich w Białymstoku. Badania–projekty–realizacja, 1999–2000*. The entire process of revitalizing the Branicki Garden was summarized in: *Ogród Branickich w Białymstoku – historia rewaloryzacji*.

7 Kola 1998, 87.

8 Kola 2000, 133.

9 Kola 2011, 147.

thoroughfares intersect in this part of the garden, a brick foundation slab of an additional Baroque fountain was unearthed. The findings enabled archaeologists to determine that the fountain currently located there was significantly larger than the present-day one.

Andrzej Kola also attempted to locate the remains of eighteenth-century garden pavilions: the Eagle Pavilion, the Chinese Pavilion, and the Canal Pavilion. Following this research, it was possible to find fragments of the stone strip foundation of the Eagle Pavilion and several oak piles on which it was historically built.[10] Archaeological excavations revealed fragments of a brick terrace which surrounded the Chinese Pavilion in the eighteenth century. Unfortunately, the foundations of this building were severely damaged during the construction of a small farm building at this location in the interwar period. With regard to the remains of the Canal Pavilion, Professor Kola expressed the opinion that they may be located outside the current boundaries of the Branicki Garden, which was significantly reduced in size from the north during the interwar period.[11] This hypothesis was corroborated in 2007 by two archaeologists from Białystok, Lech Pawlata and Urszula Stankiewicz, who discovered the foundations of the eighteenth-century Canal Pavilion several metres from the present day boundary of the garden.[12]

Results of the archaeological research carried out in the Branicki Garden were also an important factor in subsequent decisions regarding the direction of restoration works at this site. The location, size and form of the main components of the historical garden layout were confirmed. The research supplemented data from eighteenth-century sources, helped to verify the reliability of the information, and ultimately made it possible to clarify the eighteenth-century form of this valuable monument of garden art. Furthermore, they facilitated a critical assessment of the restoration work conducted at this site during the 1960s and 1970s.

Results of archaeological research were also instrumental in the design work at the palace's entrance courtyard. One of the well pavilions located there has been used to display architectural details found during many years of archaeological research.

Findings of the archaeological research carried out by Professor Kola's team in the park in Choroszcz (the Branicki family's summer residence, located about twenty kilometres from Białystok) also had a significant impact on conservation.[13] A border consisting of field stones, discovered near one of the outbuildings, provided compelling evidence in the discussion about the need to replace the border around the Branicki Palace in Białystok. The Palace is currently encircled by a stone border modelled on the eighteenth-century one found in Choroszcz.

Archaeological research in the Wilanów Garden

The Wilanów Garden is an invaluable monument of Polish Baroque garden art. It owes its establishment in the 1670s to King Jan III Sobieski and the exceptional team of architects, engineers and artists working on behalf of the monarch. In later years, it was modified and expanded

10 The current reconstruction of the wooden Eagle Pavilion was designed by Tomasz Rogala.

11 Kola 2011, 146.

12 Stankiewicz 2011, 152.

13 *Archeologiczne badania Ogrodu Branickich w Choroszczy.*

by successive owners and administrators, resulting in a multi-phase entity, characterized by spatial and functional complexity. This evolution documents the material culture and artistic trends in the periods when it was created and transformed.

From 2003 to 2005, I participated in the interpretation of results from archaeological research conducted in the Wilanów garden.[14] This research significantly expanded knowledge about the site and contributed valuable new information to the history of Polish garden art. It was conducted by a team of archaeologists from KOBiDZ under the direction of Andrzej Gołembnik, with the participation of students from the Institute of Archaeology at the University of Warsaw, and was commissioned by the Wilanów Palace Museum (currently the Jan III Palace Museum in Wilanów).[15] The objectives set before archaeologists included obtaining new information about the garden's composition and its changes over time, as well as verifying the reliability of archival records. The archaeological research was also intended to provide data that could be helpful in the planned restorationof selected parts of the Wilanów garden. This work was carried out several years later, according to design documentation prepared by a team led by Professor Zbigniew Myczkowski.[16]

One of the initial tasks for archaeologists was to examine and document extensive excavation work that had been carried out a few years earlier in connection with the planned renovation of the retaining wall of the upper garden terrace. Findings from this research made it possible to establish the chronology of the wall's construction[17] and the historical technology used to erect this type of garden structure, in particular its underground components, with the help of wooden piles meant to stabilize the marshy ground as well as massive strip foundations and underground retaining walls with buttresses.[18] The results of archaeological research carried out at the retaining wall further substantiated the reliability of a key cartographic source for the seventeenth-century phase of the Wilanów Garden – the garden plan from 1682 (known as the Adolf Boy plan). Further investigation has revealed that the wall depicted in the drawings of this plan may be shown inaccurately. However, it was difficult to draw final conclusions regarding certain sections of the wall, such as the corners, due to the numerous seventeenth-century alterations and

14 As a landscape architect specializing in the conservation of historic gardens, I worked closely with a team of archaeologists researching the Wilanów Garden during this period. This cooperation involved preparing a research programme, interpreting results, particularly in the context of analysing archival sources as reference material, and drawing coherent conclusions from archival and archaeological research. Anna Hanaka also participated in the analysis of archival materials on behalf of KOBiDZ.

15 Results of archaeological research conducted between 2003 and 2005 were summarized in: Gołembnik 2004; Sikora 2004; Gołembnik and Jankowski 2005; Morysiński 2005, and elsewhere.

16 In later years, the revitalization of the Wilanów Garden was carried out according to the design documentation prepared by a team led by Professor Zbigniew Myczkowski.

17 According to Andrzej Gołembnik, the construction of the retaining wall in Wilanów can be divided into five phases:
1676–1679: the preparatory period and the construction of clay and earth protection on the lower terrace;
1679–1682: construction of the foundations and sections of the eastern and side walls;
1682 – correction of the methods use in the foundations and wall construction;
1682–1686: construction of the wall and grotto;
1686–1694: finishing works in the grotto area and on the crown of the wall.

18 Gołembnik and Jankowski 2005, 294.

corrections.[19] Archival research conducted alongside archaeological investigations has enabled the verification of several iconographic sources. For instance, it was determined that the Wilanów retaining wall with numerous wall fountains, depicted by Bernardo Bellotto (Canaletto) in his 1777 painting[20] never existed in such form, and that the art work should be thus classified as a *capriccio*.[21]

Significantly, archaeologists were able to determine the topography of the area before the garden was established. Prior to the levelling process, the topography resembled a promontory with a gently sloping surface that extended in a north-easterly direction.[22] During the course of research, it was also determined how this area was levelled in connection with the construction of the garden. It was found that a layer of river sand was used to even the terrain. Archaeologists have described this levelling as "royal," marking the beginning of the history of the Wilanów Garden.[23] The usable level of the garden during the reign of Jan III Sobieski was also determined, which was approximately twenty centimetres below the current ground level.[24] Given the absence of this type of information in historical sources, the above findings should be considered particularly valuable.

A significant amount of information regarding the historical composition of the Wilanów Garden and its alterations over time was also provided by research conducted on the upper terrace, where the foundations of park sculptures were uncovered.[25] According to archival materials concerning Wilanów and established knowledge of Baroque garden design, the sculptures were positioned at the corners of the garden parterres. The archaeological investigation of their location in the Wilanów Garden has made it possible to determine the extent of the Baroque parterres and the width of the garden paths connecting them. This information is crucial for any theoretical or practical attempts to reconstruct the historical spatial layout of the Baroque phase of the Wilanów Garden.

During the research, it was also established that the pedestals unearthed by archaeologists are multi-phase, often exhibiting displacement of up to several dozen centimetres relative to one another. This suggests that possibly sculptural decorations were replaced at different periods of the garden's history, in addition to alterations in the dimensions of the parterres and the width of paths.[26] Further analysis revealed that only the small brick pedestals in the central part of the upper terrace, which archaeologists have linked to the times of Jan III Sobieski, turned out to be single-phase.[27]

Archaeological research has also provided insight into the surface of the Baroque garden, thereby clarifying certain issues. Traces of a gravel and sand road were discovered in the vicinity of the pedestals for the sculptures, which is also confirmed by the earliest known iconography of the Wilanów Garden – a series of paintings by Bernardo Bellotto (Canaletto), in which the park roads are depicted in yellow-beige tones. Another significant archaeological find in this regard was the

19 According to Andrzej Gołembnik.

20 Painting by Bernardo Bellotto (Canaletto), *View of Wilanów Palace*, 1777, Zamek Królewski w Warszawie, inv. no. ZKW 460.

21 Sikora 2005a; Hanaka 2005.

22 Gołembnik 2004, 143.

23 Gołembnik 2004, 143, 152; Gołembnik and Jankowski 2005, 288.

24 Gołembnik 2004, 143, 154, 156.

25 Gołembnik 2004, 151.

26 Sikora 2004, 187.

27 Gołembnik and Jankowski 2005, 285.

herringbone-patterned paving made of bricks laid with their stretcher sides facing upwards. This paving was located in front of the palace's garden façade and in the central part of the upper terrace, where a round fountain was marked on the earliest plan of the garden, dating from 1682. The existence of this fountain could not be confirmed by archaeological methods, although non-invasive research suggested the presence of its relics.[28] However, remains of a nineteenth-century fountain were unearthed, which had previously existed in front of the palace's garden façade until the restoration works carried out in the Wilanów Garden after the Second World War by Gerard Ciołek. The nineteenth-century fountain had a diameter of approximately thirteen metres, and its concrete base was set on a levelling layer of brick rubble. The walls of the fountain were constructed using a combination of bricks and stone cladding (perhaps sandstone), the remains of which were discovered during research.[29] The form of the fountain is illustrated in historical iconography and numerous photographs from the first half of the twentieth century.

Between 2003 and 2005, the scope of archaeological research was expanded to encompass the palace courtyard. Archaeologists have determined the Baroque usable level of the site to be approximately thirty centimetres below the current ground level.[30] The most notable achievement in this area is the accurate determination of the course of the fence that divided the area in front of the palace into the *cour d'honneur* and the *avant-cour* during the Baroque period. The course of this fence changed over time, as evidenced not only by archaeological research but also by historical cartography (plans of the Wilanów garden from 1682, 1729, and the second half of the nineteenth century). Research also enabled to determine the width of the gate in this fence, leading from the entrance courtyard to the *cour d'honneur*, to be four metres.[31] The fence is described in detail in the 1793 inventory of the Wilanów Garden:

> The courtyard is divided by a transparent balustrade set on a stone base, which is positioned between the gate and the palace. This balustrade is divided into two sides – one of which, on the right side, has four stone pillars on a stone foundation and six wooden pillars. Between the pillars, there are forty-two iron bars, some of which are topped with royal crowns made of sheet metal with laurels and shields […]. On the left side, there are nine stone pillars, with the remaining pillars being wooden and placed on a foundation, between which there are eighty iron bars. There are seven transverse bars, standing bars also with royal crowns and laurels, some of which are missing, and the remaining elements are similar wooden bars, painted. The gate is composed of two stone pillars each with two glass lanterns, while the remaining iron pillars support eleven complete lanterns; the rest are in a state of disrepair. There are two round stones in the gate of the balustrade embedded in the ground.[32]

28 Gołembnik and Jankowski 2005, 286.

29 Gołembnik and Jankowski 2005, 286.

30 Gołembnik and Jankowski 2005, 282.

31 Gołembnik and Jankowski 2005, 281.

32 Archives of Museum of King Jan III's Palace at Wilanów; source materials no. 110, *Inwentarz Pałacu Wilanowskiego y wszystkich w nim znajdujących się meblów, obrazów, etc. Diebus septemmbris 1793 spisany*, copy.

Archaeological research has also yielded valuable findings regarding the garden's furnishings, including the shapes of containers and pots in which plants were stored or displayed in the garden during the summer months. During the course of the excavation, fragments of ceramic pots and cold frames used in everyday plant cultivation were unearthed, along with elements of a decorative Delft vase painted with cobalt. The latter featured heraldic elements of the Opaliński family and the coat of arms of Zofia Lubomirska née Ostrogska (a combination of the Leliwa and Ogończyk coats of arms), a close relative of Elżbieta Sieniawska, the owner of Wilanów in the early eighteenth century. A twin, complete vase is currently in the collection of the National Museum in Warsaw.[33] A note in the inventory of the Italian Garden in Wilanów, dated 27 June 1729, mentions twenty-one "newly purchased blue faience (*farfurowe*) vases with coats of arms" in the inventory of the Italian Garden in Wilanów, which may refer to the vessels whose fragments were found by archaeologists.

Results of the aforementioned archaeological research, along with results of the analysis of archival records, have formed the basis for a graphic study of the developmental phases of the upper terrace of the Wilanów Garden in its Baroque form, and for a preliminary proposal of the direction of revitalization work in this area.

Archaeological research in the garden in Pidhirtsi

The garden in Pidhirtsi is one of the few surviving examples of garden designs integrated into the layout of a *palazzo in Fortezza* type of residence. These were built in the seventeenth century within the borders of the Polish-Lithuanian Commonwealth. The building was completed between 1635 and 1640, commissioned by the owner of Pidhirtsi (Podhorce), Stanisław Koniecpolski, grand hetman of the Crown. The reconstructions, modernizations and renovations carried out in the following centuries did not affect its general seventeenth-century layout.[34] The building's distinctiveness is defined by its high artistic value and the still legible Mannerist-Early Baroque form, which has retained its well-preserved compositional and functional links with the palace, along with fortifications and surroundings that include three garden terraces, corner pavilions, a grotto as well as intricate architectural and sculptural details.

In the summer of 2004, a joint Polish-Ukrainian programme of interdisciplinary research devoted to historical residences was launched at the grounds of the palace and garden complex in Pidhirtsi (Podhorce). The Polish side of the programme was coordinated by the director of KOBiDZ, Jacek Rulewicz, and the Ukrainian side – by representatives of the Lviv Regional State Administration. The research was conducted by employees of KOBiDZ and the Faculty of Architecture at the Lviv Polytechnic, as well as landscape architecture students from the Warsaw University of Life Sciences, archaeology students from the Cardinal Stefan Wyszyński University in Warsaw, and students of architecture from the Lviv Polytechnic. The research on garden archaeology was coordinated by Andrzej Jankowski from KOBiDZ in collaboration with the Ukrainian archaeologist Mykola Filipchuk, while digital documentation was carried out by Karol Czajkowski

33 Morawski and Pyzel 2020, 231; Morysiński 2005, 331-335.

34 Sikora 2005b.

from KOBiDZ. Finally, landscape architecture research was coordinated by the author of this text, while the architectural research – by Dr Oresta Remeszyło-Rybczyńska from the Lviv Polytechnic National University.

Despite the interdisciplinary nature of research carried out in Pidhirtsi (Podhorce) in 2004, which was only a pilot project of short duration (just one season), interesting results were achieved. These included measurements of garden architecture and sculptural decorations, inventorying of the dendroflora, orthophotographic documentation of the palace façade and retaining wall, archaeological reconnaissance of the central, most impressive garden terrace, analysis of the composition of the palace and garden complex based on archival records and results of the fieldwork, recording of key visual connections, and the determining of the boundaries within which the site should be protected.

The archaeological research was conducted exclusively at the central garden terrace, where it still possible to see the layout established in the early twentieth century at the site of an earlier seventeenth-century garden. Therefore, archaeologists were faced with the task of identifying the particulars of the twentieth-century quarter garden, whilst also seeking to locate vestiges of earlier arrangements of this space.[35] Archaeological research was preceded by the preparation of a site plan and an elevation plan of the area, recording the extent of visible elevations and depressions in the terrain – remnants of the parterres and paths from the early twentieth century. Outlines of main architectural elements were also marked on the map. Next, the locations of three archaeological test pits were determined: firstly, in the area of the stairs leading from the upper terrace to the middle terrace; secondly, in the central part of the investigated area, at the intersection of the main garden paths; and thirdly, on the southern edge of the terrace, where a retaining wall once existed.

The research determined the extent of the twentieth-century parterres and the width of the paths separating them, which was four metres. In the central part of the terrace, at the intersection of the paths, traces of an oval structure were found. These were initially interpreted as the remains of a former (perhaps seventeenth-century) fountain measuring approximately four by six metres. However, this interpretation should be treated as a research hypothesis requiring verification. In the area where the upper terrace descends to the middle terrace, a fragment of seventeenth-century stone steps was uncovered. These steps differed in architectural form from the twentieth-century steps as they were set directly on the rocky ground.[36] Furthermore, archaeologists were able to determine that the surface of the garden paths in the twentieth-century garden (and possibly in earlier phases) was composed of local limestone. Roads with such a surface still exist in the area, for example the so-called old road from Pidhirtsi (Podhorce) to nearby Olesko.

Excavations at the edge of the terrace under investigation, in the area where a retaining wall had previously existed, revealed traces of seventeenth-century levelling of the terrain, related to the adaptation of the hill for the establishment of a garden, as well as relics of the foundations of a balustrade, which was located there at the beginning of the twentieth century. However, despite extensive

35 Jankowski 2005.

36 Jankowski 2005, 475.

research, it was not possible find any traces of the Baroque retaining wall delineating the terrace from the north, which was documented in many archival engravings as being located to the north of the terrace. Further archaeological investigation is required to settle this issue.

Summary

Garden archaeology is now widely implemented to investigate historical gardens. In Poland, it was incorporated into conservation practice and popularized on a wider scale in the 1990s by OOZK. The project was then continued at KOBiDZ, where the methodology was significantly developed in terms of techniques and documentation of results. In recent years, such research has been carried out in leading Polish historic gardens, including Nieborów, Łazienki Królewskie, Krzyżtopór Castle, and Korczew. These studies have significantly expanded knowledge about these sites, enabling more comprehensive interpretation as well as verification of the reliability of archival sources concerning them. They have also provided information regarding elements of garden composition that are not mentioned in the sources.

However, it should be noted that garden archaeology research is destructive in nature and cannot be carried out in every location. For instance, it should not be carried out in the vicinity of valuable old trees or elements of historical garden design that would be exposed to irreversible damage as a result. In such situations, this type of research can be replaced or supplemented to some extent by non-invasive research and LIDAR analyses.

It seems that the key to success in historical garden research, including garden archaeology, has been its interdisciplinary nature. Therefore, studies of this type benefit from being carried out by teams consisting of people with various specialities, with archaeologists accompanied by architects, landscape architects, botanists, surveyors, and art historians. These professionals can thus develop a shared research programmes and interpret results as a team.

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Fig. 1 The Branicki Garden in Białystok.

Photo: D. Sikora, 2017



Fig. 2 International Council for the Conservation of the Branicki Gardens in Białystok and Choroszcz. From the left: Géza Hajós, Robert de Jong, Klaus von Krosigk, Edward Bartman, Andrzej Michałowski and Andrzej Kola.

Source: Archiwum Narodowego Instytutu Dziedzictwa, 1999

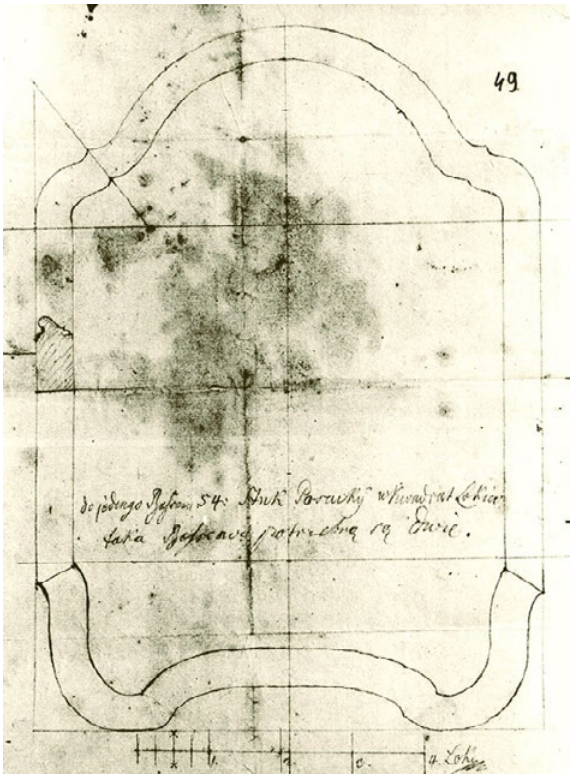


Fig. 3 Design of a fountain for the Branicki Garden, 1752.

Source: AGAD, Archiwum Roskie, XXI/22, fol. 49, public domain



Fig. 4 Fragments of the brick base of a Baroque fountain discovered during archaeological research conducted by Professor Andrzej Kola, 1998.

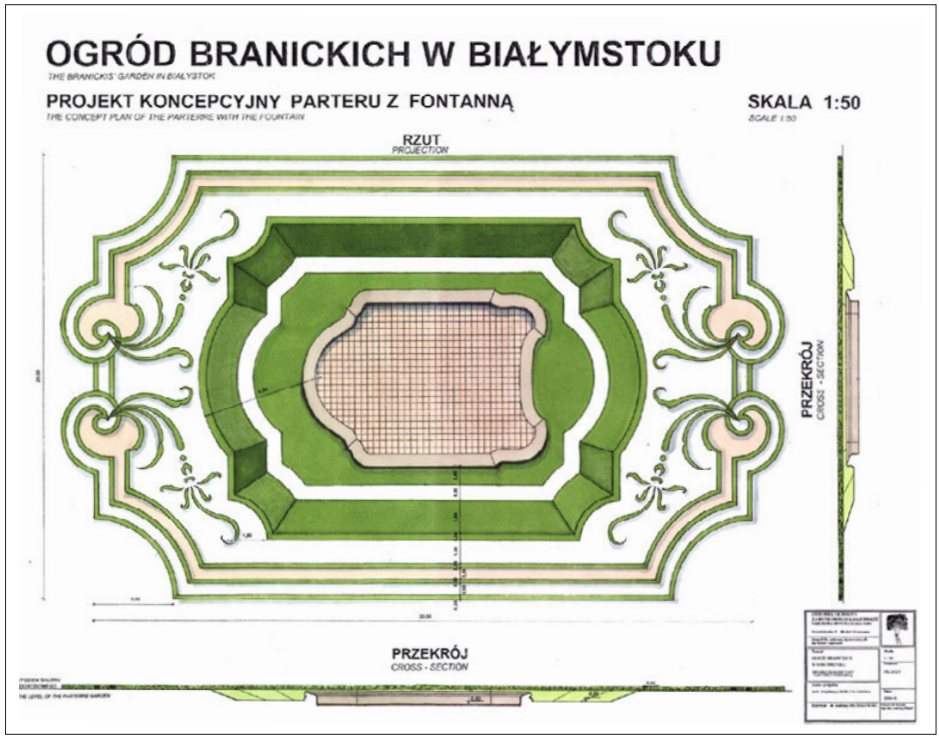


Fig. 5 Design of the parterre with a fountain.

Compiled by D. Sikora; OOZK, 2000



Fig. 6 Connectors of a wooden water system (left), and a wooden well discovered in one of the bosquets (right).

Photo: D. Sikora, 1999

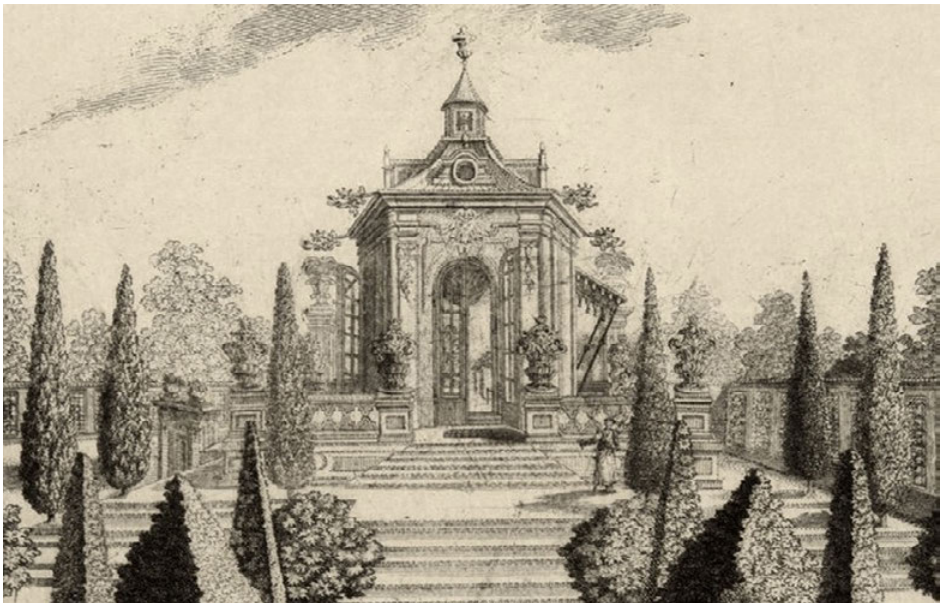


Fig. 7 Heinrich Rentz, Chinese Arbour in the Branicki Garden in Białystok, mid-eighteenth century.

Source: Muzeum Narodowe w Krakowie, MNK XV-R.-10108, public domain



Fig. 8 Remains of the terrace of the Chinese Pavilion discovered during archaeological research led by Professor Andrzej Kola, 1999.

Photo: D. Sikora

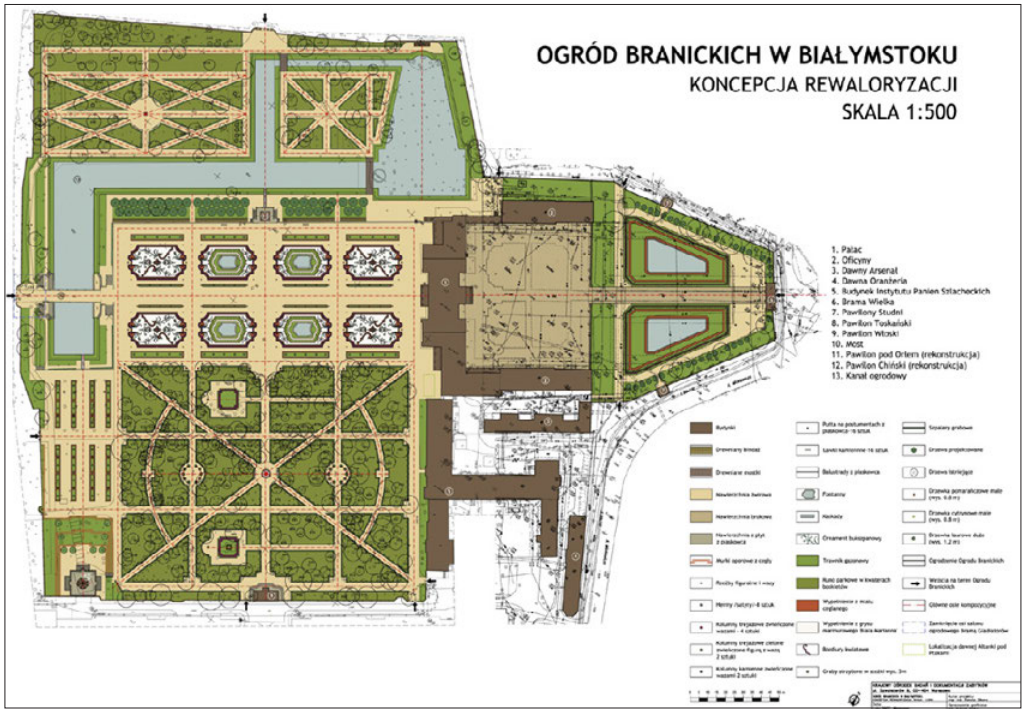


Fig. 9 Concept for the restoration of the Branicki Garden in Białystok based on archival and archaeological research, as well as the inventory and assessment of its current condition.

Compiled by D. Sikora, KOBiDZ, 2007

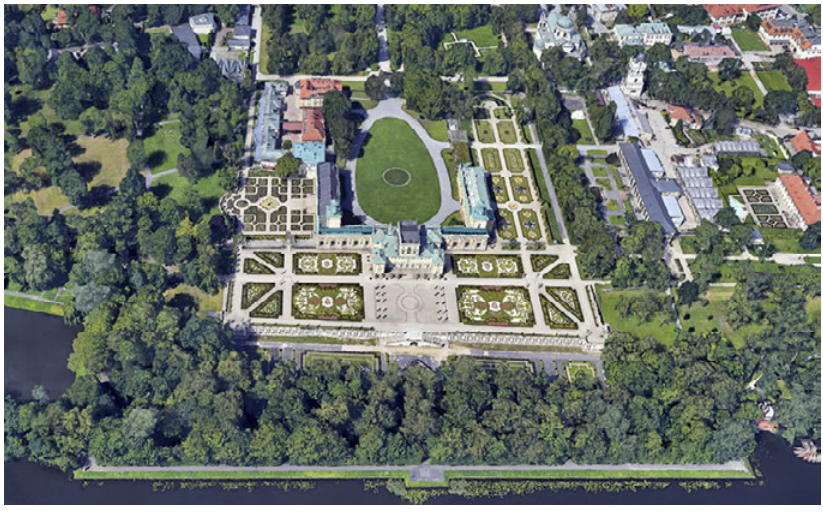


Fig. 10 The Wilanów Garden.

Photo: Google Maps, 2024 (accessed on 5 February 2024)



Fig. 11 Bernardo Bellotto (Canaletto), *Palace in Wilanów*, 1777.
The retaining wall with fountains shown in the painting never existed in this form, as proven by archaeological and archival research.

Source: Zamek Królewski w Warszawie – Muzeum, ZKW/460, public domain

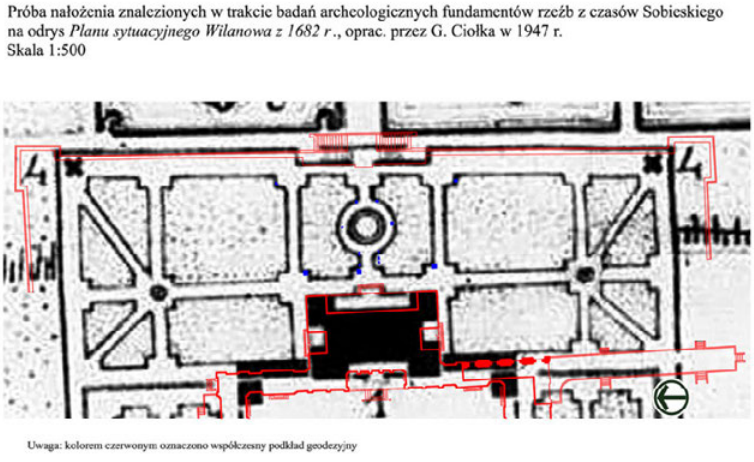


Fig. 12 Location of pedestals for sculptures, determined by archaeologists under the supervision of Andrzej Gołembnik, superimposed on a contemporary map and a historical plan of the Wilanów Garden from 1682.

Compiled by D. Sikora, A. Hanaka, H. Gałka, KOBiDZ, 2006

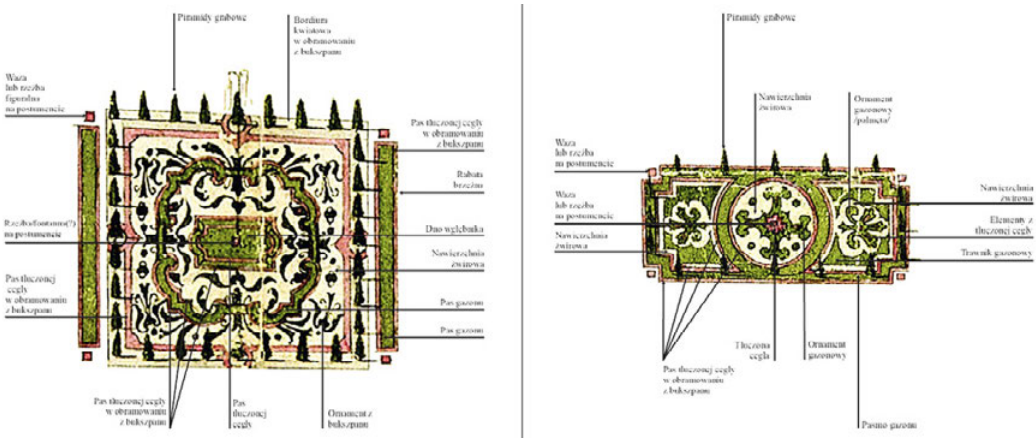


Fig. 13 Analysis of the arrangement of sculptures at the parterres in the Wilanów Garden, and their horticultural details.

Compiled by D. Sikora, A. Hanaka, H. Gałka, KOBiDZ, 2006



Fig. 14 Preliminary concept for the revitalization of the upper terrace in the Wilanów Garden, based on the results of archaeological and archival research as well as an assessment of its current condition.

Compiled by D. Sikora, A. Hanaka, H. Gałka, KOBiDZ, 2006



Fig. 15 Fragments of dismantled seventeenth-century herringbone brick paving discovered in front of the garden façade at the Wilanów Palace by archaeologists led by Andrzej Gołembnik.

Photo: D. Sikora, 2010



Fig. 16 Garden in Pidhirtsi.

Photo: D. Sikora, 2004



Fig. 17 Polish-Ukrainian agreements concerning research in Podhorce, Łańcut Castle, speech by Jacek Rulewicz, Director of the Krajowy Ośrodek Badań i Dokumentacji Zabytków, 2004.

Source: Archiwum Narodowego Instytutu Dziedzictwa



Fig. 18 Interdisciplinary research in the garden in Pidhirtsi – inventory of plants carried out by students of landscape architecture at the Warsaw University of Life Sciences.

Photo: D. Sikora, 2004

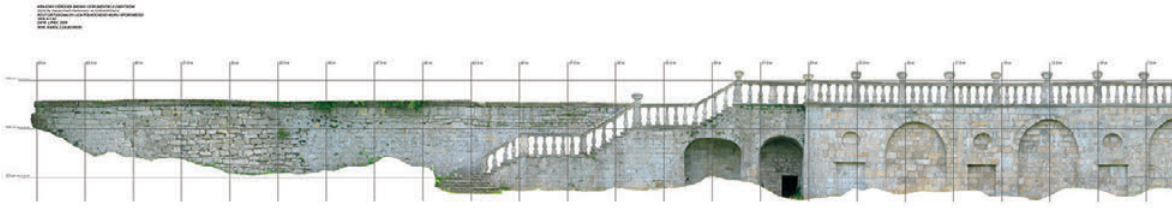


Fig. 19 Interdisciplinary research in the garden in Pidhirtsi – orthophotography of the retaining wall in the garden.

Prepared by Karol Czajkowski, KOBiDZ, 2004

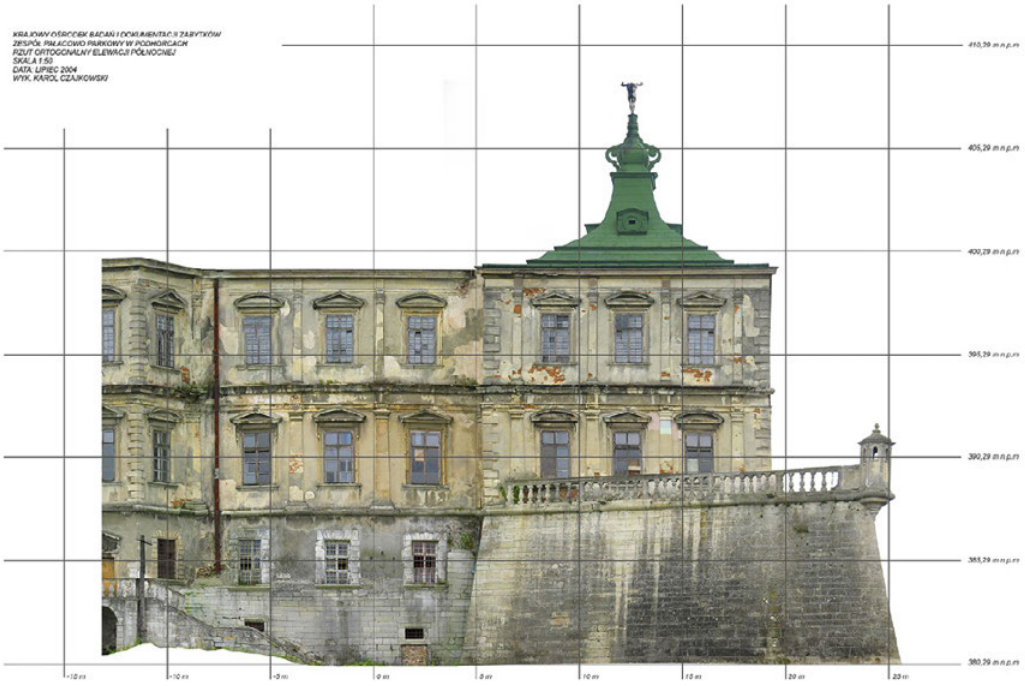


Fig. 20 Interdisciplinary research in the garden in Pidhirtsi – orthophotography of the garden façade of the palace.

Compiled by Karol Czajkowski, KOBiDZ, 2004

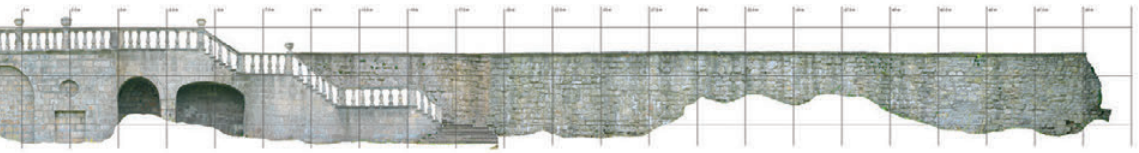




Fig. 21 Excavation at the intersection of the main garden paths, where a fountain may have been located.

Photo: D. Sikora, 2004



Fig. 22 Archaeological works in the vicinity of the staircase, aiming to determine the original usable level of the garden.

Photo: D. Sikora, 2004



Fig. 22 Fragment of a glass vessel with the coat of arms of the Rzewuski family – the historical owners of Pidhirtsi – found by archaeologists.

Photo: K. Czajkowski, 2004

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Emily Parker, John Watkins

Archaeology as a critical tool for guiding and managing the restoration of historic garden monuments

In the last forty years English Heritage has undertaken over twelve major garden and designed landscape representation projects. Each of these projects used archaeology in its many forms, combining wider site analysis with map and archival research to guide the wider understanding of each site's evolution and development, and our understanding of its significance. Using examples from these projects, this paper illustrates how archaeology has and continues to be critical to our understanding, restoration and reconstruction of historic gardens and designed landscapes, enabling better understanding and enjoyment by visitors.

IN 1983 ENGLISH HERITAGE was formed as a non-departmental public body of the British government. The organisation had two main roles: running the national system of heritage protection as well as caring for hundreds of historic monuments. In 2015 these two roles were separated, and a new independent charity was created, retaining the name English Heritage, to care for historic monuments. This includes over 420 properties spanning six millennia and including palaces, houses, hill figures, castles, abbeys, industrial sites, Roman forts as well as gardens and designed landscapes.

Today, the English Heritage Trust looks after gardens and designed landscapes throughout England and from almost every period. They range from the grand formality of Queen Victoria's garden at Osborne to the domestic-scale yet internationally significant garden at Down House home of Charles Darwin.

These gardens and landscapes are diverse and dynamic, requiring complex management and maintenance approaches to ensure that their significance is conserved. The decision to restore or reconstruct a historic garden is assessed in relation to its significance

with the aim to conserve a landscape's historic qualities. The heritage-based significance of the elements that are to be restored should decisively outweigh the significance of those that will be lost, with any new additions based on compelling evidence. The role of archaeology in gathering this evidence is critical.

Researching a historic garden

The process for researching a historic garden or designed landscape to inform restoration and reconstruction starts with an extensive evaluation of documentary evidence. At English Heritage this can include historic bills, gardeners' diaries, letters, visitor descriptions and published accounts in books, newspapers and horticultural literature as well as visual sources such as paintings and photographs. Often the most valuable historic resources available are maps and plans, and the process of collating and gathering these into a map regression usually becomes a pivotal part of the research.

Once the documentary evidence has been comprehensively examined, it can be followed up by non-invasive archaeological techniques. This includes the use of LiDAR (Light Detection and Ranging) and earthwork surveys as well as geophysical methods such as magnetometry, resistivity and ground penetrating radar. These techniques enable the documentary research to be "ground-proofed" and the level of survival of features to be ascertained; it can also add practical details about how areas were laid out and provide new information on areas not covered by documentary evidence.

In some cases, this may be followed up by targeted exploratory excavation trenches to reveal details of what survives below ground, and to inform restoration and reconstruction. Occasionally, whole garden areas, such as lost parterres, are completely excavated with the resulting evidence used to restore and reconstruct these features.

Early archaeology and garden representation projects

The use of archaeological techniques has been critical in the restoration and reconstruction of English Heritage gardens for many decades. One of the first sites where garden archaeology was used to aid the reconstruction of a garden feature was at Kirby Hall, Northamptonshire, in the 1930s. Using collated evidence, a design was laid out using concrete kerbs and modern rose bushes. In the 1980s, this reconstruction was seen as misleading due to the materials used and the fact it related to an earlier date then the surviving buildings it was located next to. Therefore, in 1987-8, a new excavation was undertaken to uncover evidence of the garden through archaeology. The findings, along with other comparative designs for parterre designs in the 1690s, were used to inform a new reconstruction of the garden in 1997.

William Sawrey Gilpin, a fashionable garden designer, advised on the design of the parterre at Audley End, Essex, in 1832 but it had become overgrown and diminished by the 1950s. Between 1985 and 1987, the parterre was completely excavated revealing the lost pattern of nineteenth-century flower beds. This led to their reconstruction and replanting in the early 1993.

The rest of this paper focuses on recent case studies that demonstrate how archaeological techniques are used in the restoration and reconstruction of historic gardens at English Heritage.

Kenilworth Castle

A formal garden was laid out at Kenilworth Castle by Robert Dudley, Earl of

Leicester, in the 1570s. It was a privy garden, used by Queen Elizabeth I and her companions when visiting Kenilworth whilst on her royal progress in 1575. The designer of the garden is not known but it was possibly Dudley's gardener, Adrian, who was probably French and would have brought with him knowledge of Continental gardens. This fashionable garden was part of Dudley's major improvements to the castle planned to impress the queen on her visit in 1575 and represented his last attempt to win her hand in marriage. A surviving letter by Robert Langham, a minor official present at the 1575 progress, provides an important eyewitness account of the garden. He sneaked into the garden while the queen was out hunting and described all the main features including the terrace, arbours, fountain, aviary and obelisks as well as including some measurements and descriptions of the plants. The castle was sleighted, between 1649-1650 by Parliamentary forces following the English Civil War, the removal of stone from the keep would have destroyed much of the garden at this time. Eventually, the area was given over to a kitchen garden and orchard to be used by the tenants who lived in the gatehouse.

In 1975, a "Tudor garden" was laid out on site based on a plan from 1656. It later became evident that the roots of the box and yew plants in this garden were destroying the archaeology. This led English Heritage to commission extensive research to inform a more accurate reconstruction of the 1575 garden. This included geophysical surveys in 2004, which led, in 2005-6, to the area being completely excavated in order to understand and record any surviving archaeological evidence. The subsequent analysis of these findings allowed the research team to understand the different phases of the garden and the fabric that survived from each period. Key findings from the Elizabethan garden were the discovery of the foundations of the octagonal fountain, the original castle wall, and terrace detail. These confirmed the accuracy of the garden's description by Robert Langham, which would prove critical for the ensuing reconstruction.

The reconstruction of the garden at Kenilworth was based on results from archaeological excavations, extensive research into comparative designs of the period, and Robert Langham's letter, which not only describes the architecture of the garden and its planting in detail but also reveals the sensory aspect of the garden. Works included the reconstruction of the aviary, marble fountain, terrace, arbours and the layout of paths, railings and knots. As one of the few physical representations of an Elizabethan garden in England, the reconstruction enables both garden historians and visitors to experience the garden as it may have been in July 1575.

Wrest Park

The garden at Wrest Park in Bedfordshire is the opposite of Kenilworth Castle insofar as it is a multi-period site. Its surviving features stretch back to the late seventeenth century, with additions and changes made over the following centuries. For over six hundred years the Wrest Park estate was home to the de Grey family. In the 1680s, a formal garden and canal were created; this canal remains the primary axis of the garden. This was followed in the early eighteenth century by the creation of a massive formal woodland garden, enclosed by canals. The owner, Henry, Duke of Kent, employed leading architects and garden designers of the time to create this garden and the garden buildings within it. The estate was then inherited by his granddaughter

Jemima, Marchioness Grey, who had a keen interest in gardens. She brought in a fashionable landscape designer, Lancelot "Capability" Brown, in the 1750s to soften the edges of the garden while preserving much of the formal layout. She also put her own stamp on the garden by adding a Chinese temple, a bridge, a Mithraic alter as well as root and bath houses. In the 1830s the estate was inherited by Thomas Robinson, Second Earl de Grey, who built a new house two hundred metres north of the original one. In front of it he laid out an elaborate formal garden but retained the formal woodland garden created by his ancestors.

Documentary and visual evidence for the garden is extensive and includes paintings, sketches, plans and maps from throughout its creation as well as bills, letters, diaries and visitor accounts describing the garden. One of the most useful is a plan and illustrations created for the Second Earl de Grey in the 1830s, which shows the state of the garden when he inherited it. When English Heritage took over the estate in 2006 it began a long-running project to restore the gardens to their pre-1917 state. As the surviving garden was a palimpsest of many different styles and periods, it was decided to restore each area and feature based on its own significance rather than by returning the whole site to a specific moment in time. The first stage of the renovation programme was to designate these character areas and undertake visual and documentary research alongside map regressions for each area. This was followed between 2009 and 2011 by non-invasive archaeological techniques including aerial photography, earthwork survey, LiDAR, geophysical survey, as well as excavation.

Results of these surveys provided critical information needed for the restoration of the garden at Wrest Park over the following years. One of the key pieces of missing infrastructure on the site was the garden paths, which could be traced using LiDAR survey and then checked on the ground through excavation. This led to large areas of the path network being restored in 2011, including all the paths around the house and the main routes through the Great Garden. Aerial photography proved critical for the restoration of the historic topography and path layout around the Archer Pavilion as it showed the area before it was significantly altered by ill-informed landscaping in the late 1940s. The Italian Garden, part of the Second Earl de Grey's new gardens, was also repaired based on archaeological excavations. In 2012 the French Parterre was also restored to its original 1830s design, following a full area excavation which revealed the original arrangements of beds and gravel, intricate detail lost in the early twentieth century when the parterre design was simplified for ease of maintenance. The restoration project at Wrest Park continues; recently, areas of the garden around the Chinese temple and bath house were replanted on the basis of documentary research and archaeological evidence.

Marble Hill

The garden at Marble Hill was laid out in the 1720s by Henrietta Howard, an important figure in Georgian court society. It was located on the banks of the River Thames in fashionable Twickenham and surrounded her new house, a perfectly formed Palladian villa. The design of the garden was decided after consultation with poet and garden design enthusiast Alexander Pope and landscape designer Charles Bridgeman, who would later become the royal gardener. Pope subsequently drew up a plan but it is thought not to have been executed on the ground,

although many of his ideas can be seen in the final design. It seems likely, therefore, that Bridgeman took this proposal and transformed it into a more practical design. The garden included an axial layout down to the river, with woodland areas containing winding paths down either side. The layout included a greenhouse, garden seat, ninepin bowling alley, flower garden and grotto. The grotto was probably added later in the 1730s. A survey of the estate from about 1749 provides a wealth of detail about the garden twenty-five years after it was created, showing both overall layout and individual features. The garden is a rare surviving example of a landscape designed and built for a woman, representing the early eighteenth-century aspiration to recreate the architecture and landscape of the "Ancients"'.

Marble Hill became a public park in 1902 and in the twentieth century many of the garden features were lost, the garden no longer reflecting the overall vision laid out by Henrietta Howard. The structure of the garden, however, did survive and some features such as the icehouse, the grotto and the layout of lawns and woodland areas were still discernible. Therefore, after extensive documentary and visual research English Heritage commissioned a programme of archaeological surveys starting in 2015. This included analysis of aerial photography and LiDAR, as well as geophysics and earthwork surveys. These surveys were critical in understanding the layout of lost features, the historic structure of the garden and their relationship with the survey from about 1749. Following this, a series of targeted trenches were excavated, which revealed detail about the lost ninepin alley and arbours. These areas as well as the overall structure of the garden were then restored and reconstructed using documentary evidence, landscape survey and excavation findings.

At the grotto, targeted excavation trenches were followed by an extensive full excavation of the whole area. The grotto was buried in the mid-nineteenth century and the grotto dell was filled in by about 1910. In 1942, a fallen tree smashed open the roof of the buried grotto but this was reburied and then archaeologically excavated in the 1980s. These excavations focused solely on the grotto and its immediate footprint, uncovering shells, coral, flint, boiler slag and glass foundry fragments. The area was subsequently landscaped and restored for visitors, but no more extensive investigation of the surrounding landscape was undertaken. During this latest phase of archaeology in 2021, the layout and topography of the surviving area was uncovered, and the surviving interior decoration investigated, revealing fragments of a flint, bone and pebble floor, and imprints of shells left in the lime mortar. It was possible to restore and reconstruct this area of the garden in 2022 using evidence of the overall layout and topography, including the plan from about 1749 and examples from other comparative grottos of the period.

Garden Archaeology and English Heritage

These case studies clearly illustrate the critical role of garden archaeology in guiding and managing the restoration and reconstruction of designed landscapes under the care of English Heritage. Continued development of technology and its application in archaeology has provided new opportunities to uncover the wealth of archaeological information in the gardens of English Heritage and will continue to be a critical asset in future restoration and reconstruction projects.

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Fig. 1 Excavation of the parterre at Audley End in the 1980s.

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Fig. 2 Initial excavation of the Elizabethan fountain in the garden at Kenilworth Castle.

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Fig. 3. The Elizabethan garden during archaeological investigation.

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Fig. 4 The Elizabethan garden after reconstruction.

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Fig. 5 Aerial photograph of the French parterre at Wrest Park following topsoil removal.

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Fig. 6 Archaeological investigation of paths in the Great Garden at Wrest Park.

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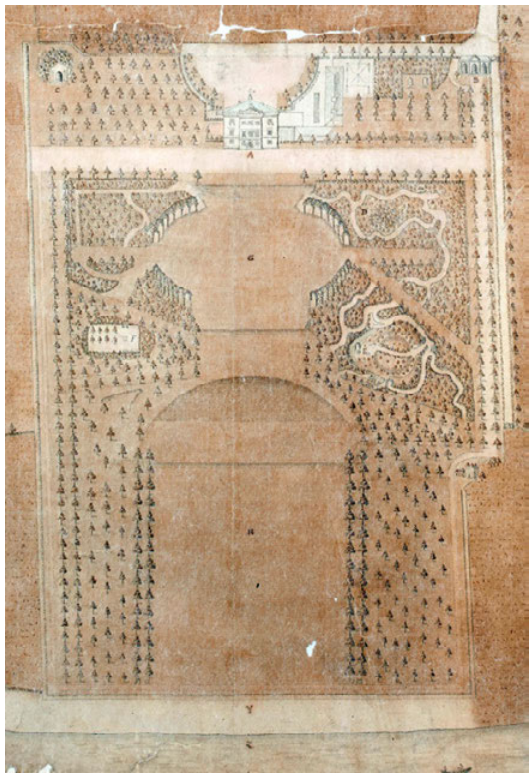


Fig. 7. Detail from a survey of Marble Hill ca. 1749 showing the garden.

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Fig. 8 The garden around the grotto at Marble Hill after restoration and reconstruction.

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The Italian approach to historic gardens and archaeology: the idea of palimpsest

In contrast to the Florence Charter, which defines the garden as an "architectural and vegetal composition" that is perishable and renewable, the Italian Charter of Historic Gardens emphasizes the distinctive quality of the garden as an irreplaceable or unique artifact that stratifies over time. Its layered composition cannot be erased but may be understood as a palimpsest that has its own material consistency. It is important to remember that archaeological excavation is a destructive technique which, according to the Italian charter, must be limited to avoid damage to the existing garden. Garden archaeology is no longer used to "dissect" the garden looking for individual phases, but rather constitutes a tool that can highlight the evolution of the garden as an entity comprised of mineral and vegetable components. Such an approach foregrounds the values of authenticity, respect for the original materials, and the possibility of making recognizable substitutions and additions during restoration. Case studies illustrate the conscious use of vegetation to represent or evoke lost elements and demonstrate how the invisible can be made visible without falsifying the palimpsest during reconstruction.

IN THE LAST CENTURY, many Western countries and cultures have developed an archaeological approach towards historic gardens, which involves investigation of their oldest phases by destroying later layers that chronicle subsequent development. The search for the "original" or "the most important historical period" has become the goal (e.g. Het Loo, Hampton Court). However, a different approach has been adopted in Italy, where gardens and their architecture are considered a series of overlapping interventions. In this method, the recognition and research of historical phases base on the techniques of "elevated archaeology" and other instruments for the interpretation of tangible heritage (in addition to usual historical sources).[1]

1 Boato 2008.

This approach has its basis in the *Italian Charter of Historic Gardens*[2] which was drawn up in 1981 by a group of Italian experts led by Isa Belli Bersali in response to the well-known *Charter for the Protection of Historic Gardens* promulgated by ICOMOS-IFLA in Florence in the same year.[2]

The substantial difference between the two charters consists, first, in the definition of the object. Whereas the international charter defines the garden as an "architectural and vegetal composition," which is perishable and renewable, the Italian charter instead emphasizes the distinctive quality of the garden as an irreplaceable or unique artifact that stratifies over time. This leads to two different lines of action: the international charter permits reconstruction, while the Italian charter allows only for conservation and maintenance, with reconstruction rejected insofar as it bases on selective judgement that freezes the garden in a single and specific phase of its evolution and development. This ascribes greater value to the range of materials, including vegetal and perishable ones, rather than merely concentrating on the composition and its overall shape.[3]

Today, the ICOMOS-IFLA Charter is being revised by a working group at the ICOMOS-IFLA International Scientific Committee on Cultural Landscapes. Various members from Europe and elsewhere have indicated the need to adapt the requirements of historic gardens to the exigencies of the contemporary world, and to conduct field verification of the effectiveness and shortcomings of the older methodology after more than thirty years of application.

The *Statement on the Workshop on the Florence Charter* underlines the importance of a broader vision than one focusing simply on the garden, focusing on its relations with the outside: "a designed landscape cannot be understood without knowledge of its broader landscape setting as well as its environmental and cultural contexts." The document also introduces the concept of "system" extending beyond the proprietary boundaries of a given asset.[4]

According to the Italian approach, the historical garden, like architecture, can be understood as a palimpsest, or a text repeatedly written and rewritten – one that has its own material structure. Its layered or stratified character cannot be erased. In an historical garden, the different phases and transformations are legible due to the presence of certain signs and artifacts: the first planting of the garden is hardly ever completely erased but often adapted to changing fashions or tastes, thereby remaining recognizable.

The Chatsworth House and its park perfectly exemplify the idea of a palimpsest (fig. 1). It is possible to recognize the changes made over time. When the Baroque garden was transformed into a landscaped garden, latter was superimposed on the former without erasing it. The first Elizabethan mansion was rebuilt between 1687 and 1707 – the exact same period when the Baroque garden and park were created. Between 1750 and 1765, the formal garden and estate were transformed by "Capability" Brown into an English landscaped park. It is possible to identify axes and other fundamental features of the Baroque landscape beneath the later interventions by Brown and subsequent designers.[5]

2 *Italian Charter of Historic Gardens.*

3 Dezzi Bardeschi 2005; Dezzi Bardeschi 2009; Scazzosi 1993; Scazzosi 2011; Scazzosi 2009.

4 ICOMOS-IFLA 2016.

5 Titchmarsh 2023.

Evidence of the fact that the Baroque layer was not erased from the landscaped garden consists in the design of its parterres and the reappearance of traces of paths during the dry summers of 2018 and 2022. These elements cause variations in soil compaction, which affects the ability to retain water; thus, in periods of drought, the formal design of the parterre becomes visible.

The recognition of different phases from the past is proper to archaeology. In Italy, the principles of stratigraphic excavation were applied by Giacomo Boni and Antonio Munoz at the beginning of the twentieth century at the sites of the Palatine and the Forum in Rome. The two architects attached great importance to the value of ruins and their context, seeking a role for vegetation, including herbaceous plants, to facilitate better reading of the archaeological site or monument, at the same time creating a context suitable for archaeological finds, which helps to safeguard the different elements left buried in the ground (foundations, kerbstones, etc.).[6]

The conscious use of vegetation in "archaeological areas" is expressed in the Italian Charter for the Restoration of Historic Gardens, which includes such elements among the various types of historic gardens (art. 1). In fact, both historical gardens and archaeological sites acquire their heritage value in stratification and the fourth dimension.[7] Stratigraphical surveys help to identify the presence, shape and position of buried elements, and to understand site formation and later modification processes.

In the second half of the twentieth century, techniques of archaeological excavation were applied in places like Pompeii for the purpose of "faithful reconstruction of the gardens" and "live reconstruction." Gardens were rebuilt by determining the position of plants using the technique of plaster casts developed by Giuseppe Fiorelli, and by identifying the botanical species through either their depiction in contemporary paintings or actual remains found prior to reconstruction using the methods of archaeobotany.[8]

It is important to remember that archaeology, especially stratigraphical excavation, is a destructive technique. Therefore, according to the Italian charter, its application in the field of historical gardens must be limited because it should not damage the existing garden. Non-destructive methods of study are an important and potentially rich tool for the purposes of research and interpretation. Archaeological study can be applied more generally only to "those places where there is nothing but scorched earth." In this sense, garden archaeology is no longer used to "dissect" the garden by looking for individual phases, but rather to highlight the depth, historical development and evolution of the garden as a unity of mineral and vegetal components.

To some extent, this alternative attitude in archaeology was anticipated in the first half of the twentieth century by Boni and Munoz. Giacomo Boni emphasized the value of ruins and looked at the vegetation, even weeds, as signs of natural processes that give new shape and quality to the monuments. Boni designed and created gardens as an "environment" for archaeological remains, using species and varieties present in ancient Roman times and recorded by contemporary frescoes and literary sources.[9]

6 Caravaggi 1989, 452-466.

7 Matteini and Ugolini 2001, 246-251.

8 Matteini and Ugolini 2001, 246-251.

9 De Vico Fallani 2021, 94-101.

Antonio Munoz used planting to recall or evoke lost architectural parts, as in the Temple of Venus in Rome, where the topiary is reminiscent of ancient pillars or columns (fig. 2). At the Villa Adriana in Tivoli, the colonnade of Poecile is similarly evoked by square laurel hedges placed immediately behind the marble sub-bases to indicate the location of column stems.[10]

Based on the principles of the *Italian Charter of Historic Gardens*, important restorations of historic gardens were carried out in the 1980s. One example of a site where archaeological studies were used as a source of knowledge for the purpose of restoration, highlighting the palimpsest quality, is the Savoy residence of Racconigi, which the Italian State acquired in 1980 after the place was abandoned for forty years. The park covers around 110 hectares and was created at the end of the seventeenth century as a garden whose formal layout was designed by André Le Nôtre. In the eighteenth century, Princess Giuseppina di Lorena entrusted Giacomo Pregliasco with transforming Racconigi Park into an English garden. Among other architects subsequently involved, the most popular figure was the German Saverio Kurten.[11]

The modern restoration project was led by the architect Mirella Macera and preceded by long studies. First, Macera investigated the hydraulic system which defined the relationship of the park with the surrounding landscape: the lakes inside the garden were fed from outside, with the agriculture of the surrounding areas sustaining the large complex.

Macera's primary aim was to preserve the palimpsest. He focused on tree masses, full and empty spaces, and the opening and closing of views that organized the entire landscape. Further, he tried to re-establish the continuity between the hydraulic structure of the landscape and the hydrology of the park.

During excavation works, traces of the ancient Baroque structure were found but it was not reconstructed. However, some lost elements have been indicated, including a former stream that has been evoked by planting thousands of grape-hyacinths (fig. 3).[12]

The second case study is the garden of Villa Pisani in Stra, managed for twenty years by its architect and director Giuseppe Rallo. It is an eighteenth-century garden marked by significant interventions by Napoleon and then the Austrians. By the end of the 1980s it was completely abandoned.

Just like at Racconigi, a long period of study and careful attention to the park helped to identify a series of elements and material peculiarities that tell the story of the place: espaliers, parterres of flowers, an orangery full of potted citrus fruits, and a large botanical collection.

Restoration has covered both the general structure of the park and individual small spaces that make up its composition and tell its story. The various plant collections have therefore been restored and the greenhouses reopened, making the work of gardeners an important element of any visit to the park.

In Villa Pisani, the meticulously assembled knowledge of the park has provided important insights into the development of vegetation. A simple delay in cutting the meadows from the end of April to the start of June, as indicated in the archives, made it possible to observe how the large parterre between the villa and the stables becomes naturally covered

10 Porretta 2008, 30-43.

11 Avataneo 1999.

12 Ferrari 2006.

with flowers and species unique to this place on account of the specific quality of the soil and its drainage. Thus, the appearance of *salvia pratensis*, buttercup, and *bellis perennis* makes the large parterre highly attractive until the beginning of June (fig. 4). Indiscriminate mowing is avoided, even in the undergrowth.

In other areas, the garden's lost geometric design is evoked through differential grass cutting and experimentation with tall grasses. Likewise, the vegetation on the wall recalls the original espalier of citrus fruits.[13]

The concept of a palimpsest also guides the restoration project of the royal gardens in Turin, which were laid out in 1563 when Turin became the capital of Savoy. They were redesigned by André Le Notre in 1697 but devastated in Napoleonic times and then finally restored between 1996 and 2001 under the artistic direction of the architect Pejrone.[14]

The project was realized at a much compromised site, where the different parts of the original garden had become dismembered and were gradually assigned new functions. The modern interpretation has aimed to restore the seventeenth- and eighteenth-century composition, maintaining the connections between the different parterres and recovering the perspectives marked by the tree-lined avenues.[15]

Whereas the parts facing the royal palace have been recomposed according to a formal design with very simple lines, the principle followed in the wooded areas has been to highlight the historical stratification by leaving the stumps of lost trees (as memory aids) and planting young trees in continuity with the older ones, i.e. preserving the material rather than shape (fig. 5).

In more recent years, different experiments have been tried, with the temptation to propose a design linked to the past becoming more evident.

Villa Arconati in Bollate has been under restoration for several years, with works covering both the historic buildings and the garden. In 2019, the large parterre located in front of the south façade of the villa was restored. The project area is demarcated by four large grass squares crossed by grey gravel paths lined by white hornbeam trees (*Carpinus betulus*) made to form a specific figure (fig. 6).

The project uses contemporary materials to reinterpret the original Baroque design recorded in the eighteenth century by Marc'Antonio Dal Re.[16] However, it favors the use of mineral rather than vegetal elements.

A rather different case is that of the Miramare garden in Trieste, developed by Massimiliano D'Asburgo from 1856. Various interventions were carried out from 2019 to 2022 with focus rather on botanical components than the shape and composition of the garden, although its design has never been lost. Ancient botanical species have been grafted in new combinations to illustrate Massimiliano's botanical curiosity (fig. 7).

The Venaria Reale residence of the Savoys near Turin was declared a UNESCO World Heritage Site in 1997. Its gardens, designed by Amedeo di Castellamonte since 1658 and later by Juvarra, were destroyed during the Napoleonic occupation. The fragmentary condition of the eighty-hectare site at the beginning of the 2000s made it difficult to envisage the original seventeenth- and eighteenth-century layout

13 Rallo 2000.

14 Cornaglia 2019.

15 Fontana 2009, 347-352.

16 Alleva and Architetti 2021.

of the gardens. However, aerial photographs taken in spring 1997, after a long period of drought, and archaeological surveys made at the beginning of restoration work have revealed traces of tree-lined avenues along with underground structures such as the system of caves that was part of the seventeenth-century layout.[17]

The restoration project involved large-scale reconstruction of the landscape. Particular attention was given not only to historical features but also to aesthetics and modern use, with almost 50,000 new plants being introduced. This has made the project a contemporary interpretation. It has also included important art works by Giuseppe Penone.

Between 2003 and 2005, archaeological excavations led to the discovery of the nymphaeum. The decision was made to reconstruct it, with lost elements recreated in acrylic resin. However, the result is of questionable value and does not enhance the existing remains, which are covered by canopy, instead producing the effect of being obviously fake.

The project for the restoration of the Villa Molinari Rasini Medolago Attanasio Park in Limbiate has been approved by the Ministry of Culture. The eighteenth-century complex, attributed to the architect Giuseppe Antonio Bianchi but built at a pre-existing site described already in the 1600s, underwent transformation from a formal layout to a landscape style, much like many other Italian and European gardens.

According to the first drawing from 1690, linked to a report by Malatesta, two vegetal galleries accompanied the northern avenue, which provides access to the small villa. Then, the complex and its formal garden were extended to the north, while areas to the south were set aside for agriculture. From the mid-nineteenth century onwards, as historical cartography shows, the complex was transformed into an English garden with an informal lake[18] and later with two wooded areas in the eastern part of the park.

Today, the complex is in a state of serious deterioration (fig. 8) but is the subject of restoration efforts aiming to preserve the visible stratification: small traces of the first layout and more recent natural qualities. Some parts will be left as ruin, particularly where the disappearance of earlier elements does not allow to restore the space's functionality without complete reconstruction at a very high cost. Instead, the project is based on criteria of economic sustainability, both at the stage of intervention and in subsequent management.

Tests have shown that the cobblestones used to build the long avenue between the villa and the historic town are still there but have been completely covered by soil and remains of vegetation (fig. 9). The project aims to restore the entire path and the still existing water collection system. The large basin in the northwestern part of the park is all that remains of what used to be a fishpond in the 1500s before becoming a small lake during the eighteenth century. The goal is to use its current form to create a water-collection basin and irrigation tank, which will be enhanced into an attractive feature through the use of aquatic, oxygenating and naturally cleansing plants. Differential cutting of the grass will delineate the flatter areas and distinguish those for walking from rest areas. Two nature paths with educational purposes will be created in the wooded areas (fig. 10).

17 Macera 2003, 201-206.

18 Ferrario 2001.

The project is not limited to defining measures necessary to guarantee safe access for the public but involves the development of a management plan for long-term maintenance with the participation of local people and other stakeholders.

The above overview of case studies demonstrates how Italy has embraced archaeological study of gardens prior to restoration, although it has not been as systematic as in other European countries. The results, however, are often quite different and derive from an approach to conservation that is not confined to historic gardens but remains attuned to the values of authenticity, respect for original materials, and the possibility of making recognizable substitutions and additions during restoration. Archaeology is primarily a research tool that facilitates providing depth to projects by bringing the invisible to light and avoiding reconstructions that falsify the palimpsest.

Moreover, conservation of cultural heritage, including gardens, must address current social and environmental problems such as climate change, loss of biodiversity, and sustainable management of natural resources. In fact, garden archaeology takes a central role in this context and has great potential for combining cultural conservation with environmental and social considerations. Taking care of historical gardens is multi-faceted and highlights the necessity for multidisciplinary and interdisciplinary work.

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Fig. 1 Chatsworth House, Derbyshire, England. In the dry summers of 2018 and 2022, traces of the formal garden reappeared, revealing paths and parts of the former broderie design due to the different levels of water retention.

Source: https://www.bbc.com/news/uk-england-derbyshire-62229372



Fig. 2 Venus temple in Rome in a stamp from 1958. In 1933-1935, Antonio Munoz reconstructed the columns with the use of vegetation.

Source: https://www.info.roma.it/monumenti_dettaglio.asp?ID_schede=1962



Fig. 3 Parco del Castello di Racconigi: restoration works in 2003; on the right, former stream with flowering grape-hyacinths (Muscari).

Photographs by Alessandra Longo and Racconigi, Archivio del Castello – Direzione Regionale Musei Piemonte



Fig. 4 Garden of Villa Pisani a Strà (Padua), view of Parterre di Fiorita. In this instance, the lost design of the parterre is evoked by a different cut of the lawn to mark the paths in contrast to the flowery lawns which used to feature decorative panels.

Photograph by Raffaella Laviscio



Fig. 5 . Royal Gardens in Turin: treatment of losses due to tree felling.

Photograph by Lionella Scazzosi



Fig. 6 Villa Arconati, Bollate (MI): the large parterre formed by four large grass squares crossed by grey gravel paths lined with white hornbeam trees (*Carpinus betulus*) formed in the shape of a dancer.

Photograph by Raffaella Laviscio



Fig. 7 Miramare garden: botanical species mentioned by Massimiliano d'Asburgo grafted in a new combination.

Photograph by Raffaella Laviscio



Fig. 8 The eastern part of the park at Villa Rasini Medolago: current state of conservation.

Photograph by Raffaella Laviscio

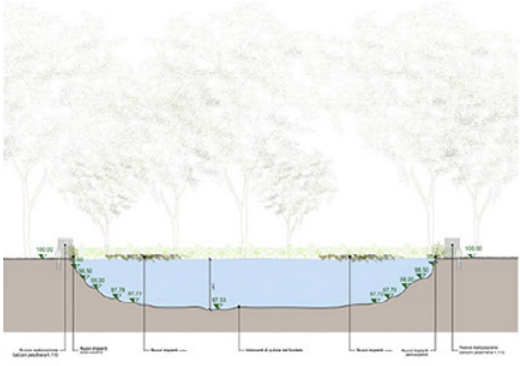
Fig. 9 Cobblestone path in the Villa Rasini Medolago park discovered through limited trial excavation.

Photograph by Raffaella Laviscio



Fig. 10 The approved project for the restoration of Villa Rasini Medolago. Reactivation of the large basin in the north-western part of the park as a reservoir and irrigation pool creates an attractive feature, while differential grass-cutting delineates flatter areas and distinguishes walking routes from rest areas.

Images: Raffaella Laviscio







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Geert Vynckier

Excavation in the courtyard garden of the castle at Gaasbeek (Belgium). How the results contribute to renovation and restoration

In 2021, a five-day-long excavation at the courtyard garden of Gaasbeek Castle was conducted in order to obtain precise information and details for the purpose of accurate historical restoration. Former paths were found to have been constructed using an early variant of asphalt.

AS PART OF ONGOING Restoration works at the castle of Gaasbeek, the courtyard garden will be renewed in 2024–2025 (fig. 1). The Flanders Heritage Agency directed that the works should include thorough historical and archival research into the design, planting and ornamentation of the courtyard. After consultations with the relevant authorities, a strategy was put forward for an archaeological excavation involving specific trenches and associated augering. Works were carried out on 17–21 May 2021, with five individual trenches being excavated and thirteen separate auger-holes being drilled.[1]

Since research was mainly focused on tracing potential remains of the late nineteenth-century courtyard garden, each trench was hand-dug after removing the crushed grey stone finish of the modern paths. One trench was located in a grass square, initially requiring removal of turf.

1 Vynckier et al. 2023.

The Gaasbeek Castle is located in the southwest of the Flemish province Brabant, about fifteen kilometres southwest of Brussels and southeast of the village of Gaasbeek. Gaasbeek is part of Lennik and is located in the middle of the Pajottenland, part of the Brabant Loam region. The site is located in the Scheldt Basin, more specifically in the Zuunbeek Basin, a sub-basin of the Senne. The terrain is strongly undulating and intersected by numerous streams. The castle is located on a pronounced south-facing outcrop of the plateau, which is surrounded from the southwest and west by the Molenbeek Valley, and to the east by the Baasbergbeek Valley (fig. 2).

Its history began in 1235 when the castle was built by the lords of Leuven to protect the region.[2]

For the history of the garden, the following facts are important. Between 1887 and 1889, the castle was thoroughly restored by Marie-Louise-Peyrat (1840–1923), marquise Arconati-Visconti, widowed after only two years of marriage. She was the driving force behind the efforts to historicize the castle; she even walked around dressed as a medieval page. Glass plates recently found by Ann Voets show the rebuilding of the castle and the situation in the courtyard before and after the garden was redesigned (fig. 3).[3]

There were several preliminary ideas to renew the courtyard as a neo-Renaissance garden. The marquise eventually chose the solution by an unknown designer, which was found in the castle archives (fig. 4). Figure 5 shows the layout constructed between 1890 and 1893, later shown in photographs from 1928. In the years 2020–2021, the garden was neglected due to lack of maintenance and management policy, and was affected by the boxwood moth (fig. 6).

A comprehensive historical study was undertaken by Ann Voets, an art historian and landscape architect employed following instructions from the Flanders Heritage Agency and the Department of Culture of Flanders.[4] As a result of her research, an inappropriate method of reworking the garden was avoided just in time. It also raised specific questions that were meant to be answered through the excavation of trenches at strategic places.

Prior to the latest excavation, others had been undertaken by the Flanders Heritage Agency between 1996 and 2000, led by Van Bellingen.[5] These were limited in scale and not intended to find new information about the courtyard garden; indeed, it was largely untouched. Works mainly revealed wall remains from the defunct part of the castle wing, ramparts and tower foundations, along with floors and cellars of the partly destroyed and demolished castle.

As a result historical and archival studies, it soon became clear that additional archaeological research was required to answer specific questions crucial for the later restoration, renovation and reconstruction of the neo-Renaissance garden in the courtyard. We hoped that the results could provide a good idea of the original garden layout. From the outset, it was clear that historical and archaeological research would be complementary. Fieldwork took place over five days in May 2021.

2 Agentschap Onroerend Erfgoed 2022a and 2022b.

3 See below.

4 Voets 2022.

5 Van Bellingen 1997 and 2006; Van Bellingen and Simillion 1998; Van Bellingen and Verkeyn 2000.

Five trenches and thirteen auger-holes were planned in critical places (fig. 7) to answer the following questions:

1. What material was used to build the original paths beneath the modern gravel, and to make them durable?
2. Was there an edging between the paths and the parterres?
3. What material was used to harden the boundary between maintenance paths and border hedges?
4. Are there any archaeological features or foundations of the garden's earlier ornaments shown in the original plan?

The four longer trenches yielded similar result. After removing the recent top surface of the path, we came across a grey-green layer of a bituminous substance that represents the remains of a kind of asphalt (fig. 8). This type of material was used since the beginning of the nineteenth century and was imported from France. It could have been flattened by rolling, and cut off at the edges. Examples of similar paving material were used in England in London's Regent's Park and at the Osborne home of Queen Victoria on the Isle of Wight.[6]

At the edges of this bituminous layer we found nothing that could be considered a hard boundary between the paths and the parterres, indicating there was no border between them.

The maintenance or access paths between the box rows in the parterres were found to contain a granular layer of crushed orange-red brick fragments, clearly designed to give a different colour (fig. 9). This is also visible in photographs from the beginning of the twentieth century.

6 Elliott 2000; Rohde and Schwarz 2008.

In all trenches there was a basal layer of loam with fragments of bricks, lime mortar/plaster and rubble, which we interpret as a levelling layer. Beneath it, a layer of fine, compact, white mortar, followed by further evidence of levelling, was presumably introduced after the destruction of parts of the medieval castle. Such layers were also found in section during excavations carried out in the years 1996–2000.

The fifth, square trench revealed a foundation of bricks and mortar that we interpret as the base supporting a garden ornament (fig. 10). A plastic bucket in the centre was filled with modern cement and had a hole in the middle, which we think may have supported a flagpole.

Augering, meant to reveal the stratigraphy of the courtyard, provided results similar to ones described above.

Although excavations were limited, all research questions were answered.

Conclusion

Extensive historical and archaeological study and research have revealed the assumptions behind the garden, helping to understand it. Excavations provided clear answers to research questions.

Ann Voets made recommendations concerning the surface of the paths and the edges of the paths and parterres, in addition to garden furniture, wall vegetation, and the replacement of box plants with more resilient varieties. Additionally, historical study has provided fresh insight into the original layout of the garden, making it clear that the topiary was very important.

Voets proposed three scenarios for accurate garden restoration at the irregular inner courtyard. She also proposed to take into account the revolutionary character of some of the features in the neo-Renaissance garden, arguing it should guide the restoration.

The castle was reopened on 30 June 2023. Recently, a tender invitation was sent out to three landscape gardening firms to carry out the garden restoration.

The tender documents state that the restoration should follow the nineteenth-century layout and that the results of both archaeological and historical studies should be taken into account when reconstructing the paths. Thus, the new lower layer in the main paths and in the maintenance paths between the box rows should be covered with a granular layer of orange-red brick fragments. At the same time, existing box plants should be removed and replaced with more resilient varieties. Also, an ornamental topiary, which has had a long history as seen in photographs, should be made visible again. The parterres should be adjusted in accordance with the original plan, while the seats or benches should be cleaned and restored. No lighting will be installed.

Although the archaeological excavation in the courtyard garden of the Gaasbeek Castle was limited, the interplay between archival-historical research and garden archaeology shows that bringing together different scientific disciplines is valuable in the study of gardens and in the context of the restoration and renewal of individual sites.

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Fig. 1 Aerial photograph of the Gaasbeek Castle. The courtyard and the surrounding park from the south.

© Flanders Heritage Agency: Johan Van Laecke

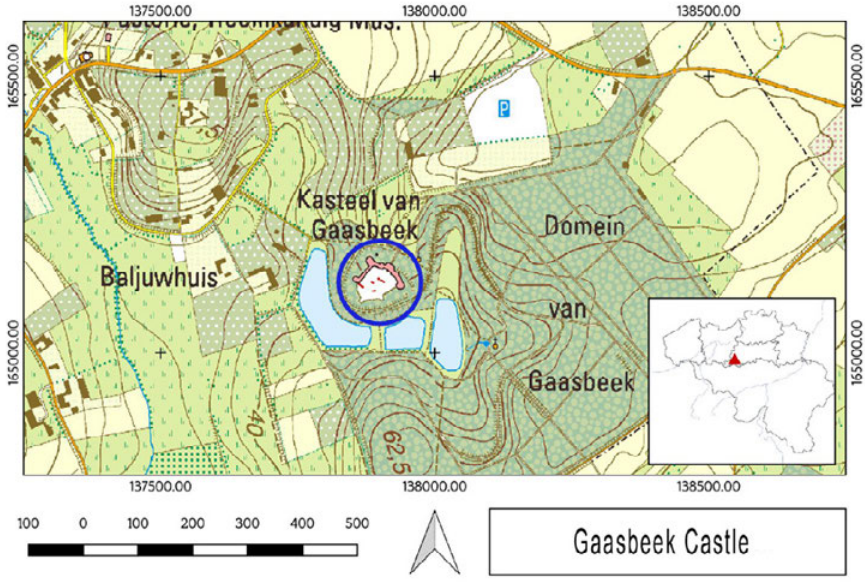


Fig. 2 Location of the castle on the topographical map.

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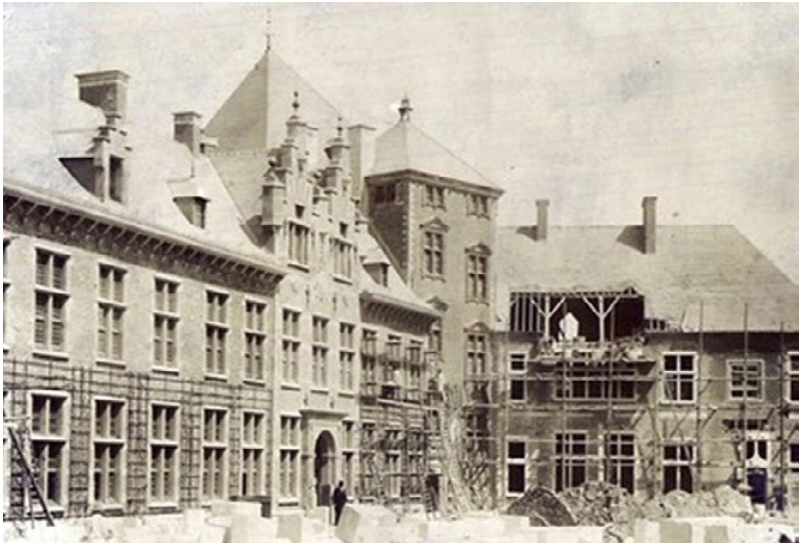


Fig. 3 View of thorough restoration works at the castle, carried out in 1887-1889.

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Fig. 4 Anonymous and undated design plan of the neo-Renaissance garden at the Gaasbeek Castle. The North is in the upper right corner.

© Castle archive Gaasbeek P-38



Fig. 5 Postcard with a winter view of the newly constructed neo-Renaissance garden at the end of the nineteenth century (1894?).

© Nels serie 11, nr. 25 via Delcampe.net



Fig. 6 View of the courtyard garden in 2021.

© Flanders Heritage Agency



Fig. 7 Location of working trenches and auguring holes projected on the current plan of the garden. 1: trenches; 2: drillings.

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Fig. 8 Grey-green layer of a bituminous substance that represents a kind of asphalt in WP5.

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Fig. 9 Granular layer of crushed orange-red fragments of bricks in WP5 on one of the maintenance paths.

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Fig. 10 Foundation of a garden ornament, constructed using bricks and mortar.

(© Flanders Heritage Agency: Geert Vynckier

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Annick Heitzmann

Archaeology in the royal parks of Versailles, Trianon and Marly

Garden archaeology was introduced at Versailles in 1990 in the aftermath of extensive storm damage, which presented the opportunity to restore the groves and other features to the state they were in at their peak around 1700. Throughout the replanting, archaeological investigation provided supporting information. To date, over half of the latest interventions at Versailles and in its satellite estate of Marly have been in the gardens. In addition to uncovering trellis-foundations, a major class of evidence relates to waterworks of various kinds, including several different types of basins.

ARCHAEOLOGY ARRIVED at Versailles in 1990. Why this particular date? On 6 February 1990, a storm devastated all of the ageing tree canopies. Indeed, the trees in the parks of Versailles and Trianon reached obsolescence because they may become dangerous after one century and the last tree planting had been carried out between 1860 and 1880. After the storm, it was decided to undertake a major replanting campaign over a twenty-year period, during which the park was to be restored to the state that it was in when its creator, André Le Nôtre, passed away in 1700. Indeed, as soon as he died, the groves were damaged and several were transformed already during the replanting of 1774–1775.

During the campaign, the groves were restored one after another. A grove is an area of greenery surrounded by tree foliage, enclosing numerous basins, sculptures, water features, wooden trellis-architecture, etc. Before each grove could be restored, a preliminary study had to be carried out, including historical and documentary research along with archaeological investigation. Thus, the first kind of archeology at Versailles was garden archaeology.

Since 1990, twenty-six projects have been undertaken in the estates of Ver-

sailles and Trianon, eight of which relate to the gardens. The first worksites were part of the replanting campaign carried out between 1990 and 2011 at the groves in the park of Versailles. At Trianon, works were carried out in the gardens in 2006, 2014 and 2018.

In 2009, the Marly estate became part of the Versailles estate. This provided the opportunity to carry out several programmed excavation campaigns (i.e. for research purposes and independently of any other works). Four of these involved the gardens.

In the course of the dozen or so projects carried out in the former gardens of Louis XIV, laid out by André Le Nôtre between 1661 and 1700, I came across a number of structures specific to the garden design from that period. This article largely concerns the main types of structures uncovered.

Basin construction techniques

Three different basin construction techniques were used at the royal estates. They are described in contemporary treatises on garden design, in particular Dezallier d'Argenville's 1747 edition, which includes a complete chapter on hydraulics.[1] The clay-sealing technique was by far the most widely used.

Clay-sealed basins

The finest example of a clay-sealed basin can be found in the garden of the *Pavillon frais* at Trianon. This small garden is located between the *Grand Trianon* and the *Petit Trianon*, in what is now called the French Garden as opposed to Marie-Antoinette's later English Garden. The French Garden was laid out in 1749–1750 by Louis XV and Madame de Pompadour. In 1751, it was extended by several garden plots, including a small garden adjoining the pavilion called *Pavillon frais*. This pavilion and its surrounding trellised portico were destroyed in 1810. The garden was transformed and the basins filled in 1840. The pavilion was rebuilt in 1980 but the portico and garden were never restored. This was the aim of the work planned for 2006.

During the archaeological dig, we uncovered the east basin, with a central water jet control chamber and water drainage canals (fig. 1). The basin is clay-lined, meaning that it was formed by a bowl of clay held in place on its vertical walls by the counter-wall and the moat wall. The bottom of the basin was decorated with patterned paving composed of sandstone and flint. Under the moat wall, we found a large part of a wooden platform that prevented it from sinking into the clay. As this basin is not as old as the other clay basins I have excavated, its platform still existed, whereas others had completely disappeared in the seventeenth-century basins.

Lead-sealed basins

Lead sealing was generally used for smaller basins. I found very few basins built using this technique. The finest example is located in what has been the *bosquet de la Reine* since the reign of Louis XVI. Under Louis XIV, this grove was a labyrinth, dotted with thirty-eight small fountains illustrating the fables of the Greek poet Aesop. The one that remains intact to the greatest degree is that of the Wolf and the Porcupine. This basin consisted of rubble and mortar masonry supporting a bed of bricks. At the interface, a layer of plaster evened out the masonry. On top there were strips

1 Dezallier d'Argenville (Antoine-Joseph), *La théorie et la pratique du jardinage […]. Avec les pratiques nécessaires pour tracer sur le terrain toutes sortes de figures. Et un Traité d'hydraulique convenable aux jardins*, Paris, chez Pierre-Jean Mariette, 1747.

of lead, which were salvaged when the grove was converted. Grooves were cut into the brickwork for the welds.

Cement-sealed basins

The cement used for the third type of basin was Roman cement or hydraulic mortar, made from air lime and crushed bricks, which gave it pink colour. The only example I found was in the park at Marly. Marly was a residence of Louis XIV near Versailles, built in 1679 and destroyed at the beginning of the nineteenth century. One of the jewels in its park was a large waterfall, called *la Rivière*, which was built in 1697 and replaced by grass in 1728. It was often transformed and, at its best, looked like a succession of basins built with cement waterproofing and covered in marble. Traces of it still remain in the layer of pink cement. When I excavated one of these basins in 2013, I found a layer of pink cement that covered the masonry, where impressions of marble slabs could be identified (fig. 2). Thanks to those imprints and old pictures of the waterfall, we were able to propose a model for virtual reconstruction (fig. 3). A breach made in the masonry during the demolition of the waterfall made examination possible without causing further damage. The layer of cement rested on simple, thin masonry as well as mortar of lime and yellow sand.

Lead and cast-iron pipes

Another aspect concerns the pipes that carried the water to the basins. Louis XIV wanted the best for his gardens and thus advanced research into hydraulics, particularly thanks to the work of the Francine family. Despite the cost, lead was used even for large-diameter pipes, although cast-iron pipes were introduced in 1672.

The finest example of pipework was discovered in the *bosquet d'Encelade*, which was excavated in 1995 (fig. 4). This octagonal grove takes its name from the mythological giant Enceladus, whose lead statue by Gaspard Marsy adorns the large round basin in the centre. When it was created in 1675, this basin was surrounded by octagonal grass terraces, topped at the corners by small basins decorated with rockwork, and framed around the perimeter by trelliswork punctuated by pavilions on the four cardinal sides. Between 1706 and 1709, the grove was transformed: steps were replaced by a simple embankment, while the trellis and small basins were removed. These elements were rebuilt after archaeological works and the grove was restored to its former state in 1997.

Back in 1675, the central basin was fed by lead pipes fixed to cast-iron pipes (fig. 5). Lead pipes were shaped using lead sheets rounded on logs and assembled by crushing the lead with hot iron. They are inserted into two sections of cast-iron pipe with an old-style flange. Two other pieces of iron pipe are fitted onto these sections using a later flange that could have been made in the second half of the nineteenth century. When the central basin was restored in 1966, new cast-iron pipes were laid, forming a bayonet system to avoid the old pipes.

The same worksite revealed a cast-iron pipe running through the foundations of the trellis framework. It was laid after the demolition of the trellis in 1709 and passes over its foundations. A record of the laying of this pipe was found in the National Archives in Paris, indicating that it was done in 1718 to replace an older lead pipe.

This pipe is made of grey cast-iron formed in two-part moulds, the seams of which can be seen on the sides. The junction flanges are pentagonal and tightened with bolts and nuts. On the inside,

a lead washer forms an irregular joint giving the pipe a slight curve. For the straight parts, leather washers were used.

Trellis foundations

The *bosquet d'Encelade* was surrounded by a wooden-trellis, the foundations of which were discovered during the 1995 excavation. They consisted of masonry blocks supporting limestone cubes (known as "dice"). Embedded in them were the bases of metal posts and arches that supported the trellis (fig. 6). These dice exploded when the framework was removed but we were able to put them back together and understand exactly how the cradle was constructed. Several dice still contained the base of the posts, which made it possible to develop a complete diagram.

There is another example of trellis foundations, this time for a portico, dating from the mid-eighteenth century. It was discovered in 2006 in the garden of the *Pavillon frais* at Trianon. The beds were levelled, leaving no limestone cubes (fig. 7). It was therefore difficult to understand the organisation of these foundations, which differ from those found in the *bosquet d'Encelade*. However, I knew the design of the portico's metal frame (but not how it was anchored in the masonry blocks) and I knew that lime trees were inserted into the portico pillars, which led me to the hypothesis that the blocks were split in two and spread apart to make room for tree roots (fig. 8).

Decorating basins and fountains: the rockwork

Until the mid-1680s, the coping stones of the basins and fountains in the gardens of Versailles were decorated with rockwork or *rocaille*, consisting mainly of coloured stones and shells (fig. 9). Later, marble replaced the rockwork. Many elements of the old decorations were left in the ground after they were demolished and we found them during our work: millstones, flint chips, sandstone concretions, quartz and amethyst, blue or green glass pastes from the metallurgical industry and many local or exotic shells (conch, abalone, porcelain, etc.) as well as corals (fig. 10).

The labyrinth grove was found to contain copper metal elements that imitated reeds and leaves.

We identified three techniques for hanging these materials, depending on their location. When placed on overhanging masonry, they were attached by copper alloy wires linked to iron pitons. This gave the rocaille materials mobility and made them rustle in the wind or water. When placed on flat or slightly sloping masonry, they were glued directly with hydraulic mortar if in contact with water or with lime mortar if away from water.

Story of a garden

The main structures discovered in the parks of Versailles, Trianon and Marly in the course of various archaeological investigations bear witness to the techniques used in the seventeenth and eighteenth centuries to lay out gardens. However, we are studying each garden as a whole, using stratigraphical methods. The most spectacular stratigraphic study was the one I carried out with Cécile Travers in the garden of the *Pavillon frais*. We dug a long trench across the entire width of the garden. This enabled me to deduce the entire history of the garden and, thanks to the historical research carried out beforehand, to understand when the different layers were deposited: from the geological era to the day before the works began.

In an archaeological career spanning more than thirty years, I have discovered many techniques used to lay out gardens during the reign of Louis XIV and in the following century. Further, I have carried out work in buildings and courtyards, also with other archaeologists working at the Versailles estate. All the discoveries made during these works are currently recorded in a GIS developed by my department. Eventually, this data will be published online.

Acknowledgements
I would like to thank all the people who have worked with me: volunteers at *association Volutes*, who help me throughout the year, and archaeology students participating in the excavations.



Fig. 1 Overhead view of the east basin in the garden of *Pavillon frais* at Trianon.

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Fig. 2 View of steps at the great cascade in Marly.

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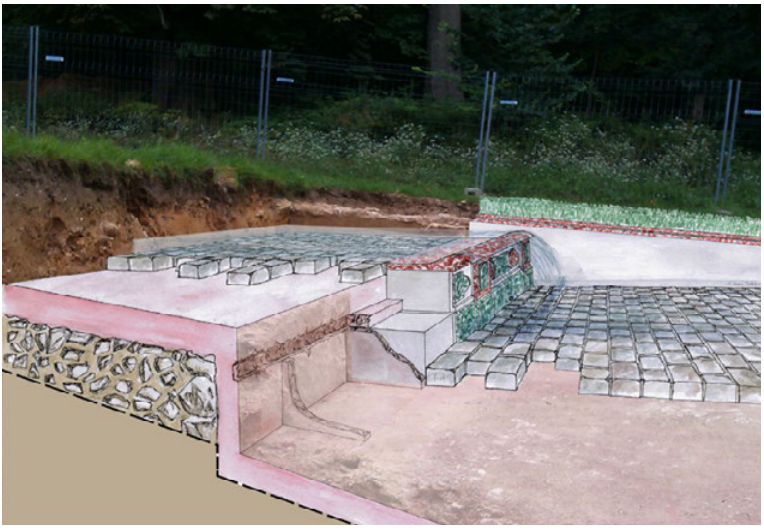


Fig. 3 Virtual reconstruction of steps at the great cascade at Marly.

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Fig. 4 View of *bosquet d'Encelade* following archaeological investigation.

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Fig. 5 The 1675 pipes that fed the central basin of Enceladus.

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Fig. 6 Foundation of the trellis framework in *bosquet d'Encelade*.

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Fig. 7 View from above the foundations of the portico at *Pavillon frais* in Trianon.

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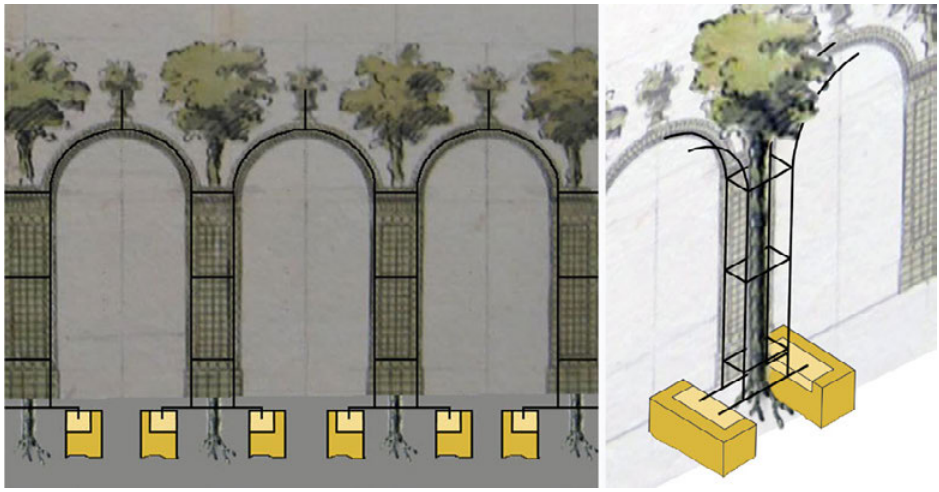


Fig. 8 Hypothetical reconstruction of pillars at the trellis portico of *Pavillon frais* in Trianon.

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Fig. 9 Fountain of Hare and Tortoise in the Labyrinth. Engraving by Sébastien Leclerc, coloured by Jacques Bailly, 1674: Paris, Petit Palais, Inv. Dutuit 724.

© Jean-Marc Manaï (Établissement public du château de Versailles).



Fig. 10 Assemblage of *rocaille* material from various archaeological sites.

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Interdisciplinary archaeological research conducted at the grounds of the former residence of King Jan III Sobieski in Wilanów has exemplified the new approach to the responsibilities of the administrator of a historic space, and featured unprecedented implementation of technological advances in excavation work (laser scanning, short-range 2D photogrammetry and 3D photogrammetry). Due to the specific nature of the fieldwork, it was dubbed "Wilanów archaeology" even before its completion due to its unprecedented intensity as evidenced by four hundred research points, where work was carried out without winter breaks for nine years. It included exploratory excavation, documentation based on the latest measurement and illustration techniques, with the use of CAD spatial data organization, as well as processing of accumulated knowledge based on the GIS structure, detailed inventory of the finds, as well as maintaining a website to inform about results. Earthworks were carried out in a space open to the public and became a tourist attraction. With time, the research in Wilanów also gained the name of "public archaeology." Excavations were carried out in a place with a long tradition of settlement, dating back to the Iron Age. However, the most intriguing discoveries were related to the time immediately preceding the construction of the royal residence. Archaeologists entered an area with a detailed history, and it seemed that

Andrzej Gołembnik

Material truth or formal truth – assessment of the credibility of archaeological sources based on the results of research conducted in the years 2003–2011 in the gardens of the royal residence in Wilanów

their research would serve to consolidate this knowledge. However, the possibility to precisely compile the results of the research and subsequently compare them with other historical sources became the basis for new findings, the fundamental part of which, concerning the chronology and scope of spatial and structural changes, is certain, while the rest, concerning the organization of the works and the impact of emotions, remains hypothetical at least at this stage.

THE TERMS "material truth" and "formal truth" originate in legal terminology. The former, also called objective truth, is based on facts and evidence. The latter is based on presumptions and can be considered to refer to hypothetical findings. Perhaps the convergence of compound procedures means that these terms can be successfully used when describing the reality studied by archaeologists. This happens in every scientific discipline in which the interpretation of sometimes ambiguous phenomena plays a leading role, and the result of the argument depends on the ability to not only combine facts but also make associations. Therefore, recognizing the full possibility of functional coexistence of two

independent ways of presenting knowledge, it is worth considering the credibility of the sources constituting its basis and the possible ways of grounding their value. The results of research conducted in the gardens and parks at the Wilanów residence of King Jan III Sobieski serve here as an example of these considerations. Was this a classic example of "garden archaeology"? Yes and no. From the composition of the royal gardens, only the foundations of the architectural decoration remained, set in the layers of the embankment, creating the topography of the residence area. It is the sequence of these layers, the dynamics of their growth, and their relationship with the emerging structures that create the colourful history of the residence's spatial transformations.

The residence in Wilanów is a multi-hectare estate with a diverse topography. Its constant spatial changes, both natural and manmade, record the history of the area, which goes back to the fourth century CE. However, the most sudden and far-reaching changes occurred in the second half of the seventeenth century. In 1648, the area of the future residence was bought by Bogusław Leszczyński, Vice-Chancellor of the Crown, grandfather of the Polish King Stanisław Leszczyński. This happened shortly before a difficult time for the country, specifically the war with Charles X Gustav, King of Sweden. After the death of the owner of the estate, the area briefly fell into the hands of Jan Stefan Krzycki, who then sold it to Stanisław Krzycki, his relative and the Chamberlain of Kalisz. Materials concerning the history of the residence contain no information about the achievements of either of them, although the land was in their possession for fifteen years (1661–1676). Ultimately, the lands of the former Milanowski family estate were acquired in 1676 by King Jan III Sobieski. After almost twenty years of intensive earthwork and construction, the residence was built, stretching over an area characterised by a new, fully stabilized terrace topography.

In the years 2003–2011, extensive conservation and revitalization investments were carried out on the residence grounds. This gave rise to the development of a broad front of archaeological research. As required by the Museum's management, these were interdisciplinary studies based on the latest research, measurement and documentation techniques. The results were expected to be scientifically convincing and technically facilitating future use for educational, popularization and exhibition purposes. Thus, the Wilanów research proved to be a testing ground for innovative solutions. A team of archaeologists from the National Centre for Research and Documentation of Monuments (KOBiDZ) in Wilanów was assigned the ambitious task of creating a system for conducting excavations that would not only guarantee full professionalism but also transparency of research. One important aspect was working in a space open to tourists.[1] For this reason, a website was launched to inform about the progress of works. On the other hand, the method of preparing documentation, evolving over nine years of excavations, and adopting new solutions along with the development of measurement and photogrammetric techniques, served to create a complementary system of description, measurement and imaging, with results recorded in a spatial database (GIS) constructed from scratch.

1 The experience gained during the research in Wilanów was developed in the following years at other archaeological sites and served to create a new term: "public archaeology": Gołembnik 2017, 303-321.

This method of conducting research, along with the pursuit of exhaustively defined conclusions, was based on experience and practice from research of multi-layered urban sites.[2]

During the nine years of excavation research, a staggering number of over four hundred excavations and surveys were carried out in Wilanów. Parallel supervision was carried out in several linear installation excavations of several hundred metres in length. These work were conducted continuously, maintaining rigour in documenting, inventorying and reporting. The research strategy was based on principles derived from the archaeology of cities, where knowledge of the general outline of history helps researchers settle detailed problems. Given the increased pace of investment works and the fact that it was a rescue research project, success could only be achieved by maintaining iron discipline. In terms of subject, the project required interdisciplinary cooperation, respect for the principles of stratigraphic exploration, and rigorous measurements, at the same time improving methods of laser scanning and geodetic digital photogrammetry. In the sphere of interpretation, it was necessary to unify terminology used in descriptions and define the addressed phenomena. Due to the narrow framework of the post-conference publication, I would like to elaborate on only selected aspects of the project.

In Wilanów, due to lack of historical garden layers, researchers focused on reconstructing events related to the time of construction of the residence, and on creating the basis for spatial solutions. The key role was played by the method of assessing the character of layer units. Although the levelling and construction layers are not as diverse in their composition and structure as the settlement layers of urban sites, while their assessment is not as complicated, the procedure of describing them according to the identification category was maintained during research.[3] This is an important detail for consideration of the credibility of archaeological sources and the value of field conclusions. Let us begin with layers because they are the basic source of knowledge for archaeologists – a source that is irreversibly destroyed during excavations. Appreciating the value of the cognitive potential dormant in archaeological layers, physical work was commissioned in Wilanów to students from the Institutes of Archaeology at two Warsaw universities: the University of Warsaw and the Cardinal Stefan Wyszyński University. Thanks to their work, the exploration process took on the characteristics of a strictly research-focused activity. Results of this stage of works served as the basis for assessments underlying the stratigraphic analysis and reconstruction of complex stratification processes. It can therefore be safely stated that in Wilanów the first and most important factor determining the credibility of the results of archaeological field research has been the quality of exploration.[4]

Having a reliable basis for further analyses, the principle of defining layers together with giving them identifying names as well as specifying their nature

2 Gołembnik 1995, 303-328; Gołembnik 2010, 36-75.

3 Gołembnik, Dunlop 1996, 247-258.

4 English researchers are leaders in the field of systematizing knowledge about layers and stratigraphy. A comprehensive work in this regard is the publication: Harris 1993. At the same time, it should be emphasized that during the Wilanów research, Harris's matrix was used only to describe local relationships (surveys, excavations). Due to the extensive area and long linear excavations, the stratigraphy record for the entire residence was based on spatial database records.

and method of sedimentation was continued in Wilanów.[5] The principle of abandoning the general term "layer" and replacing it with a name in the stratigraphic analysis facilitated grouping the separated units within specific categories and types. Following the research model developed in Bergen (Norway), three such types were introduced: deposit, sediment, and bed. Each of them was placed in a defined category; in the present case, two groups were identified, differing only in the rate of accumulation. The first is a group of units with dynamic growth, while the second – with slow growth. Then, a more detailed division was made, defining the rate in terms of episodic (short-term) cycles, seasonal cycles, and periodic ones with a constant, long-term growth. This method of defining the nature of layered units organizes their catalogue and improves stratigraphic analysis. It is also helpful in establishing the spatial structure of the database, allowing to sort specific types of layers and assign them not only in the excavations, but also in their broader context.

Identifying the nature of a layer by its name is not a new idea.[6] However, as is clear from research conducted in Wilanów, Gdańsk and Płock, it is a procedure that forces greater discipline during exploration and activities related to determining the nature of these layers. It is a helpful procedure in creating stratigraphic summaries using Harris matrices, or in models of reconstruction of the stratification process. In the system adopted in Wilanów, the term "layer" (interchangeable with "layered unit of stratification") was used as a general term referring to the description of broader phenomena, not to the reconstruction of stratification processes. Other research procedures were organized in accordance with generally accepted principles, ensuring interdisciplinary cooperation. Architects played a special role in the Wilanów research. In the first phase of excavation works it was Jacek Gzowski, and in the second one – Tomasz Żebrowski. One important element of their cooperation was the introduction of the principle of recording registrations in the CAD system and then in the GIS system. This allowed researchers to work on a single map base, which, given the large area covered by research and the scattering of excavations in it, facilitated maintaining archival order.

A huge role in this system was played by digital documentation, based on the principles of short-range photogrammetry. At first, it was two-dimensional, and in the final phase – three-dimensional. Over time, it was enriched with measurements taken with a laser scanner, which has been particularly useful for registering linear objects. The precision gained in this process played a key role in the creation of spatial models for subsequent garden phases (made on the basis of discoveries and historical maps). It also served to correlate the results of investigations carried out by archaeologists and architects.

Photogrammetric geodetic positioning played a special role in the research and later during verification. The precision of the recording as well as the faithful image of recorded planes enabled the meticulously conducted research to gain the highest quality in documentation. Skilfully created photograms made it possible to develop lossless images in the scale of 1:10, which means that even the largest close-ups can be viewed on a computer monitor. The possibility of entering defined, measured surfaces or faces of masonry structures directly into CAD/GIS systems is an additional advantage. This

5 Urban Archaeology 2012, 217-235.

6 Gołembnik 2004b, 351-363.

has played a key role during the work and in the process of summarizing results.

The introduction of photogrammetry to the repertoire of fully-fledged methods of field documentation encountered many administrative problems in Wilanów. Suffice to say that throughout the excavations, traditional drawing-based documentation was made in parallel. Although the obligation to secure two forms of documentation was a hindrance, it ultimately made it possible to acknowledge the superiority of the digital approach. It should be remembered that, in the final version of documentation, geodetic positioning combined with scanning made it possible to calibrate spatial models. This two-way system finally refuted the counterargument of critics of digital photogrammetry, who would argue that its use precludes scientific interpretation. Nothing could be further from the truth. Skilful use of new image recording techniques, which also involve taking measurements, is the quintessence of a stratigraphic exploration that captures a defined and therefore interpreted space.

It can be thus safely stated that, due to their precision and universality, modern visualisation and measurement techniques enhance the evidential value of archaeological sources, adding to them, as a primary source, explored layers and partially or completely destroyed objects. When the results of full field analysis are complemented with definition, exhaustive measurement and illustrative documentation, it becomes possible to use them in a variety of ways, including conducting exhaustive verification work. This makes them a primary source, because they are embedded in a defined historical and spatial context.

Excavation research in Wilanów was carried out without winter breaks. This was probably the most difficult aspect of the adopted strategy. Lack of time for scientific reflection entailed simplification and formulation of conclusions that would be uncritically accepted as the basis for further interpretations. Only the author's verification of the research results, which at the last stage of the work took into account the analysis of the historic material collected from conservation, allowed them to be specified and clarified. By creating a multi-level network of stratigraphic relations, a chronological framework was developed, connecting events and explaining the meaning of the records in preserved written sources. A new picture of the genesis of the residence was also obtained, which facilitated adding previously unknown events to the story. Since it differs from the previous version of events, it is worth discussing its main assumptions in more detail, as well as the method used to reach conclusions.

The essence of the changes is presented in two diagrams. The first one shows the story that is still valid today, in which the heir of Bogusław Leszczyński sold his estate in Milanów near Warsaw to an insignificant nobleman. According to this version, the property was sold and an investment was to be completed on it, including the regulation of the topography of the future garden, park and farm layout along with their surroundings. The construction of the future palace was also to begin in the area prepared in this way, and its designer was to be a famous Italian architect. Then, after a period of stagnation, the estate was sold to the Polish King Jan III Sobieski. In this simple form, this story has been preserved for generations,[7] and it was on this version that archaeologists based their first findings. And since the period of laying the foundations of the

7 Fijałkowski 1996, and older literature there.

residence was relatively short, and the events seemed obvious, archaeologists conducting research entered their discoveries into this outline.[8]

The changes introduced after the verification of the working conclusions are important for several reasons. Firstly, they constitute a documented alternative to the previous version of history. Secondly, they provide an impulse for a broader discussion about the genesis of the royal residence. Thirdly, they should guide future plans for further archaeological research. Fourthly and finally, they allow us to understand the king's conduct in matters related to the investment, which is only partially described in the monarch's correspondence with Augustin Locci, the architect and construction supervisor.[9] The new findings form a picture of a dynamic investment process, one that was full of dramatic turns, successes and failures. They also make it possible to explain numerous simplifications recorded not only in the construction solutions but also in the composition of garden forms. They are an emanation of emotions that accompanied the construction, and explain their impact on the final shape of the country residence of the King of Poland – a carefully designed space with a separate garden and park as well as a farm, court and ceremonial area.

It should be remembered that in order to create the foundations of the planned residence, investment activities had to be started within the radius of several kilometres, which involved changing the course of two local streams and digging a canal connecting them with the Vistula. At the same time, the space of the lower terrace had to be created, strengthening the base of the upper terrace, the main arena of the investment. There, in the space enclosed by the horseshoe of the retaining wall, the future palace was to be built. It should be emphasised that the success of these works would depend on maintaining a constant investment cycle. Any longer breaks, especially near the base of the upper terrace, would thwart the effort. A twenty-year break in work recorded in the previous version of history therefore seems unrealistic or even impossible.

The lower part of the diagram informs about the extent to which discoveries made during the verification work changed the previous version of history. Firstly, a new, previously unconsidered dimension was introduced to the history of the residence, one related to the time when the manor buildings were thoroughly destroyed, which occurred at the beginning of the second half of the seventeenth century. Although only one detail was decisive in the first phase of verification, it triggered the need to undertake further research. It was a coin minted in 1650, which was found in the corresponding layer among the ashes spread over the central and northern part of the plateau of the upper terrace of the residence.[10] The great fire that entirely consumed the wooden buildings at the edge of the escarpment could therefore have occurred at the beginning of the second half of the seventeenth century at the earliest. It took place before the appearance of first elements of the new, brick palace, which is evidenced by the layout of the levelling layers that immediately preceded the construction and covered the ashes. Taking into account the deep burn marks on structural elements, including ones in the basement, it can be concluded that

8 Gołembnik, Jankowski 2005, 136-143, 154-175, 275-305; Jankowski 2004; Gołembnik, Sikora 2004, 47-50.

9 Starzyński 1933.

10 A collection of tiles found in the destructive layer also dates from this period: Dąbrowska 1984.

the fire was not extinguished. It is therefore highly probable that its cause was arson. The only event recorded in historical sources from this period, which could be related to destructive actions is the occupation of Swedish troops stationed in nearby Służewo, who plundered the area in the years 1655–1658.[11]

This discovery, which is crucial for the history of the Wilanów residence, has been verified on many levels. Due to its significance, a detailed stratigraphic analysis had to be performed, taking into account not only the immediate surroundings of the find (the upper terrace), but also the arrangement of stratification units located in the broader spatial and structural context. The direction of search was again indicated by layers from the exploration in which the coins were obtained. They were found in the layers of the Bacchus Mountain embankment and in the levelling masses forming the base of the lower terrace. These coins were minted during the reign of Jan Kazimierz, in the years 1659–1668, i.e. after the death of Bogusław Leszczyński. In this way, a narrow time margin was identified, spanning only a decade during which the layers and structures were formed with evidence of levelling and construction activities. All of them were related to the first stage of forming the basic elements of the topography of the future residence, which began after the aforementioned destruction and after the death of the Crown Vice-Chancellor. This, in turn, undermines the previous version of history.

The Bacchus Mountain is considered to be the oldest element of the original garden composition, perhaps preceding the royal layout. However, this is not the essence of the matter. More important for the present considerations is the fact that the core of the embankment consists mainly of river sand. Its deposits are located nearby, in the area of the former floodplain of the Służewiecki Stream, and therefore on the plateau of the future manor. It can be therefore assumed that the core of the future Bacchus Mountain was formed during works meant to change the course of the stream bed, which, according to the new project, was to form the boundaries of the future economic base of the residence from the west and south. Augustyn Locci mentions these works in his letters.[12] However, if the layers of sand were found on the mound-forming heap and were not used to pour the long-awaited upper terrace, it means that the activities related to the regulation of the stream's course should be somewhat postponed and attributed to Stanisław Krzycki. After all, we know, at least from the content of the document confirming the sale of the estate, that he invested in this area by building a brewery at the farm. It is therefore likely that the royal team was only finishing the work started by the previous owner. The mound could have been temporary in its first function, similarly to the arrangement of its surroundings, only later incorporated into the space of the royal gardens.

Following the trail of layers containing coins minted by Tytus Liwiusz Boratyni, we reached the foot of the escarpment. Thanks to extensive engineering works, the river bend was filled in there and a usable space was created, closed from the east by the reinforced quay. In this way, the lower terrace of the garden's composition was created. Stratigraphic analysis of the layers and earth structures forming the plateau of the terrace, together with an assessment of the progress of work on the construction of an

11 Markowicz 2011.

12 Starzyński 1932–1933, 119-127.

extensive retaining wall topped with bastions in the corners and a centrally located cave, proved that these works were carried out at the same time as the filling of the upper terrace and the construction of the palace. Therefore, if coins minted after Bogusław Leszczyński's death were found in layers forming the lower terrace, he could not have been the initiator of these works.

In this way, it was possible to complete the process of compiling and spatially verifying the results of works carried out in many areas of the residence with regard to the determination of the time when the foundations of the royal residence were commenced. The initial conclusions, drawn from the simple relationship between the dating monument, the layer defined by its character and possible historical events, turned out to be unconvincing. It transpired that only the analysis of spatial changes and accompanying processes recorded on a wider scale, supported by written sources, provided evidential value in comparison with previous information, making the working hypothesis a material truth. Its strength lies in the fact that in view of the research results presented here, it is difficult to present a different version of history. This simply cannot be done effectively.[13]

The discussion regarding Bogusław Leszczyński's presence among the people involved in the construction of the Wilanów residence will probably continue for a long time, but in view of the discoveries made by archaeologists his role may remain in the sphere of intentions, not achievements. Perhaps the Crown Vice-Chancellor had plans, or even commissioned their execution, but the Swedish invasion, followed by financial problems and failing health, meant that not much evidence of his activity is left in Wilanów. This conclusion not only undermines previous findings, shortening the history of the residence by a full decade, but also introduces many new unknowns. These will have to be resolved through further archival research and future excavation work.

Turning to the potential contributions of subsequent owners of Wilanów, it should be stated that the aforementioned Stanisław Komorski could not have carried out works of supra-local scope. For such undertakings, not only a larger budget would be needed, but also a different driving force. Even if we assume that he was only a figurehead and came into possession of the Wilanów estate in collusion with Stanisław Krzycki, to whom he was related, it is hard to believe that they managed to undertake actions beyond the local context. They can be credited with minor cleaning works related to the removal of the ruins of manor buildings,[14] earthworks on the farm, the initiative to form the upper terrace, and finally the commencement of construction of a small manor house, which currently constitutes the central part of the palace's body.[15] It is probable that this was part of the implementation of Bogusław Leszczyński's plans, although there is no evidence supporting this.

13 During the verification process, numerous attempts were made to create alternative versions. None of them could be tied together into a coherent whole.

14 A significant portion of them was swept toward the northeast slope of the escarpment, which was confirmed during excavations. Thanks to this work, the first step was taken in the formation of an expanded upper terrace *plateau*.

15 The soil obtained during the excavation of the manor cellars was used to form the southern and south-eastern parts of the upper terrace. They create a clear horizon. First, as already mentioned, these layers covered the ruins pushed onto the south-eastern slope of the escarpment. The excavation profiles provide a complete record.

The interpretation of this part of archaeological research should not raise any major doubts. As for the chronology of events, they are supported by the presence of the aforementioned coins. Although they only indicate the lower time limit (relative dating *post quem*), the comparison of two coins with different issue dates, found in layers with different stratigraphic positions, allows us to include the finding on the list of certainties. In order to close the history and reconstruct the process of spatial changes, it was only necessary to indicate the place in the stratification sequence that would provide evidence of the change of investor. The answer to this was sought in areas located on the main axis of the future development. At its centre were the cellars and ground floor walls of a brick residence mentioned in the deed of the property's purchase. On the northern side stretched the already flattened plateau at the edge of the escarpment, while on the opposite side the terrain formed a depression with barely outlined boundaries of the future upper terrace. On the same axis lay the lower terrace formed according to the new design. Therefore, in these two cases it was necessary to analyse the successive growth of layers revealed in the rhythm of construction works and hydro-engineering activities. In these reconstruction attempts, archaeologists gained invaluable help from historical written sources, including above all the aforementioned correspondence between the king and his architect.

Stratigraphic analysis of these areas was an important element of the search, becoming the basis for considerations related to the mysterious purchase of the residence by the royal proxy. It thus opened the field for further investigation by historians. It was possible to find a level in the sequence of fill layers of the upper terrace that can be interpreted as a turning point in the investment. It was recorded on the ceiling of the aforementioned fill layers, created by sands from digging construction pits for the palace basements (from the north) and levelling the front of the future residence (from the west). The sequence of these layers, pushed into a narrow strip in the south-eastern slope of the escarpment, was topped with a thin horizontal layer of humus. This layer was of particular interest to archaeologists, and its discovery was considered almost certain evidence of a stage related to the tidying up of the investment area. The layer of horizontally arranged humus that accumulated at that time would indicate, however, that there was a break in activities – a possible period when investment was suspended.

There is one more detail in the described arrangement of layers, this time indicating the duration of the break and the manner in which the levelling was resumed. Namely, the top of the humus layer itself is extremely irregular. This irregularity was preserved despite the undoubtedly rapid appearance of another layer of sand levelling. There could have been several reasons for this state of affairs – from the way the work was organised to climatic or seasonal conditions prevailing during the transition from one stage of construction to the next. Leaving aside the presentation of possible solutions, the details of which are not important, it is necessary to pay attention to the fact that the method of conducting earthworks changed. The core of the upper terrace was already finished and its boundaries were established. In the new phase of forming the terrace, it was necessary to proceed to the successive filling of the designated space, which consisted of adding and superficially spreading out subsequent levelling layers. This process

is clearly visible on the southern side of the upper terrace, where layers were added to the parallel retaining wall that was being built at the time. Something similar happened on the eastern side, although the original stratigraphic context was broken during later construction works. This is how the content of the stratigraphy of the upper and lower terraces was combined. The retaining wall turned out to be the binding element, while the subsequent phases of its construction comprise a separate, colourful episode in the creation of the residence.

Determining the place in the analysed stratigraphic layout where the royal team began working was of great importance for the detailed analysis of subsequent accounts. In the final stage of verification, after confrontation with the contents of Augustyn Locia's letters, it became a key discovery. At this point, it is necessary to recall another finding, made at the junction of two terraces, in the line of the retaining wall.[16] Namely, the foundations of its oldest, northern part were dug into the embankment layers of the lower terrace.[17] These, on the other hand, as already mentioned, are dated by coins found in the embankments. Once again, these were coins minted by Boratyni. This completed the process of creating the basic chronological framework related to the development of King Jan III Sobieski's residence. I emphasize this fact because the arguments presented after verification of field findings met with open disbelief. The process of creating the foundations of the residence, when seen through the prism of archaeological sources, is a colourful story, one that is full of previously unknown details. Some of them directly refer to written sources, for example in the case of the construction of a wooden water supply system connected to the fountains on the upper terrace. Analysis of stratigraphic relations between this structure (together with its excavation), the levelling layers, and the arcade foundation of the northern retaining wall has been crucial for conclusions drawn so far. Others, such as the engineering division of the area of the future lower terrace with a network of clay embankments, were a new finding, legible only in the content of the layers uncovered in archaeological excavations. These embankments marked the range of polders securing the area in the first phase of construction. In the next stage, they were filled with earth, while some of them were reused to create a transitional composition consisting of a line of shallow pools visible on the above-mentioned, oldest plan of the Wilanów residence, the so-called Boya plan.

We can see that in many cases the values encoded in the content of archaeological layers and in their relationship to the accompanying objects can constitute the basis for a binding conclusion. In special cases, as was the case in Wilanów, this can gain evidential power and become material truth, especially when the content of archaeological layers is combined with the sequence of events identified in the analysis of the stratigraphy of linear brick structures (e.g. retaining wall). All additional information, such as the dating properties of monuments or reliable written sources, only strengthen this truth. It can therefore be assumed that the content of archaeological sources increases its substance, possibly broadening the spectrum of analysis. In the case of a narrow catalogue of questions, limited to fundamental decisions such as dating, a set of archaeological monuments from a specific context has decisive power.

16 Sikora 2005, 351-374; Hanaka 2005, 337-350.

17 Gzowski 2004.

Since the field research in Wilanów can be described in its methodological and documentary layer as experimental, also in the final phase of the reconstruction of garden decoration, an unconventional method was used. These analyses were based on limited data due to frequent land reclamations, during which the remains of old compositions were finally removed. Only elements of the foundations of small garden architecture remained in the ground, including mainly the bases of sculptures in the corners of the ground floors, marking the course of the alleys. Remains of their brick surfaces were found preserved in the main axis of the upper terrace. Nearby, on the northern side, negatives of a fountain were discovered, connected to the wooden water supply. It began on the grounds of the manor, then ran under the foundations of the southern wing of the retaining wall. Remains of the surface drainage system at the fountain were uncovered in the axis of the palace. There is justification to assume that they flowed in a cascade down the wall of the cave. Small fragments of the former marble pool were obtained from the backfill layers filling the negative of the fountain. Based on them, its outline could be detailed. In addition, several unidentified objects were discovered in the garden space, as well as traces of garden plantings, including shrubs arranged in the unsophisticated form of parallel beds in the southern garden. This is obviously too little to describe or reconstruct the earliest gardens. Research and comparative analysis was therefore based on cartographic, iconographic and descriptive sources.[18]

It is obvious that the original spatial layout of the gardens, and also – in its basic principle – their composition, have survived in almost unchanged form. This is important information. Thanks to research, however, we know that corrections were made during the realization of the investment, and the royal team improvised during the works, trying to maintain the impression that the construction works were more advanced than in reality. This probably happened for organizational and technical reasons, in which, for example, the complexity of the task exceeded the executive capacity (for example the construction of a retaining wall). An economic factor was also possible, as exemplified by the poor quality of the water supply system. However, the main reason, easily identifiable in the correspondence between Jan III Sobieski and Augustine Locci, was the pressure exerted by the king. It was clear at almost every stage of construction, and was expressed as the inclination to make haste. It is difficult to offer a different explanation of unsuccessful executive decisions and construction simplifications. It is also known that some of the rushed arrangements did not stand the test of time, for example the installation with two globes, which was part of a spatially closed garden composition. It remains an extremely interesting issue to find the reason for the monarch's haste. It would be appropriate to point out the thread of love correspondence maintained by the royal couple, which was previously untouched by historians. Taking into account the emotional thread would explain all the failures mentioned above. It can be safely assumed that enriching the history of the construction of the king's private residence with the spiritual sphere, rooted in feelings and beautifully expressed in the couple's correspondence, can be considered the main takeaway from undertaken efforts. Such an approach to the work and the sequence of events has opened

18 Sikora, Hanaka 2005.

up new research possibilities, at least in the sphere of symbolism, legible at various levels of the task implementation, starting from spatial planning and ending with the symbolism of the architectural decoration.

In an attempt to refer to the assessment of the value of the discoveries and their verification, we consulted the records of the garden inspection, commissioned by Elżbieta Sieniawska, who acquired the royal estate twenty-four years after the king's death.[19] It was a meticulously prepared document, which was in fact an inventory prepared by a person moving along a set route. All that remained was to establish this route and confront the content of the inspector's records with what the archaeologists managed to discover during the excavations. Since the inventory contains not only descriptions of buildings and their accompanying structures, but also of the vegetation, it was considered that the verification could be carried out to the full extent. In this way, many layers and objects were identified, about which there was no certainty during research. However, this aspect of goes beyond the scope of this article.

All these discoveries create a novel quality and introduce new knowledge to studies on the history of Wilanów, necessitating further scientific verification as well as broad discussion. However, it must be preceded by work towards organizing and supplementing the existing GIS database, and publishing the details of this research, which poses a great challenge and an opportunity to further deepen our knowledge about the history of the residence of King Jan III Sobieski.

19 The inventory was made in 1729: Nesterow, Sito 2010, 6, 20-30.

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Fig. 1 Bird's eye view of the Wilanów residence of King John III Sobieski (from the archives of the Museum of King Jan III's Palace in Wilanów)



Fig. 2 The first plan of the residence of King Jan III Sobieski in Wilanów (Adolf Boy, 1682), included in the reconstruction of the area's original topography

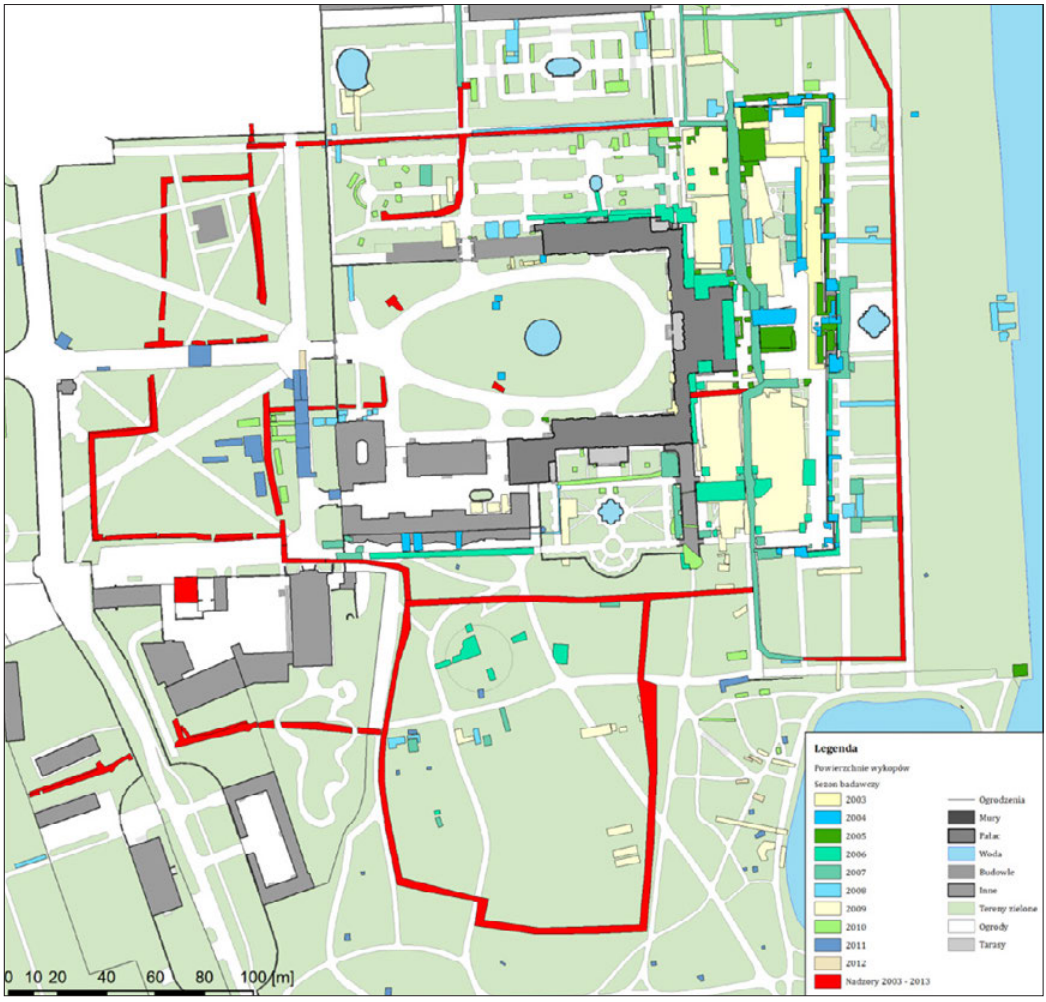


Fig. 3 Wilanów – residence of King Jan III Sobieski. Scope of archaeological prospection in the years 2003-2011

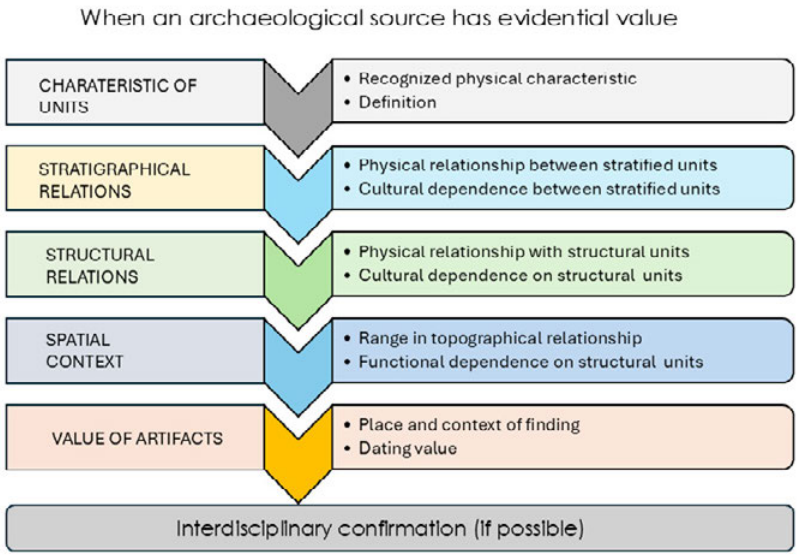


Fig. 4 Archaeological research of the residence in Wilanów. Stages of analysing research results, or the path from material truth to formal truth

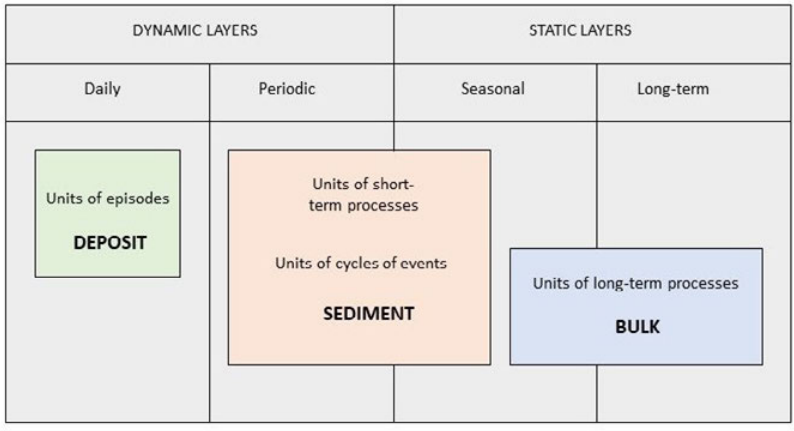


Fig. 5 Basic characteristics of layers in the approach adopted in Wilanów

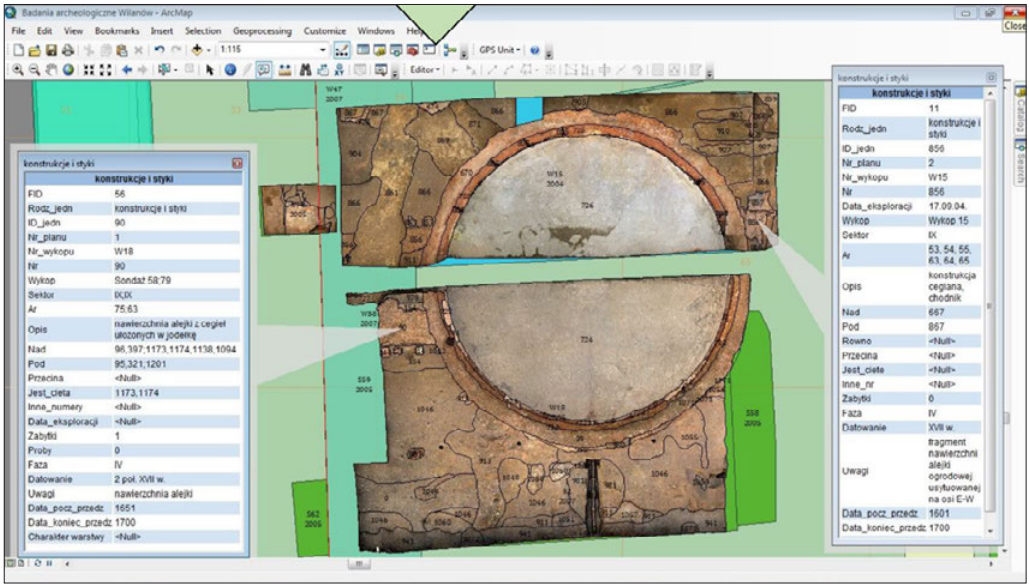


Fig. 6 Detail of the GIS database map with relics of the central fountain and a description of the stratification units discovered near it (database stored in the Archive of the Documentation Department at the Museum of King Jan III's Palace in Wilanów)

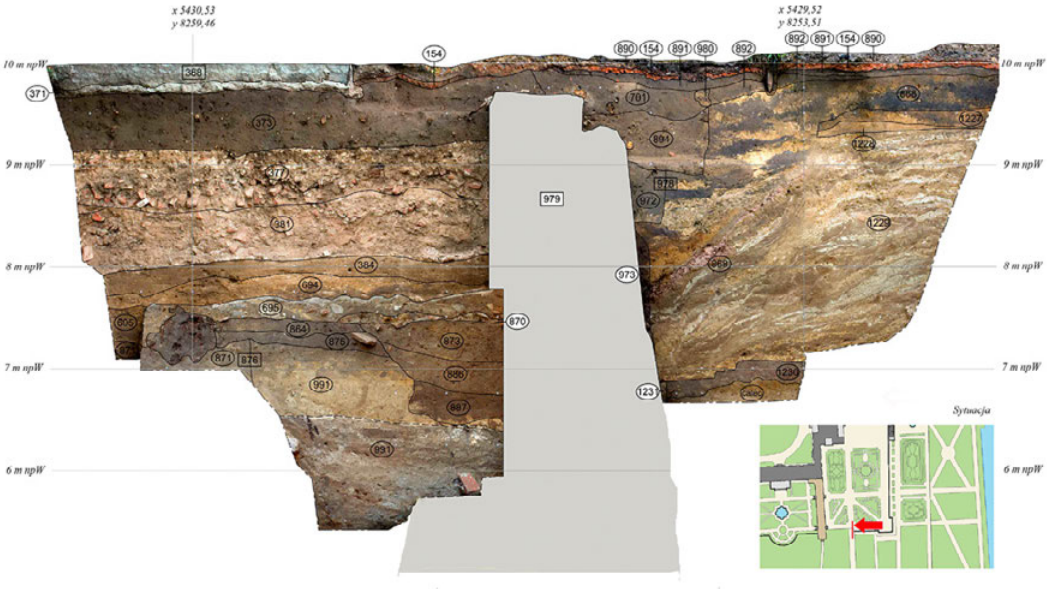


Fig. 7 Example of the relationship between earth layers and masonry structures. Cross-section of the southern part of the retaining wall with levelling layers extending to the upper terrace (right) and levelling layers raising the terrain of the lower terrace (left). The cross-section shows the method of construction of the retaining wall



Fig. 8 The first attempt to use a laser scanner to record discoveries made during excavations in Wilanów (2004)

Dating and owners		Structural changes - topographic and building								
Owner	Change dates	Initial topographic restructuring	Local topographic works	Large scale topographic changes	Construction of the residence	Construction of the quay	Construction of the retaining wall	Courtyard and front gardens	Lower and upper garden terraces	Building facilities and farm
Jan III Sobieski (b)	from 1684									
Jan III Sobieski (a)	since 1677									
Stanisław Krzycki	since 1676									
Jan Stefan Komorski	since 1661									
Bogusław Leszczyński	1654-1661									
Milanowski family	Up to 1648									

Fig. 9 Diagram illustrating the history of the Wilanów residence in the version preceding excavations

Dating and owners		Structural changes - topographic and building								
Owner	Change dates	Initial topographic restructuring	Local topographic works	Large scale topographic changes	Construction of the residence	Construction of the quay	Construction of the retaining wall	Courtyard and front gardens	Lower and upper garden terraces	Building facilities and farm
Jan III Sobieski (b)	from 1684									
Jan III Sobieski (a)	since 1677									
Stanisław Krzycki	since 1676									
Jan Stefan Komorski	since 1661									
	1655-1660									
Bogusław Leszczyński	1654-1661									
Milanowski family	Up to 1648									

Fig. 10 Graphical illustration of the history of the residence, made after the completion of field research and after the author's verification of results

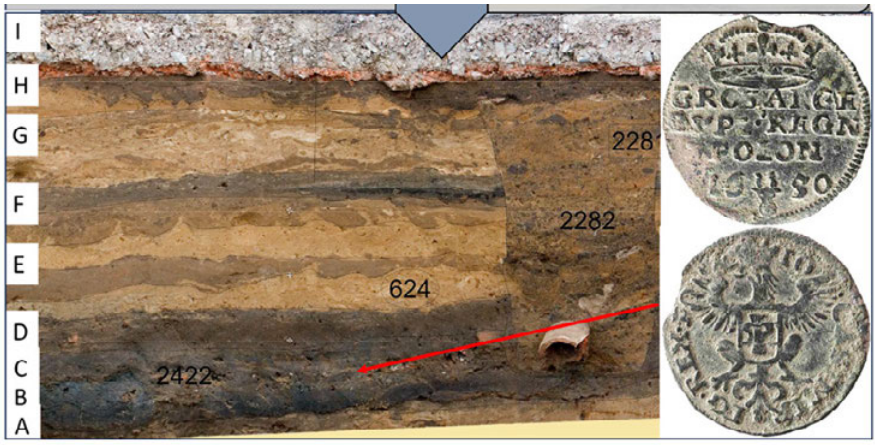


Fig. 11 The two-grosz coin of Jan Kazimierz II used for dating. It was minted in 1650 and represents the variety with a wide crown on the reverse and "POLON" in the legend



Fig. 12 Research at the retaining wall during spring water rise

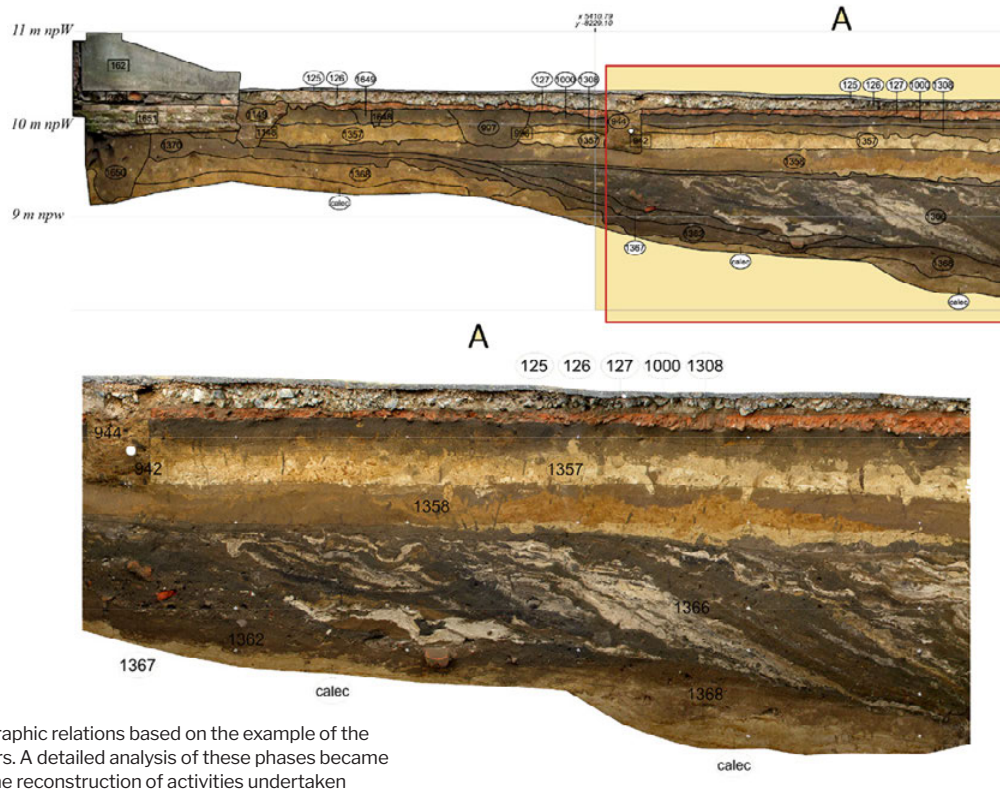
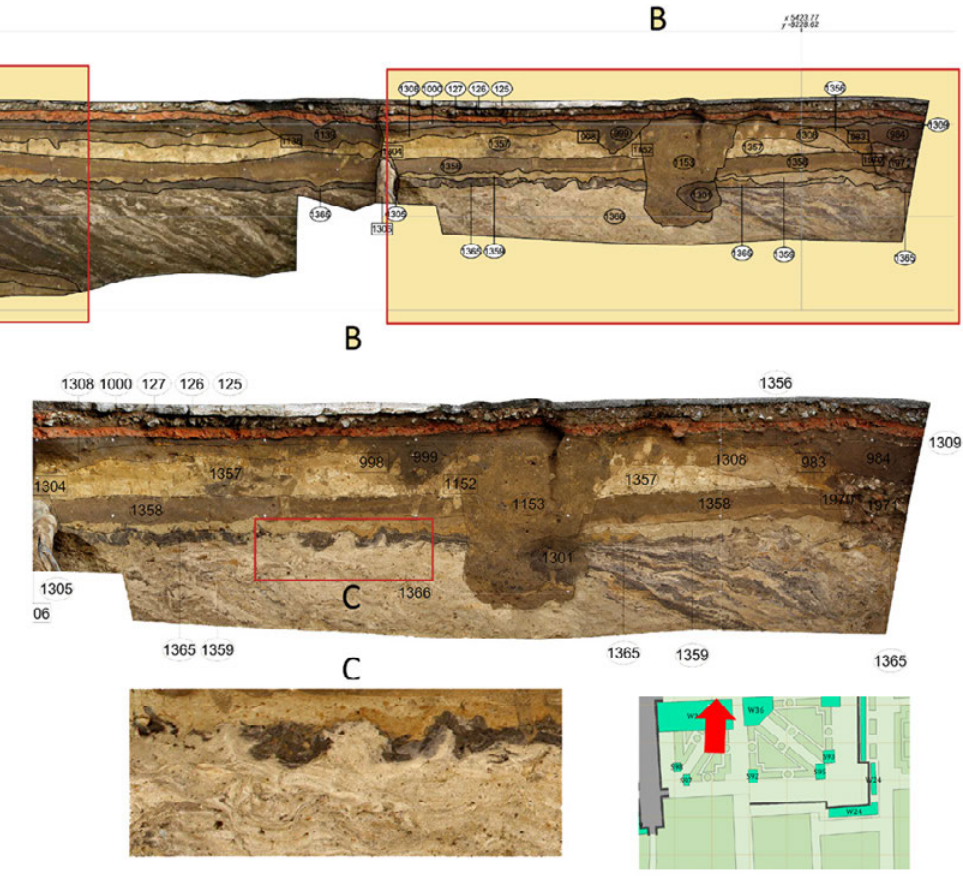


Fig. 13 Stratigraphic relations based on the example of the staged fill layers. A detailed analysis of these phases became the basis for the reconstruction of activities undertaken before, during and after the purchase of the investment site



Fig. 14 Reconstruction of the spatial layout of the residence of King Jan III Sobieski, based on A. Boy's map from 1682. It is an ideological visualization, creating an image that is partly designed and partly real.

Made by T. Żebrowski



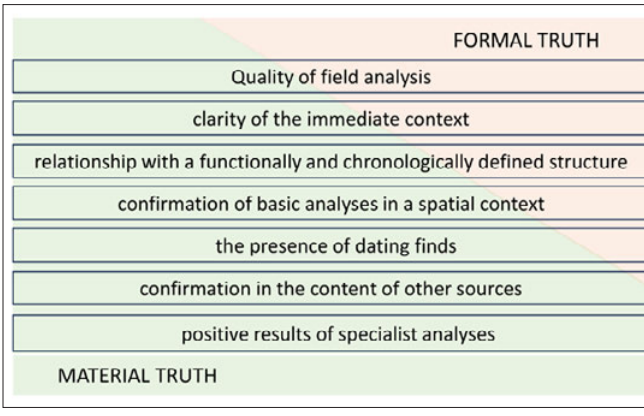


Fig. 15 Assessment of the credibility of stratification units in the process of multi-level analysis

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Karin Lindeblad, Ann-Mari Hållans Stenholm, Annika Nordström

Excavations, surveys, and restorations – garden archaeology in Sweden

Garden archaeology in Sweden, although still a young branch of research, has developed a multidisciplinary approach in which archaeobotanical analysis is an integral part of the excavation process. This enables priorities for investigation to be more easily established and has proven especially helpful when excavating cultivated garden soils. In addition to indicating the range of plants that were possibly grown, information can be gained regarding former strategies for irrigation, fertilisation and other soil improvements, each having possible socioeconomic implications. Artefacts such as flowerpots can likewise shed light on life in the household as well as gardening activities.

GARDEN ARCHAEOLOGY is a relatively recent field of research in Sweden. Over the past few decades, however, it has generated significant new insights into how earlier generations designed and managed their gardens, as well as the range of cultivated plants. This previously hidden archive of knowledge continues to stimulate new questions, methodologies, and analytical approaches. The results of these studies have considerably deepened our understanding of the development of garden culture and horticulture over the past millennium. One notable finding is that the introduction of many plants to Scandinavia occurred much earlier than previously assumed. For instance, opium poppy, turnip, garden cress, and carrot were introduced during the Scandinavian Roman Iron Age (0–400 CE), most likely reflecting the northward expansion of Roman influence during this period. Another significant result is that, in the Viking Age (750–1050 CE), Scandinavian trading centres such as Birka in Sweden and Hedeby and Ribe in Denmark may be regarded as important hubs of horticultural activity.[1]

1 Heimdahl 2010; Rodhe Sloth et al. 2012; Larsson 2015; Heimdahl 2021.

This paper provides a brief historical overview of the development of garden archaeology in Sweden, its methods and source materials, as well as collaboration with other disciplines. It concludes by presenting results from four different historic gardens investigated through the approaches discussed.

Garden archaeology in Sweden

Garden archaeology emerged on a modest scale as a new field of research in Sweden during the 1990s. The earliest excavations were primarily linked to restoration projects in historic parks and gardens associated with manors and castles.[2] Their results were used not only to enhance knowledge of these sites but also to facilitate the restoration and reconstruction of the historic gardens. In recent years, the number of restoration projects informed by archaeology has increased, with notable examples at Rosenlund in Jönköping, Johanneberg in Gothenburg, Djurgården in Stockholm, and Axmar ironworks in Gästrikland, among others (cf. fig. 1). These projects have fostered interdisciplinary collaboration, bringing together archaeologists, landscape architects, art historians, garden historians, and other specialists to advance a deeper understanding of historic gardens.[3]

Since the turn of the millennium, the studies and excavations of historic gardens have been pursued more systematically. Today, such research is frequently conducted within the framework of Swedish contract archaeology. Drawing inspiration from landscape and agrarian archaeology, as well as from British and American traditions of garden archaeology, both research themes and questions have expanded, accompanied by the adoption of modern excavation techniques and analytical methods. Among the most significant developments is the systematic integration of archaeobotanical analysis as a core component of excavations.[4]

In recent decades, many archaeological investigations of gardens have focused on kitchen gardens in medieval and early modern towns (fig. 2), where remains are generally better preserved than in rural contexts. Findings from urban excavations demonstrate that gardens varied considerably in size, depending on the period, location, and social status of their owners. For instance, the gardens of noblemen in early modern Stockholm were exceptionally large, in some cases extending up to 50,000 m^2. By contrast, smaller kitchen gardens in late medieval Vadstena typically measured around 200–300 m^2, while those in early modern Kalmar were even more modest, ranging from 20 to 40 m^2.[5]

Findings from several excavations also indicate that gardens were established by farmers in the countryside, as well as in villages and hamlets, although these contexts still require further investigation. Fragmentary written sources from the thirteenth century onwards corroborate the archaeological evidence from gardens in different parts of Scandinavia, suggesting that garden culture gained increasing significance during this period. Gardens were owned and utilised not

2 Andreasson Sjögren 2016.

3 Franzén 2019; Lindeblad et al. 2019; Bramstång Plura et al. 2021; Blennå and Lindeblad 2022.

4 Currie 2005; Lindeblad 2006; Lindeblad and Petersson 2009; Heimdahl 2010; Gleason 2013; Lindeblad and Nordström 2014.

5 Hedvall 2002; Lindberg and Lindeblad 2013; Lindeblad and Nordström 2014; Heimdahl 2014, 83ff; Tagesson and Carelli 2016, 290ff; Haltiner Nordström 2019; Hansson and O'Meadra 2020; Andréasson Sjögren 2021, 79ff; Hållans Stenholm and Lindeblad 2023.

only by noblemen and various religious and state institutions, but also by ordinary men and women (cf. fig. 3). Beyond their practical and economic roles, gardens also carried aesthetic, cultural, and symbolic values.[6]

Historic gardens can therefore be approached from multiple perspectives, continually generating new questions and offering insights into everyday life in the past. Moreover, the study of historic gardens illuminates practical concerns and leisure activities, horticultural practices and production, as well as economic structures and cultural symbolism.[7]

Source materials and methods

Garden archaeology is a branch of historical archaeology, combining archaeological evidence with complementary sources such as historical maps, written records, photographs, paintings, and other forms of visual material.[8] Archaeological remains provide information on a range of aspects, including artefacts, garden soils, construction techniques, and the size, layout, and building materials of gardens. Through the study of artefacts discarded in garden soils, together with scientific analyses of the soils themselves, historic gardens can be dated and investigated in relation to cultivation practices, fertilisation, irrigation, and composting.

Systematic garden excavations have demonstrated that features such as paths, terraces, cultivation beds, enclosures, compost pits, and water sources may be well preserved. Numerous artefacts are likewise often found within buried garden soils and other cultural deposits, offering insights into the individuals who cultivated the gardens, including the social status of the households that owned or used them. In addition, such artefacts provide evidence of tools and containers employed in the management of the garden.[9]

Interdisciplinary collaboration is essential in the study of historic gardens, as it enables the development of knowledge through innovative approaches. In our projects, emphasis is placed on maximising exchange at every stage of the research process, from planning through fieldwork to analysis. This requires close cooperation between archaeologists and specialists from other fields. A key advancement has been the relocation of part of the microscopic analysis from the laboratory to the field, allowing for rapid examination of materials prior to full excavation (fig. 4). This approach provides archaeologists with immediate insights into the micro-content of layers as they are being excavated, thereby enhancing the interpretation of deposits. Archaeobotanical research likewise benefits from in situ analysis, which can add further depth and precision to archaeological interpretations.

In excavating the remains of historic gardens, we employ a modified contextual method specifically adapted to garden archaeology.[10] This approach has been developed in recognition of the fact that the remains of gardens and gardening differ fundamentally from those of buildings, streets, refuse deposits, or ordinary occupational layers. Garden soils typically accumulate over extended periods of time and, through repeated cultivation, are often substantially homogenised.

6 Lindeblad 2006; Lindeblad and Nordström 2014; Andréasson Sjögren 2021, 79ff.

7 Cf. Wolschke-Bulmahn 2001, 2ff; Bodin and Hedlund 2013, 9ff.

8 Cf. Andrén 1997.

9 Cf. Currie 2005.

10 Cf. Currie 2005; Lindeblad and Petersson 2009; Gleason 2013; Lindeblad and Nordström 2014

As a result, cultivation layers frequently lack visible stratigraphy and discernible structures.

To identify the former garden soils, we use three different criteria:

- placement and form,
- soil structure and texture,
- organic content.

Defining the placement and form of cultivation layers and beds is fundamental to identifying garden soils in situ. In this context, placement and form refer to the stratigraphic morphology and the spatial distribution of strata interpreted as cultivation soils. Typically, buried garden soils are characterised by a homogeneous stratum measuring between twenty and forty centimetres in thickness (often compressed); in some instances, however, the continual addition of new material has resulted in metre-thick uniform garden soils. Other garden features, such as paths, fences, and terraces, are usually best preserved either in the upper surface of the garden soils or in the contact zone between the cultivation layers and the underlying deposits or subsoil (fig. 5).

A three-step method has been developed for excavating the buried soils within former gardens.[11]

1. Upper surface

The first step is to remove recent layers with an excavator to the upper surface of the garden soils, followed by manual cleaning and systematic metal detecting of the exposed surface. Individual contexts are subsequently examined, documented, and interpreted. At this stage, the preservation conditions of the garden are also evaluated to determine which areas of the garden are likely to yield the most substantial information

2. Garden soils

Garden soils are man-made. They represent a mixture of materials reflecting the ideas and practices of gardeners. The more extensive garden soils are examined by digging sample pits (fig. 3). The intention is to study stratigraphy (if any) and, if possible, determine an approximate date of cultivation by examining artefacts. Soil samples are also collected and examined microscopically to determine their texture and composition. Choices regarding soil improvement—such as the addition of clay, sand, ashes, or woodchips; the application of fertilisers including dung or kitchen and latrine waste; irrigation; and the cultivation of particular plants—reflect various aspects of horticultural practice. To quaternary geologists, these anthropogenic soils are identifiable as anomalies.[12]

After parts of the buried garden soils have been examined manually, they are carefully removed in thin layers by an excavator, and any preserved features are documented and interpreted.

3. Contact surface between garden soils and subsoils

Finally, the interface between the garden soils and the underlying layers is cleaned and excavated by hand. This approach has proven most effective for identifying cultivation beds and techniques, including traces of spade work, as well as other common physical features such as wells and pits. The remains are carefully examined and recorded, with samples collected for subsequent analyses.

11 Cf. Currie 2005; Lindeblad and Petersson 2009; Gleason 2013; Lindeblad and Nordström 2014.

12 Heimdahl 2010; Heimdahl 2014.

Restoration and garden structures

As noted above, several park restoration projects in Sweden have relied on close collaboration between a range of specialists, including landscape architects, archaeobotanists, quaternary geologists, gardeners, and archaeologists with expertise in garden archaeology. Achieving optimal results requires a focus on shared research questions, as well as the integration of diverse skills, methods, and techniques. What follows is a brief presentation of findings from two restoration projects in which ground-penetrating radar (GPR) was employed by an archaeologist skilled in 3D documentation. The advantage of this method in garden restoration lies in its ability to survey large areas without disturbing vegetation, particularly the roots of mature trees.

The two examples discussed are located on Royal Djurgården, a large island in Stockholm under the administration of the ruling monarch since the Middle Ages. During the medieval period, Djurgården functioned as a hunting park; however, by the mid-eighteenth century, this use had fallen out of favour, and parts of the island were made available to members of the royal circle. The land was either leased or purchased by private individuals, who subsequently constructed smaller mansions accompanied by parks.

Frisens Park

The park is in the southern part of Djurgården, next to the sea. In 1759, the bookkeeper Isak Kierman bought this former hunting residence. He erected buildings and a park that was later named Frisens Park after another, the wholesaler Carl Magnus Fris.[13]

13 Bolin et al. 1925, 109ff; Laine 2003, 27ff; Lindeblad et al. 2021.

The natural topography is striking, characterised by pronounced differences in elevation and exposed rock outcrops. The park's design emphasises these natural features, incorporating avenues and pathways that link seating areas and viewpoints, as well as an artificial pond or small lake. The park is well preserved, with many of its historic features still visible today. Frisens Park represents an early example of an English-style landscape park, incorporating distinctly Baroque elements in its central area. Contemporary accounts described the park as a novelty. The recent restoration focused primarily on the pond and its immediate surroundings.

Numerous historical maps of the park exist, including Kökeritz's 1777 map, which is highly accurate and depicts the various elements of the garden in considerable detail (fig. 6). The pond is depicted as a gently undulating feature, strategically positioned within the landscape. The pond was not fully visible from the south, where the main building was situated, but gradually revealed itself upon approach. Surveyor Kökeritz refers to it as a *Reservoir*. Archaeological excavation revealed that the pond had been filled with waste deposited by both household residents and visitors using the park for recreational purposes. Once emptied, a drystone wall lining the interior became visible, and the stone foundation of a bridge was also recorded (fig. 7).

One of the questions concerning the pond is how it was supplied with water and how its water level was regulated. Limited excavation located the inlet and outlet; however, the wider system of channels could not be traced archaeologically. The large area containing them was investigated using ground-penetrating radar, which enabled identification of the supply system far beyond the excavated area (fig. 8).

Rosendal Palace Park

During the nineteenth century, Djurgården was transformed into a popular recreational area. The creation of Rosendal Palace by King Charles XIV John in the 1820s marked the beginning of a new phase in the island's development, with a park soon established around the palace. An archaeological survey was conducted to enhance understanding of the park, particularly its paths, plantings, and locations of seating areas and viewpoints (fig. 9).

The restoration of the park focused on the "Pleasure Grounds," constructed in the nineteenth century on a former meadow west of the palace. The Pleasure Grounds were designed to be experienced either by carriage or on foot. Today, the area functions as pasture and is almost entirely devoid of its original park character, with nothing visible above ground. The terrain is largely flat, except for a few mounds intended for planting or seating, as shown on a map from 1834 (fig. 10a). To investigate this relatively extensive open area, a ground-penetrating radar (GPR) survey was carried out. The survey clearly revealed the locations of former paths, which correspond closely to those depicted on the historical map (figs. 10a and b).

An archaeological excavation was undertaken based on the GPR data, with several trenches opened not only along the paths but also at the locations of planting beds and seating areas. It was apparent that the historic features were very well preserved just beneath the vegetation layer. The excavated paths are of two different widths, both in accordance with the old Swedish measure called *aln* (59.38 centimetres). They were 1.8 and 2.4 metres wide, respectively, and surfaced with a similar yellow-brown gravel material, entirely different from the gravel in the palace courtyard, which is finer and has a reddish tone.[14] Archaeobotanical analysis has shown that the paths were not edged by a flower bed but fringed by untended meadow vegetation, possibly with single planted bulbs and the like (cf. fig. 11).

Plants in the garden – examples from a seventeenth-century garden in Stockholm

Plants are central to both the character and functioning of a garden. Collaboration with archaeobotanists has played a crucial role in the excavations of gardens in Sweden. The Rosendal Quarter, located in central Stockholm, provides a notable example of a large-scale excavation yielding well-preserved plant seeds (fig. 12). An archaeobotanist carried out field analyses throughout the excavation, which was essential for prioritising the sampling strategy and for identifying specimens for further analysis as early as possible in the research process.

The Rosendal Quarter was situated on the outskirts of the city during the seventeenth century, where wealthy burghers and nobility would establish summer residences with gardens. The focus of excavation was one such residence owned by a priest during the second half of the century. He was a highly prestigious individual who served as a priest at the queen's court.[15]

Cultivation plots were common in Swedish towns during the Middle Ages and the early modern period, indicating that urban farming played a significant role in the organisation and planning of urban space.[16] In 1636, it became possi-

14 Lindeblad et al. 2019.

15 Hållans Stenholm and Lindeblad 2023.

16 Lindeblad 2006, 30ff.

ble to establish summer residences with gardens in Stockholm. In the 1600s, it was mainly the nobility who built such facilities, whilst in the next century, it was the burghers. At that time, there were more than one hundred residences of this type in the city.[17]

The gardens of these summer residences in Stockholm remain largely unexplored archaeologically and thus represent a new area of research. The remains of the garden in the Rosendal Quarter appear to be unique within the Swedish urban context, owing to their complexity, variability, and the exceptionally well-preserved and diverse archaeobotanical material. Abundant plant residues were recovered during the excavation, alongside finds related to fertilisation and soil improvement. These discoveries have significantly enhanced the understanding of the varieties of cultivated plants and garden management practices. The excavation provides clear insight into the design and development of urban gardens during the seventeenth century.

Layout and design

The garden features were also well preserved in Rosendal. They were organised in a strictly baroque style of garden quarters, planting beds, paths, and planting pits for bushes and trees. The garden was divided into at least four rectangular cultivation areas, separated by gravel paths—two running north–south and two east–west, parallel to the fence delimiting the northern boundary of the plot. In addition, two smaller cultivation areas were located near the main building (fig. 13).

The gravel used for the paths was analysed, with geological composition, grain size, and colour considered key elements contributing to the garden's aesthetic expression (fig. 14).

Cultivated plants

The garden contained vegetables, herbs, medicinal plants, and even fruits and berries (cf. fig. 15). The most abundant species were cabbage, turnips and beets, but cultivation also included basil, onions, red and black currants, coriander and purslane.[18]

One cultivation bed had a particularly favourable south-facing position and rich content, with over twenty different species represented. They included everything from staple crops to vegetables, herbs and ornamental flowers, as well as particularly heat-loving plants such as basil. Remains of cabbage, tobacco, and poppies were particularly rich in the macrofossil assemblage. It may seem strange that everyday crops like brassicas were grown in such a visible location. Some varieties, however, such as cauliflower, Brussels sprouts, and red cabbage, have been valued as more prestigious. Among the identified species, henbane provides clear evidence of its deliberate cultivation as a medicinal plant in the garden. The large number of identified herbs and vegetables suggests that several herb species may have been cultivated simultaneously.

Onions and purslane characterised another south-facing cultivation bed. Remains of the garden carnation are of particular interest; it is a purely ornamental plant and cut flower. Columbine can also be included in this category. Traces of grapes were also present and, like figs, almost always come from latrine waste in the soil. Thus, the household must have consumed dried figs and raisins. In one of the cultivation beds, however,

17 Selling 1930, xvii; Bengtsson 2007, 64ff.

18 Heimdahl 2023.

the discovery of grapes stands out. Two grape seeds were found, but the material did not contain any other traces of latrine waste. This supports that the grape vine was grown in the bed. Similarly, a fig seed discovered in a planting pit lacking latrine material raises the possibility that fig trees were cultivated, although the prolific seeding of figs complicates interpretation.

Another noteworthy feature of the planting beds south of the path was the presence of plant supports in the form of sticks and poles, suggesting the cultivation of climbing plants. These may have included peas and beans, which typically require drying or charring to be preserved and therefore rarely appear in the archaeobotanical record.

The northern cultivation beds contained large quantities of medicinal plants that testify to the preparation of household remedies. It was not uncommon for priests to be interested in such plants. Similarly, tobacco was considered a medicinal plant at this period, and it may be significant that two varieties were found, each presumably with different properties.[19]

Cultivation and gardening

Several of the samples inform us about cultivation strategies such as irrigation, fertilisation and soil improvement.[20] The diversity of plants, comprising staple crops, vegetables, medicinal herbs and spices, together with evidence of seasonal variation, indicates the practice of crop rotation.

The soil was fertilised using household waste in the form of kitchen refuse. In some cases, threshing residues are also noticeable, as well as brewing waste. Kitchen refuse includes animal bone fragments, fish bones and scales, oyster shells, shells of hazelnut and almond, and charred grains. There were also compost pits in the garden, with the noteworthy presence of herbaceous fragments in one sample.

Traces of aquatic creatures were found in several soil samples, almost all from cultivation beds. Eggs from the hibernation state of water fleas (*Daphnia*) can be interpreted as evidence of irrigation, which, being labour-intensive, is one of the management criteria that distinguishes small-scale horticulture from arable farming.

In summary, fifty-one species were identified and contextualised to specific garden beds, several previously unknown in Stockholm, making this study a significant contribution to the understanding of early urban gardening in both Stockholm and Sweden more broadly.

Artefacts in historical gardens

Artefacts and other objects found in historical gardens have hitherto been a relatively unexploited resource in Swedish research. Garden soils often contain a wide range of materials with different informational value. The finds can be divided into the following three categories[21]:

1. Artefacts used by gardeners, which have been discarded in the garden, for example, planting pots and garden tools.
2. Artefacts and other material introduced into the garden through fertilisers and soil improvement. This category often constitutes the largest share of garden finds, including animal bones, pottery, glass, and metal. Its interpretive value increases when the

19 Franck and Hernodius 1633.

20 Heimdahl 2023.

21 Cf. Currie 2005; Lindeblad and Nordström 2014.

provenance of the fertilisers can be established, for example, linking them to the household utilising the garden.
3. Items thrown or dropped in the garden, either by people working there or visitors (guests, students, etc.). This category may include coins, buttons, broken clay pipes, etc.

Not all artefacts from historic gardens fit neatly into these categories, yet they provide a useful framework for analysis. As with the contextualisation of plant remains, archaeological methods are essential for extracting the maximum information from artefacts. The following section demonstrates how different types of planting and flowerpot use can inform interpretations of horticultural practices and contribute to identifying the household that owned and used the garden.

Flowerpots from the Linnaean household in Uppsala

In autumn 2022, we had the opportunity to excavate part of the home of Carl Linnaeus (1707-1778) in Uppsala (fig. 16). Although excavation did not extend to the actual botanical garden beside the house, the artefacts that were found nevertheless contribute to our knowledge of its management as well as answer questions regarding the socioeconomic status and identity of the household.[22]

The Linnaean Garden in Uppsala, founded in 1655 by the naturalist and physician Olof Rudbeck the Elder (1630–1702), is the oldest botanical garden in Sweden. By the time Carl Linnaeus arrived as a student in 1728, it was the largest and best-known facility of its kind in the country. He soon gained the favour of Olof Rudbeck the Younger (1660–1740), professor of medicine at Uppsala University, and lodged with his family while tutoring the Rudbeck children and guiding fellow students through the garden. Biographers note that Linnaeus was dismayed by the garden's poor condition following the great fire of 1702, yet it was in this context that he laid the groundwork for *Systema Naturae* and his revolutionary binomial classification system.

In 1741, Linnaeus was installed as Professor of Medicine and Botany at Uppsala University and subsequently moved with his family into the newly renovated Prefect's Accommodation next to the botanical garden (fig. 17). It was refurbished according to Linnaeus's new classification system and organised after the seasons. In the back of the garden, a modern orangery was built for cultivating and preserving exotic tropical plants.

The archaeological excavation was carried out in the private quarters of the Linnaean household. The plot was arranged with a residential house to the south, fronted by a formal garden. The northern half comprised a stable at the far end and, centrally placed, an outbuilding containing staff accommodation and workspaces. Together, the two buildings enclosed an open courtyard.

The excavation encompassed the outbuilding, part of the courtyard and part of the stables (cf. figs 16 and 17). The building was constructed on a stone foundation, probably with wooden walls, and two storeys high. The house was divided into two rooms, separated by a passage, and both rooms had foundations for fireplaces. The house has been interpreted as living and working quarters for people employed in the household. An overview of the finds suggests a wealthy burgher household, with the notable distinction that a substantial proportion of the ceramic assemblage comprised planting pots and urns.

22 Nordström (in preparation).

In Sweden, very little research has been conducted on planting pots, perhaps because their designs have remained largely consistent over time, making it difficult to distinguish older examples from more recent ones. These hand-turned pots, made of unglazed earthenware, typically feature a hole in the base, and in some cases multiple holes both at the bottom and on the sides. Planting pots were being produced by Swedish potters no later than the seventeenth century and were initially used in the large formal gardens of castles and manors.[23] Excavations in Swedish towns indicate an increased use of planting pots by burghers in their kitchen gardens during the eighteenth and nineteenth centuries.[24]

Christopher Currie investigated the unglazed flowerpots from England and Wales, using both written sources and archaeological finds.[25] He concluded, among other things, that flowerpots (equivalent to what we choose to call planting pots) changed subtly over time. Regional characteristics and datable features can be identified, which suggests that the theory about pots being made in accordance with a standard design throughout the early modern period is an over-generalisation. He also suggests that although pots were used to contain plants throughout history, it was not until ca 1700 that purpose-made flowerpots were manufactured in any quantity.[26] Research on planting pots in Sweden remains in its infancy, and further analyses are required to enhance our understanding of the development and use of these ceramics.

The planting pots recovered from the Linnaean household exhibit a wide range of sizes, as well as variation in the number and placement of holes (fig. 18). This diversity may reflect their use in cultivating a variety of plant species, necessitating different types of pots. The assemblage from this excavation provides an excellent foundation for further research.

Large urns were likely used to display specimens and exotic plants, which may have required special care or protection, including overwintering indoors, either in the household or in the orangery. Most are made of red earthenware, often glazed and decorated with animal motifs or floral and wavy band ornaments (fig. 19). Urns of this size are unusual finds in common bourgeois households in early modern Swedish towns. Even larger urns of iron were fairly common in historic manor gardens from the mid-seventeenth century onwards.[27] Iron urns were expensive but generally more durable than ceramic vessels, surviving longer, which explains why so few ceramic urns have been preserved from the period. This makes the large ceramic urns from the Linnaean household interesting in several ways. Firstly, the evidence indicates that the household likely maintained exotic plants. Secondly, it indicates that ceramic urns were used concurrently with iron urns. As with planting pots, the vessel type remains poorly researched in Sweden, and further analyses are required to advance our understanding of its use and development.

An even rarer type of flowerpot is represented by a fragment of a yellow tulip vase. A similar vase is exhibited in the museum at the Linnaeus farmhouse in Hammarby, just outside Uppsala (fig. 20). Such vases were probably imported from

23 Lindqvist 1981.

24 E.g. Hedvall 2017.

25 Currie 1993.

26 Currie 1993, 240.

27 Flink 2004.

Holland. During the seventeenth and eighteenth centuries, tulips and other flowers were popular motifs in the visual arts and appeared in decorations of various items, symbolising knowledge as well as happiness and prosperity.

The eighteenth century was characterised by utilitarianism and a specific aesthetic. During this period, a new type of "academic" household formed in the university town of Uppsala, influenced by the aristocratic and bourgeois ideals they had in common.[28] The abundance of various flowerpots in the Linnaean household can be viewed from different perspectives. The planting pots indicate the nurturing of plants (for the botanical garden), perhaps not only by the gardener and his appointed helpers. Decorative urns and tulip vases, however, are most likely an important part of the academic and aesthetic identity that Linnaeus and his family wanted to convey.

In summary, further research and analysis of planting pots and decorative urns are essential to establish when the use of purpose-made flowerpots began, how they were used, and how different types of pots can indicate the species cultivated. Moreover, variations in flowerpot types may provide insight into socio-economic relations and household identities.[29]

Conclusion

Over the past twenty years, we have examined a previously untapped, yet often well-preserved and diverse, archaeological record. Regardless of the type of garden studied, a multidisciplinary approach is essential for obtaining robust research results. Another key factor is that, over the last two decades, theoretical, methodological, and technological advances in Swedish contract archaeology have facilitated the formulation of better-informed scientific questions.

The fact that we have been researching a variety of gardens has also proved beneficial. Results have shown that gardens are an important part of past societies and reflect their culture. Our research has also shown that garden archaeology answers questions not only regarding horticulture, design and aesthetics, but also about self-sufficiency, economy, division of labour, and gender issues. In short, garden archaeology encompasses several dimensions of past societies.

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28 Windahl Pontén 2020.

29 Nordström 2025

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Fig. 1 Excavation in the English landscape park in Axmar Bruk in Gästrikland. Archaeologist Inga Blennå has located one of the overgrown paths, surfaced with two different layers of gravel.

Photo: The Archaeologists, National Historical Museums



Fig. 2 Map of the southern parts of Sweden showing garden features and garden plants that have been identified through archaeological excavations in medieval and early modern towns.

Illustration: The Archaeologists, National Historical Museums

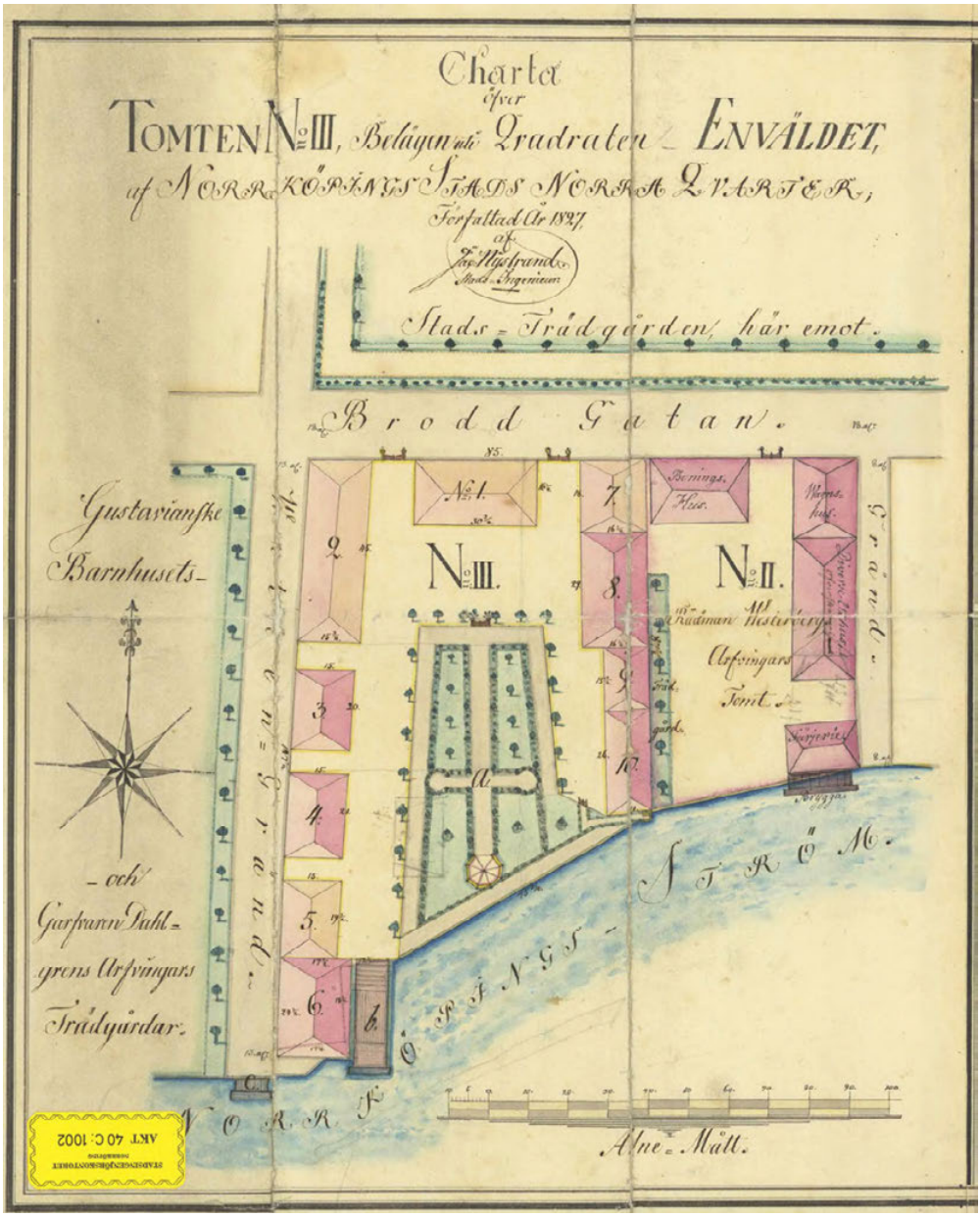


Fig. 3 Historical map dated 1826 showing the industrialist Magnus Lars Ekelund's town yard with buildings and garden in Norrköping, Östergötland. The fenced garden was situated, like most historic gardens in the towns, behind the dwelling house and was divided into four quarters by paths. There were also two alcoves and a gazebo in the garden.

Source: Act 0581:1002. The Land Survey (Lantmäteristyrelsens arkiv)



Fig. 4 Archaeobotanist Jens Heimdahl sampling the garden soil at the excavation of the medieval and early modern vicarage of Östra Eneby in Östergötland. According to preliminary results, plant remains have been identified from different periods, for example cherry, plum, elder, opium poppy, tobacco and sweet reseda.

Photo: The Archaeologists, National Historical Museums



Fig. 5 Cross-section of occupational layers containing buried garden soil from an excavation in the town of Norrköping, Östergötland. At the bottom of the cross-section, in the yellow sand, there are marks from earthworms and roots, and above – brown homogenised buried garden soil. In the surface between the sand and the soil there are traces of spade use.

Photo: The Archaeologists, National Historical Museums



Fig. 6 Kökeritz's map from 1777, with the pond visible in the middle of the park



Fig. 7 The pond after excavation.

Photo: The Archaeologists, National Historical Museums



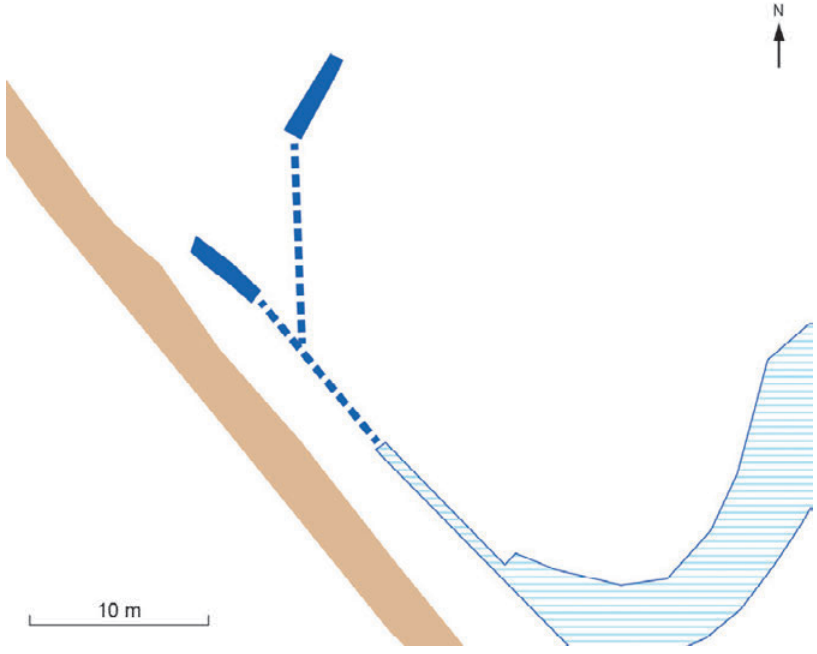


Fig. 8 (top) The inlet to the pond consisting of a stone-lined covered channel. (bottom) Parts of the channel detected by ground penetrating radar, where the dashed line indicates the exposed part of the inlet.

Photo: The Archaeologists, National Historical Museums

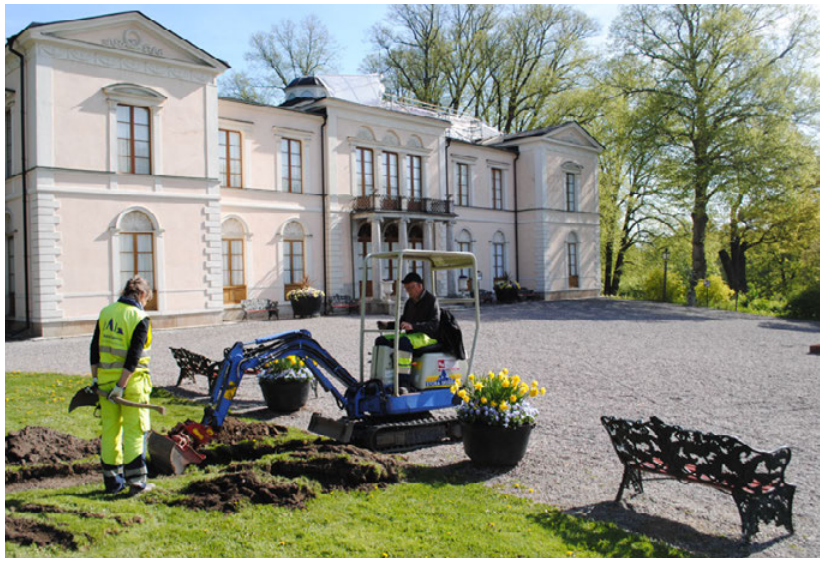


Fig. 9 Rosendal Palace with archaeological excavations in the foreground.
Photo: The Archaeologists, National Historical Museums



Fig. 10a Rosendal Palace. Map from 1834, with the Pleasure Ground circled in red.
Source: The Archaeologists, National Historical Museums



Fig. 10b Rosendal Palace. (top) Ground penetrating radar survey results. (bottom) The meadow area today.

Source: Pär Karlsson, Astacus





Fig. 11 The Royal Djurgården Administration, which manages the park, arrived at a creative solution for reconstructing the layout of paths by cutting the grass following the former park design.

Photo: Christiaan Smits – Nivå Landskapsarkitektur AB



Fig. 12 The excavation area in the Rosendal Quarter, Stockholm.

Photo: The Archaeologists, National Historical Museums



Fig. 13 Reconstruction of the priest's garden based upon archaeological results.

Source: Jens Heimdahl The Archaeologists, National Historical Museums



Fig. 14 (a) Paths and planting beds preserved within the foundations of a house from the nineteenth century.

Photo: The Archaeologists, National Historical Museums

Fig. 14 (b) The “white garden” where white sand was laid out most likely to provide contrast to the darker paths and garden beds.

Photo: The Archaeologists, National Historical Museums





Fig. 15 Seeds from (top-left) poppy, (top-right) parsley, (bottom) purslane.

Photo: The Archaeologists, National Historical Museums



Fig. 16 The reconstructed Linnaeus Garden and private home of the Linnaean family in Uppsala, showing the excavation at the bottom left.

Photo: The Archaeologists, National Historical Museums

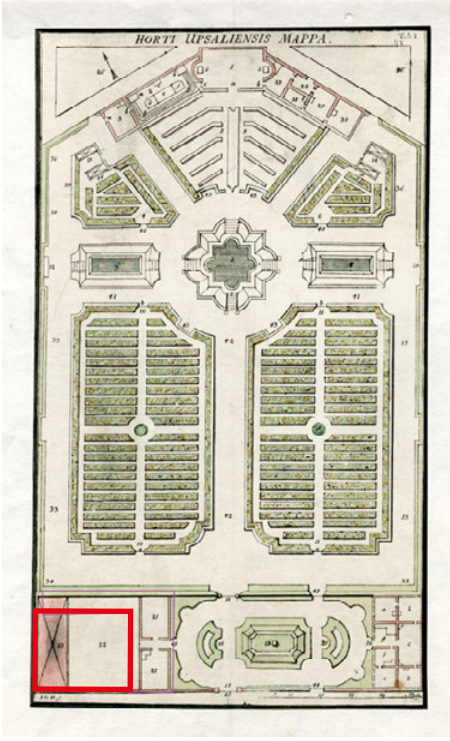


Fig. 17 Plan of the renovated Botanical Garden and Prefect's Accommodation in 1745; marking indicates the archaeological excavation.

After: Hallman, *Horti Upsaliensis mappa*, Tab. I (1745); Uppsala University Library



Fig. 18 Examples of planting pots from the Linnaean household (left) and from Frisens Park (right).

Photo: The Archaeologists, National Historical Museums



Fig. 19 Two urns found in the excavation at the Linnaean household. Left: a large urn with a Medusa head; right: one decorated with a lion head.

Photo: The Archaeologists, National Historical Museums



Fig. 20 Sherd of a yellow tulip vase found during excavation (left) and an example exhibited in the Linnaean Museum in Hammarby (right).

Photos: The Archaeologists, National Historical Museums (left); Uppsala University (right)

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Natascha Lensvelt, Jan van Doesburg, Menno van der Heiden

Digging the gardens of Duivenvoorde Castle. The contribution of archaeology to garden history research in the Netherlands

Recent years have seen an increase in the number of excavations in historical gardens in the Netherlands, especially in the gardens and parks of manor houses and castles. At the same time, projects have increasingly involved archaeobotanical studies in addition to other scientific methods such as non-destructive geophysical survey techniques and other remote-sensing ones like Lidar. Some of these approaches were applied in 2014-2015 in connection with research in the park of Duivenvoorde Castle, near The Hague. By accurately georeferencing the content of historical maps to modern topography it was possible to predict where proposed new paths would intersect with lost elements of earlier garden layouts, helping to select the locations of excavation trenches. The results not only proved the accuracy of the historical mapping but also added value to the research of written and pictorial sources, revealing missing information such as the nature of the materials used as well as what may have been grown and where.

Garden archaeology in the Netherlands

What do we really know about historic gardens and the activity of gardening?[1] Written and pictorial sources alone cannot answer all the questions we may have about a garden. One relatively new way of researching gardens is archaeology. The site itself is of great value as a source for garden historical research.

This paper consists of a brief overview of archaeological garden research carried out in the Netherlands, followed by a garden archaeological survey in the historic park of Castle Duivenvoorde in

1 A Dutch version of this article was published as Lensvelt et al. 2019. The present paper has been modified and updated.

Voorschoten near The Hague, which the authors conducted in 2014 and 2015.[2]

Interest in garden archaeology is slowly increasing in the Netherlands. The first systematically conducted garden excavation in the country was at Het Loo Palace in Apeldoorn in the early 1980s. It was prompted by a reconstruction of the formal gardens (fig. 1). In particular, archaeological investigation was used to trace fountains and basins known from written sources and drawings.[3] The waterworks were indeed located where they were expected. Their original remains were documented and then removed and replaced with new fountains and basins. Much later, during the excavation of a part of the gardens further from the palace in 2003, more attention was paid to the paths and planting, and more effort was made to conserve the original materials.[4]

A second relatively early study is that of the gardens at Castle Neercanne, near Maastricht. However, no comprehensive report was ever published.[5] In recent decades, the number of garden excavations has increased considerably.[6] The reason to carry out archaeological research was often the reconstruction of a vanished garden from an earlier phase or modification of an existing garden. Most of the investigations focused on the hard materials of paths and squares, water features, water supply, garden walls and garden buildings. Much less attention was paid to shallow soil features such as planting holes, flowerbeds, unpaved paths and postholes of wooden constructions like trellis or pergola.

In many cases, the survey was of limited scope. The location of trial trenches and excavation pits was dictated by the works done in the garden: only locations where civil engineering operations involved soil disturbance could be investigated. There are at least two reasons for this. First, there has been no legal obligation to carry out archaeological research in a historic garden. It is necessary to research a protected historical garden when the garden is changed but the type of research is not specified. Second, the policy for archaeological monuments (which differs from the policy for built monuments like gardens) is to leave sites with their archaeological remains intact as much as possible for future generations.

In recent years, garden archaeological investigations have increasingly embraced non-destructive geophysical survey techniques such as resistivity, magnetometry and ground-penetrating radar. These techniques are especially suitable for detecting hard materials such as brick or gravel-laid paths, steps, brick constructions of fountains, buildings, pedestal bases, plant beds and flower borders or deeply dug features such as canals and moats. Examples of such surveys include ones made at the Zorgvliet estate in The Hague, De Wildenborch in Vorden and Trompenburg in 's-Graveland.[7] The results have been variable. Some provide a clear picture, or an overview of the construction, while others show only certain elements.

Archaeobotanical research is more often an integral part of garden excavations. Analysis of pollen and macro-remains

2 Van Doesburg et al. 2019.

3 Jacques 1997; van Asbeck and Erkelens 1976; Wispelwey and Bloemink 2005; Nieuwenhuize 2014.

4 Wispelwey 2009.

5 Brummer 1993; de Jong 1997.

6 Enumeration in: van Doesburg et al. 2019, 13-16.

7 De Kort and Kattenberg 2001; Albers et al. 2004; van Kappel and van Holl 2012; Dijkstra 2023.

in the lost classicist garden of Huys ter Nieuburch in Rijswijk yielded a list of grains, nuts, southern fruits and olives but also melon and berries.[8] A species like melon was probably locally cultivated, while other fruits were purchased and eaten in or near the garden, where peels and seeds would be thrown away. Pollen spores may also be preserved. One example of a study on ornamental planting is the palynological study at the Frankendael estate in Amsterdam.[9] There, species such as cedar, hemlock fir and larch have been found; sometimes down to species level, such as *Astrantia*, and in other cases limited to the family such as roses and dianthus.

Just like archaeologists, garden and landscape historians, historical geographers and landscape architects use freely accessible digital data such as Lidar images (AHN viewer) measuring the height of all Dutch soil surfaces, as well as old aerial photographs and modern satellite images. Downloadable datasets reveal even more information after additional data treatment. For example, the lost maze at the Arcen Castle, only present in the slight elevations of soil surface, was discovered after processing Lidar images with specific software (local relief models).[10]

All the garden archaeological investigations mentioned so far were carried out by a variety of organisations and groups, ranging from universities and archaeologists attached to local and provincial governments, the Cultural Heritage Agency (RCE, part of the Ministry of Education, Culture and Science) and private excavation companies to amateur archaeologists and managers of historic gardens.[11] Because of this diversity, much of the collected data is difficult to access and knowledge about garden archaeology in the Netherlands remains fragmented. The National Archaeological Reference System (ABR), as well as the National Archaeological database Dans Easy, where all formal archaeological reports and data are deposited, do not offer enough garden-related search terms to navigate the results of garden excavations and reach the information contained in these reports. There is also no university department specifically dedicated to the subject. These factors thwart any unified approach to garden archaeological research, hindering the development of new methods and techniques specifically for garden archaeological research.

However, the situation is slowly changing. In 2017, a session was held at the Dutch Archaeology Symposium Reuvensdagen on "Garden Archaeology in the Netherlands" and in 2019 the Rijksmuseum of Antiquities (RMO) in Leiden organised an exhibition on garden archaeology.[12] Furthermore, in the Dutch Archaeological Research Agenda (NOaA 2.0) several questions were formulated on historical gardens and parks as well as designed landscapes.[13] In the last few years, the number of excavations in historical gardens has increased, especially in gardens and parks of manor houses and castles. These are all encouraging developments.

Gardens at Duivenvoorde Castle

In 2014-2015 an opportunity arose to conduct garden archaeological research in the park of Duivenvoorde Castle on the south side of Voorschoten, near The Hague. The reason for the research was

8 Van Haaster 2012.

9 Van Haaster 2000.

10 http://www.cascade1987.nl/unieke-doolhoven-ontdekt-op-landgoed-arcen/

11 Beelaerts van Blokland 2013.

12 Willemsen 2019.

13 https://noaa.cultureelerfgoed.nl/search.

the owner's intention to renovate the park. In consultation with the municipality and owner of the estate, it was agreed that RCE would carry out a limited garden archaeological survey.

The primary aim of the survey was to document the remains that would be destroyed during the renovation work and to gain a better understanding of the historical stratification and significance of the garden. The secondary aim was to test methods and techniques of garden archaeological research. As the renovation works were scheduled and had already started, there was little time for archaeological fieldwork. Fortunately, literature and documentation were available and research had been done on the history of the gardens.[14]

Duivenvoorde was a tower house surrounded with a moat in the thirteenth century, which expanded into a castle with side wings in the Late Middle Ages.[15] A charter from 1440 gave Jan van Duivenvoorde (from a branch of the Van Wassenaer family) the right to arrest anyone stealing his fowl, geese, ducks, apples or pears. This charter also mentioned the avenues on the property.

Almost two centuries later, in the first quarter of the seventeenth century, in addition to an orchard there were also promenades and a garden (fig. 2).[16] The garden and forecourt contained nut trees. F. de Roos's map of 1703, based on a survey from 1680, shows an elaborate symmetrical layout befitting the symmetrically remodelled castle.

In the first quarter of the eighteenth century, the classicist garden reached its greatest extent. Arent IX (1669–1721) and his wife Anna Margaretha Bentinck (1683–1763) were passionate garden lovers as were several of their relatives, including Johan van Arnhem (1636–1716) of the Rosendael Castle and Anna's father, Hans Willem Bentinck (1649–1709).[17] Interesting correspondence between Arent IX and his father-in-law Hans Willem has survived.[18] In one of the letters, Arent IX requested his father-in-law to order from England several varieties of apple trees, plum trees, cherry trees, peach trees and honeysuckle for his gardens in Duivenvoorde. Given the long tradition of fruit cultivation at Duivenvoorde, it would be interesting to see if archaeobotanical research would reveal anything about the fruit trees.

Around 1709, a large bird's-eye view drawing was made to assist new landscaping of Duivenvoorde. The unsigned drawing, accompanied by twenty garden views in marginal drawings, shows the French classicist ideal image with a long central axis extending far into the landscape and with variously arranged garden areas on either side. However, the garden would probably be executed gradually and differently.[19]

A map from shortly before 1717 shows the garden enlarged on all sides (fig. 3). Attempts were made to give the somewhat oblique layout on the map a symmetrical appearance in the field. The map only includes the garden layout around the house. One striking feature is the large number of ponds, no doubt related to the wet terrain. The elaborately designed map is enlivened with human and animal figures.

14 Bierens de Haan 2010; Canneman and van de Klooster 1967.

15 Galjaard and Rijken 2002; Scheffer 2010.

16 After: Bierens de Haan 2010, 38-9.

17 Hans Willem Bentinck was friend and advisor to the Dutch William III also known as William of Orange (1650-1702), King of England, who rebuilt the palaces Het Loo and Hampton Court.

18 Bierens de Haan 2010, 45.

19 Bierens de Haan 2010, 45-6.

A 1736 map of Duivenvoorde by surveyor Leendert Swemkoop (1671–1748), differs from the 1717 one only in details. Because a similar layout is depicted in a series of maps, it is plausible that the formal garden existed for a considerable time. Still, the detailed maps raise questions concerning the exact way in which the formal garden was made. Did the numerous ponds have wooden or hard stone edges, or ones of plastered brick? What was the foundation of the paths made of? How and with what colour were they finished? Were they accompanied by trellises or hedges as the drawing seems to suggest? What were the planting distances? Did drainage have to be used to grow all the vegetation? Whether these questions can be answered depends in part on the thoroughness with which the formal garden was removed in favour of the landscape park.

The conversion to a landscape-style park occurred relatively late. On the 1821 cadastral map, the formal ponds are still present; and yet there are indications that modern planting was being experimented with as early as in 1765. The owners had thirty-six different species of flowering trees and shrubs sent to them from family estates.[20] Rosehip, weeping willow, bird cherry, blackthorn, jasmine, dogwood, juniper, acacia, Spanish oak and elder were among the species brought from Zorgvliet in The Hague. From Charles John Bentinck (owner of Het Nijenhuis until 1773) they received black poplar, *Catalpa*, *Ptelea*, *Spirea*, *Cornus*, *Hydrangea*, broom and *Ceanothus*, among others. It is not known where these trees and shrubs were planted. From 1771 Duivenvoorde was rented out for several decades and probably nothing much changed in this period.

In 1817, Henriette Jeanne Christine van Neukirchen, named Nyvenheim (1807–1849) acquired the estate by inheritance. After her marriage to Nicolaas Johan Steengracht (1806–1866), the couple moved into Duivenvoorde in 1831, only to have it undergo a major transformation. It is known from accounts that the well-known landscape architect Jan David Zocher (1791–1870) provided a design in 1837 or 1838.[21] In it, separate ponds were joined together to form a "natural" brook (fig. 4). Neither any design drawing nor precise maps have survived from this period. The layout can only be reconstructed from topographic maps. The 1850 Topographical Military Map still shows the two large formal ponds at the rear (west side) of the castle but the grand canal is already missing. The 1876 topographic map shows the meandering course of the newly created brook. The old formal pond in the front park seems the last one to have been transformed. The outlines of this landscaped park, also visible on aerial photography from the first half of the twentieth century, remained intact until 2014 (fig. 5).

Due to lack of money, the estate was transformed into a foundation in the twentieth century and opened as a museum in 1963. However, maintenance of the park was carried out so extensively that it began to lose its form and appeal to visitors. Landscape architect Michael van Gessel was asked to revitalize the park. He aimed to make the underlying structure of the formal garden more visible by reconstructing short sections of straight watercourses at the corners and avenues. He removed wild shoots and added flowering shrubs. The sometimes boggy paths were reconstructed and occasionally shifted. He also introduced a very large

20 Bierens de Haan 2010, 50.

21 Bierens de Haan 2010, 52.

pond in the southern forest at the location of an eighteenth-century pond.

Getting to grips with the gardens

Most of the maps showing the classicist layout of the garden have survived. The most detailed and reliable map is the aforementioned Duivenvoorde map from ca 1717. It was georeferenced with modern topography so that it could be established where the new paths would intersect with elements of the formal garden layout (fig. 6). Based on this, the locations of excavation trenches were selected. The grand canal, some ponds and ditches on the map were also selected for investigation by coring. The aim was to locate and sample these features for archaeobotanical research.

Topographical maps from the nineteenth and early twentieth century showing the park in landscape-style were also used but were not georeferenced due to their lack of detail. Because the soil would be disturbed at a limited number of locations, it was decided not to deploy geophysical prospecting because any potential structures could not be verified through excavation and would therefore be difficult to interpret. Archaeological remains of gardens are usually located at the surface or just below it. To gain insight into the depth and stratigraphy of the remains, test trenches were dug.

In one of the first trenches, a pavement of yellow bricks with an edge of vertically placed bricks was found. Both the stratigraphy and the top view of the pavement were measured, drawn and photographed directly on site. The trench was located where a path from the formal garden was expected on the basis of the historical map from 1717. However, its shallow location and curved shape led to the conclusion that it must be a nineteenth-century path. Since it was known that bricks had been incorporated into the landscaped paths, probing became an effective way to trace nineteenth-century paths. Indeed, most of them were found, measured and mapped with GPS. The paths were located almost directly below the sod or leaf mould and were composed of an average thirty-five centimetre thick sand layer topped by a sloppy paving of bricks (fig. 7). The width of the paths varied from about three and a half to six metres. Fine gravel, possibly a later top layer, was found on the pavement in several places. The redesigned paths would partly correspond with the old ones but sometimes there was a difference ranging from one to several metres between the two. Some other parts of retraced paths were not included in the new plan.

The remains of the classicist garden were fragmentarily preserved; most of the elements appear to have been cleared in the eighteenth century and later. Nevertheless, some interesting discoveries were made, such as the ponds in the north-west and south-west parts of the park. They were located exactly as expected based on georeferenced historical maps. This means that these maps are accurate in terms of size and location of elements.

In the north-western pond, parts of a brick wall built on planks were exposed (fig. 8). This is probably part of the masonry pond edge; the wooden foundation prevented the heavy weight from sinking into the peaty soil. Close to this location, on the north-east side of the pond, part of a more than two-metre wide shell path was found from the same garden phase. It could be traced for a length of seven and a half metres and was presumably constructed all the way round the pond .

The pond in the south-western part of the park was preserved in inverted form. When the newly designed pond was dug, the full extent of the old formal pond appeared as it had been filled with contrasting white sand (fig. 9). The shape and size of the old pond matched its depiction on maps. A wooden lining remained at the pond's edge. Around it was a metre-wide strip of dark grey mottled sand. Wood identification revealed that the pond shoring was made from a surprising mixture of species such as alder, elm, oak and pine, and the non-durable birch wood.

Core samples and excavation showed that the ditches indicated in Van Gessel's new design as a reconstruction of the rectangular formal layout were sometimes projected near but not in the historic location of the watercourses. The grand canal, which lay between the two above- mentioned ponds, was sampled by coring. This large body of water does not appear to have been filled in but seems to have slowly gone swampy. This is remarkable for a water feature so close to the house.

Archaeobotanical research revealed remains of beech and oak, silver fir, horse chestnut, Dutch lime, a member of the cypress family (which could be, for example, thuja, juniper or cedar) and possibly sycamore (a pollen grain), in addition to native species expected on moist soil. Pollen and macro-residues from these species came from deeper layers of the pond and probably date from the eighteenth century. Remains of apple and pear trees were also found, as expected from maps and written texts. The herb layer was found to be richer in species in the higher levels of the pond than in the deeper ones. This may indicate the more natural park forestry of the nineteenth century. The pollen survey revealed a number of plant species with ornamental value such as *Campanula*, lozenge, large bulrush and possibly (woodland) anemone. In the pond, water lilies were probably planted or at least tolerated.

The species found are a valuable addition to those recorded in written sources. The letters mainly mention unusual trees and shrubs while the archaeobotanical survey shows what grew in large parts of the park. Remains of planting beds were not found and planting holes were almost entirely absent. This is caused by the fact that the soil was dug for the creation of the landscape-style park. In addition, only a small part of the park was surveyed (fig. 10). The survey yielded a relatively small amount of garden-related finds: several dozen sherds of simple decorated terracotta flowerpots and some pieces of richly decorated ones.

Creating opportunities

The archaeological survey at Duivenvoorde added value to research based on written and pictorial sources, not only proving the accuracy of eighteenth-century maps but also revealing information missing in written sources, for example regarding used materials.

As previously stated, interest in garden archaeology has been increasing in the Netherlands in recent years. Some garden historians and landscapers are familiar with the possibilities that archaeology offers and to a certain extent make use of data collected through archaeological research. In general, however, garden archaeology is still undervalued and underused.

Close cooperation between experts from different fields throughout the entire process – from desk research and formulating research questions as well as the choice of excavation techniques and sample strategies, interpretation of features and found materials, to writing the

report – can significantly increase knowledge about historic gardens. In addition, garden archaeology is not only of interest to professionals but also to a wider audience. An owner of a garden or park can open the property to the public during the excavation or create an exhibition or publication about the research. Furthermore, public involvement in excavations, from digging to processing finds and publication of results, should be promoted and facilitated. After all, public involvement is essential for the survival of historic gardens.

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Fig. 1 Palace of Het Loo, vista from the palace towards the central axis of the reconstructed garden.

Photo: National Heritage Agency, N. de Jong, 2011

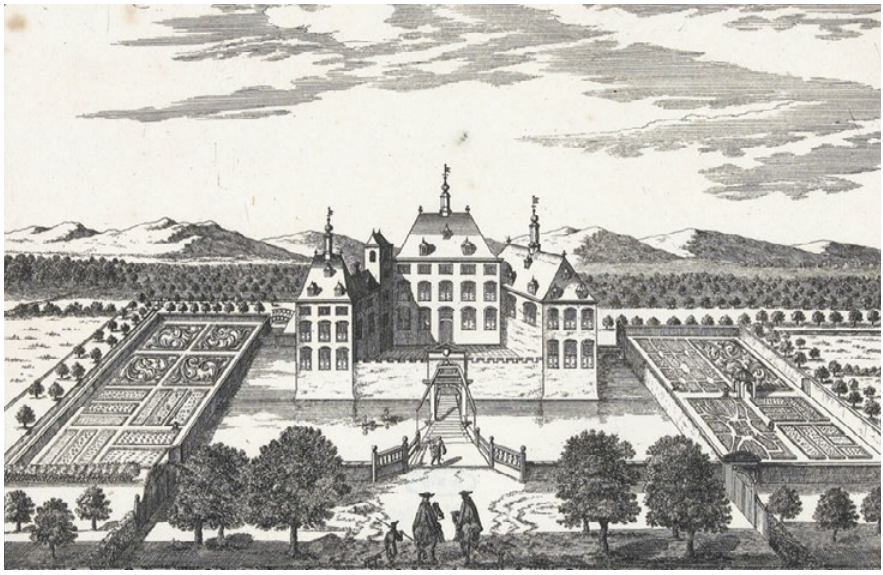


Fig. 2 Duivenvoorde manor ca 1667 with symmetrical enclosed gardens and sand dunes in the background.

Detail of engraving, collection Duivenvoorde, no. DV02151

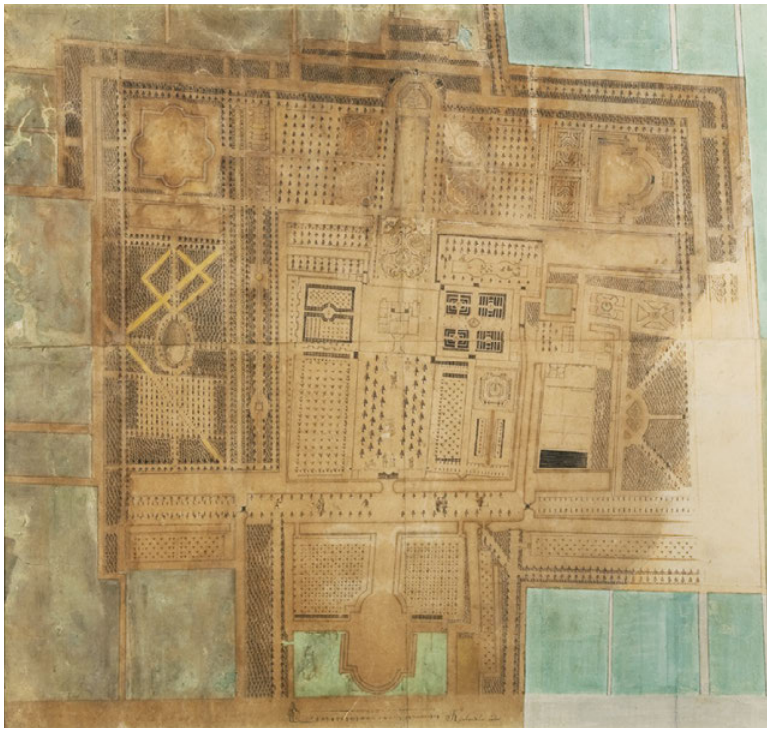


Fig. 3 The garden ca 1717, with the house barely visible in the centre.

Watercolour, collection Duivenvoorde, no. DV02337



Fig. 4 The garden transformed into landscape-style.

Lithograph by P. J. Lutgers, 1847. Photo: Margareta Svensson

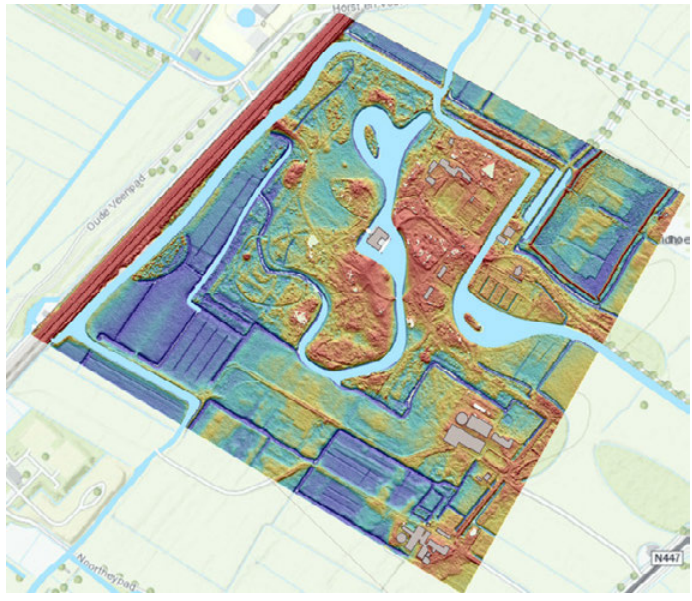


Fig. 5 Relief map of the current garden (brown and yellow denote higher ground, and blue – lower).

Source: AHN viewer

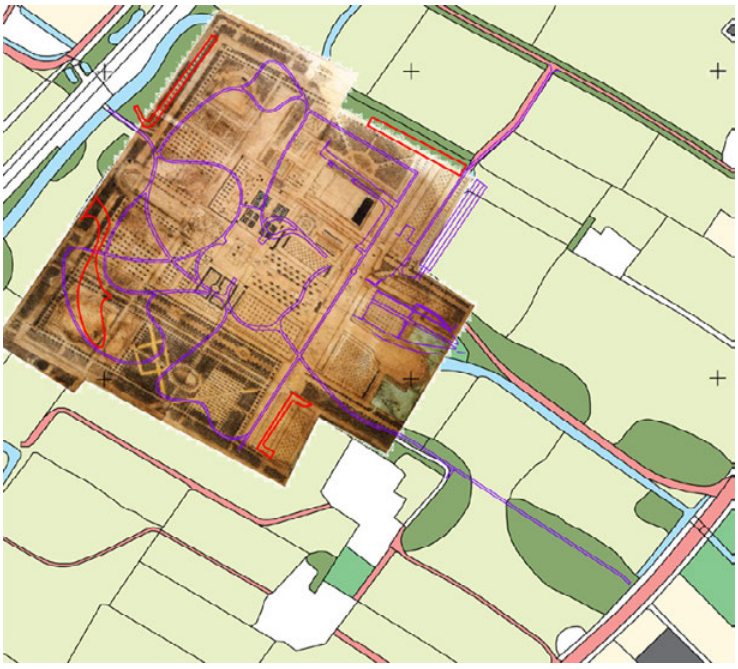


Fig. 6 Map of 1717 georeferenced with the present topography, with the new garden design also superimposed, showing the new pond in red and proposed paths in purple



Fig. 7 Exposed path from the landscape-style period, nineteenth century



Fig. 8 Excavation along the edge of the north-western pond showing brickwork laid on planks to prevent sinking into the peaty soil



Fig. 9 Southern pond filled with white sand, which was exposed when the new pond was dug

Fig. 10 The castle and park of Duivenvoorde today.

Photo: National Heritage Agency, M. Mees, 2016



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Maria João de Sousa

Archaeology in the reconstruction of a Romantic garden: the National Palace of Queluz in Sintra, Portugal

The Botanical Garden at the National Palace of Queluz was dismantled at the end of the twentieth century. However, historical research has shown that the space perpetuates the memory of an outstanding endeavour that could be restored. Built around 1770 and inspired by contemporary science, the Botanical Garden had an interesting character. A research project was carried out in 2012, anticipating the possibility of an informed restoration based on existing documentation and identifying the remains of former masonry, fountains and ornamental elements. Archaeological excavations were carried out as preparatory work to support future strategic decisions. The discovery of the original botanical index (1789) concluded the research project, fostering contact with botanical institutions worldwide to supply plants from their respective seed banks and nurseries.

Introduction

The gardens of the National Palace of Queluz are an archetype of rococo and neoclassical architecture in Portugal and date back to the second half of the eighteenth century, between 1754 and 1800. Designed as a summer residence, the palace became a privileged place of leisure for the royal family.

The style of the garden is classical or formal, based on Enlightenment aesthetics, which favoured a geometric and balanced conception of space and nature through the artistic technique of topiary. The spatial composition and layout of the park thus reflect the contemporary values of order, clarity, proportion, and harmony.

Current interventions in the landscape were preceded by archaeological work with the following objectives:

- restoration of the layout, green structure as well as old tree and shrub alignments in the plots;

- restoration of the built elements, water features and decorative elements;
- recovering the pavements and infrastructure;
- collecting samples for scientific analysis.

The work carried out in the different areas of the garden has shown that prior archaeological research is an essential part of historic restoration projects.

Parques de Sintra – Monte da Lua, S. A. (PSML), a wholly-owned public company, carried out all the studies for the restoration of the Queluz Palace Botanical Garden. It was created in September 2000, after UNESCO declared the Sintra Cultural Landscape a World Heritage Site. The company is currently in charge of the management of the most important natural and cultural assets of the Sintra Cultural Landscape and the Queluz National Palace.

Historical framework

The history of the National Palace of Queluz dates back to to 1654, when King João IV created the Casa do Infantado, part of the Queluz estate. However, it was not until 1747, after the intervention of King Pedro III, the future husband of Queen Maria I, that the complex acquired the status of Royal Palace, fulfilling its natural vocation as the Summer residence of the royal family. Construction works began at that time based on the design by the court architect Mateus Vicente de Oliveira.

Landscaping began in 1755 under the supervision of the Dutch gardener Giraldo José Van den Kolk, assisted by Luís Simões Ressurgido, a Portuguese. However, it was only after the earthquake that struck Lisbon in this year that works received a major boost with the arrival of the French architect João Baptista Robillion. He designed part of the palace and its gardens around 1758, creating the Neptune Garden, or Hanging Garden, in the style of Le Nôtre, on a terrace above the house. In the same year, the Malta Garden was also built. It was placed at a lower level than the Neptune Garden and separated with an elegant stone balustrade from what had been a lake.

In 1794, during the Regency of Prince João, later to become King João VI, the palace became a permanent residence and remained so until 1807, when the royal family moved to Brazil following the invasion of Portugal by Napoleonic forces.

After the return of the royal family, several changes were made, particularly in 1822 after the construction of cages in which exotic animals were kept. During this period, animals also played an important role in the gardens, as shown by the records of 1826, which refer to the presence of swans in the garden ponds. Influenced by Romanticism, palm trees were introduced and planted between the garden hedges, as can be seen in nineteenth-century photographs.

In 1908, King Manuel II gave the palace to the National Treasury and it became a state possession. It was declared a National Monument in 1910.

On 5 October 1934, a huge fire broke out. It had a devastating effect on the gardens, particularly those adjacent to the façades. The palace was reopened to the public in the 1940s. It is one of the most representative monuments of courtly life from the second half of the eighteenth century, with important collections of decorative arts, mostly from the royal household. In 2012, Parques de Sintra – Monte da Lua. S.A. was appointed to manage the monument.

The botanical garden

The Botanical Garden, with a surface area of 2,557 square metres, features

a parterre of sixteen beds around the central fountain, four greenhouses, a four-part parterre to the north, and a small group of triangular beds to the south. There are also two series of tiled beds along the sides of the garden, which are essential for interpreting the ensemble we have come to call the Queluz Gardens.

In order to reconstruct the layout of the Queluz Botanical Garden, a detailed understanding of its historical context is essential. Designed and built in 1769 by Jean Baptiste Robillion and the gardener Geraldo José Van den Kolk, with the collaboration of Vandelli, the botanical garden was rich in plant rarities from the New and Old World, despite the lack of an institutional framework providing scientific and economic support.

A certain eclecticism prevailed in the private gardens, which seemed to respond to the desire to accumulate the unusual, the rare, the exotic, and the unknown. These places aimed to achieve a synthesis of art and nature, with botanical and mineral exoticism coexisting in the same space alongside sculptures, ponds, vases, tiled features, and eccentric pavilions.

Botany became a true court fashion, shared by the curious, the adventurers, the naturalists and the collectors alike. Their enthusiasm drove the construction and planting of countless gardens. The botanical gardens designed by Vandelli were among the most expressive and famous of the period. At the estate of Geraldo Devisme, exotic gardens began to attract the aristocracy and the wealthy. People loved them and it became a popular pastime to learn about plants and grow them in living rooms and gardens.

This cultural trend led to the creation of the Queluz Botanical Garden. Interest in the acclimatization and cultivation of exotic species was also displayed by D. Pedro and D. Maria Francisca Benedita, as well as by Queen D. Maria I. Considering the grandiose ambitions of certain botanical gardens in the period, Queluz was rather small-scale but it naturally came to serve this role. Although, as a private park, the Queluz Botanical Garden was much more modest than some of its counterparts, it still delighted visitors, reflecting the growing passion for such realizations among eighteenth-century Portuguese nobility.

As shown in a survey from 1865, the garden was laid out geometrically, with symmetry playing an important role, although it was set on uneven ground (fig. 4).

In 1926, the garden was described as a "botanical or greenhouse garden where King Pedro planted the pineapple. It has a beautiful marble pond in the middle as well as a number of stone busts and statues. It is bordered by a beautiful balustrade that was installed in 1800 when Prince João had the upper part of the palace built, after it had previously lined the front of the palace." An interesting manuscript describing part of the botanical collection displayed in the Queluz Botanical Garden was presented as gift from the physician of Queen Maria I, Manuel de Moraes Soares (1727 – ca 1802). The title of the manuscript, dated 1789, is revealing: *Index of Plants in the Royal Botanical Garden of Queluz with a brief description of their Classes, Genera, Species and Properties, and a small Botanical Alphabet for a better understanding of this branch of natural science*. It was discovered by Pedro José da Silva, who published parts of it in the *Official Journal of Agriculture* in 1877 in an article entitled "A Botânica Portugueza."

The Chinese house

Chinoiserie, a decorative style inspired by both the culture and the art of the Far

East, became popular in Europe early on. This was due to its aura of extravagance, the distant, inaccessible and idealized image of the Orient, and the centuries-old commercial prestige associated with Asian products. In the history of ornamentation and ephemeral architecture, chinoiserie seems to represent the most extraordinary manifestation of European ingenuity in the seventeenth and eighteenth centuries.

The phenomenon was not confined to Western Europe. From Potsdam to Moscow, monarchs and aristocrats spent a great deal of money imitating the gardens of Versailles, Marly or Bagatelle, and creating Anglo-Chinese gardens that added a touch of exoticism to the natural landscape.

Queluz was no exception. Between April 1771 and May 1772, the Chinese House at the Queluz Botanical Garden was built next to the greenhouses, painted and gilded (fig. 5). It was demolished around 1844. However, its octagonal base and three steps survived until 1984.

An oriental arch or portico carved in wood, with two sculpted figures and a crown in the middle, provided access inside. Since it was a private place, completely enclosed within walls and guarded by a gatekeeper, it was chosen as accommodation for the visit by Moroccan princesses in 1793. According to protocol, they could not be seen by anyone except for their husband and the eunuch. The arrangement meant that they could visit the gardens and woods in complete privacy, away from all eyes.

Remains of the Chinese Pavilion still existed in 1921.

Growing pineapples

The pineapple has been known and depicted as an ornamental plant since the beginning of the sixteenth century. One painting demonstrates that pineapple cultivation began very early in Europe; sometimes attributed, though without certainty, to Hendrick Danckerts, it shows the royal gardener presenting the first pineapple produced in England to King Charles II in the mid-seventeenth century (fig.6). The entire continent was abuzz with the cultivation of this tropical fruit. Apart from its strange appearance, the fruit was said to have unparalleled smell and taste. A large number of greenhouses were immediately built to cultivate it.

Pineapples were naturally destined for the royal table, just like many of the flowers grown in the Botanical Garden. It was necessary to achieve perfect mastery of the fruit's cultivation: pineapples are delicate and must be cut as soon as they become ripe. Therefore, the gardener of the Botanical Garden was ordered to send any such products immediately to the royal lords.

In 1774, the greenhouses at the Queluz Botanical Gardens were already producing pineapples in large quantities, grown on the bark of oak trees from the Junqueira tannery (Lisbon) and renewed each year.

Between the nineteenth century and the present

The gardens were altered in later years, particularly during the reign of Queen Maria II (1834–1853), who made changes to the Queluz Gardens in keeping with the Romantic spirit of the time.

Over the centuries, a great deal of information has been gathered on storms and the extent of their severity in terms of the material damage they have caused. Extreme seasonal phenomena, either due to the physical characteristics of the river basin, which had a tendency for rapid flooding, or to the periods of drought

during the Summer, have repeatedly made it necessary to recover the structures and the area surrounding the Botanical Garden.

The Botanical Garden suffered its worst degradation on the night of 25–26 November 1967, when the Lisbon region was hit by intense concentrated rainfall that caused a flash flood on the Jamor River. The damage was extensive and the lowest and most critical area of the garden next to the confluence of the Jamor and Carenque rivers was badly affected (figs 7–8).

Despite repeated repairs, the Botanical Garden was already in a state of abandonment when floods struck again in 1983, which further deepened its degradation.

After the floods, it was decided to use the site as an open-air riding ring for the Portuguese School of Equestrian Art/ EPAE (figs 9 and 10). This initiative was interesting because it promoted and preserved Portugal's valuable equestrian heritage, involving not only horses and horse-riding but also collections of harnesses and costumes from the Baroque. It kept alive the tradition of the now defunct Royal Stables and provided a tourist attraction for the Queluz Palace, which was integrated into the programme, emphasizing the eighteenth-century character of the National Monument.

The existing structure of the garden was completely destroyed, leaving only the balustrade that King João had moved from the Palace, being used to enclose benches for spectators. Figures 11 and 12 show how the former layout disappeared with the construction of the ring.

In 2012, the management of the Queluz Palace and Gardens and the EPAE was transferred to the PSML. EPAE's works in the former Botanical Garden were suspended. At the same time, a study of the needs of the Queluz Gardens identified the Botanical Garden as one of the most damaged areas of the complex, with the potential, once restored, to become a new centre of interest.

In August 2013, the seating to the south of the Botanical Garden was dismantled and removed. This left the beautiful balustrade in its original eighteenth-century setting (fig. 13).

Timeline

1769 From November 1769 to April 1770 slabs were laid at the bottom of the central pond to hold the carved marble superstructure; masonry for the entrance also delivered and laid.

1770 Delivery of steps and various pieces of stonework for the garden.

1771–2 Wooden Chinese House built to contain oriental plants. Two glasshouses also built and several consignments of stonework supplied.

1774 About 300 balusters supplied.

1799 Two additional glasshouses constructed.

1844 Demolition of the Chinese House.

1877 22 February: Torrential rain damage.

1886 23 December: Flood-damage to the water system and greenhouses.

1892 10 February: Storm damage.

1910 16 June: Classification of the monumental complex of the Palacio de Queluz as a National Monument, approved on 16 June 1910, DG, 1st series, no. 136 of 23 June 1910, with the ZEP – 'non aedificandi' zone defined by ministerial decree, DG, 2nd series, no. 200 of 24 August 1968.

1911 3 April: The Botanical Garden is assigned to the Queluz School of Pomiculture, Horticulture and Gardening (Escola Prática de Pomicultura, Horticultura e Jardinagem de Queluz), by government order, published on 3 April 1911, leaving it in the hands of

the Central Federation of Portuguese Agriculture.

1936 27 October: The Botanical Garden is transferred to the Ministry of Finance, as part of the National Palace of Queluz, by Ministerial Decree of 18 September 1936, coming into force on 27 October 1936.

1954 1 June: Storm damage.

1958 22 November: Storm damage.

1967 12 December: A storm causes extensive damage to the Botanical Garden and the square in front of it, as well as to the area surrounding the canal, causing the disappearance of the river gates and the destruction of the canal's paving, walls, gates and statues.

1969 Restoration of the paving; canalization of the garden; construction of a pond in the greenhouse at the Botanical Garden.

1972 13 July: Repair of damage caused by heavy rains.

1983 18 November: Storm damage to the Botanical Garden, the square in front of the garden, and the whole area around the canal.

1984 Demolition and transformation of the Botanical Garden into an arena for the Escola Equestre (Portuguese School of Equestrian Art – Royal Riding Arena). The stonework and ponds are dismantled. The dimensions and layout of the balustrade are changed and existing vegetation removed.

1992 1 June: The gardens and estate are given to the Portuguese Institute for Architectural Heritage by Decree 106F/92.

2007 29 March: Assignment of the Palace to the Institute of Museums and Preservation, Legislative Decree No. 37/2007.

2012 31 August: The Palace, the Queluz Gardens and the EPAE are transferred to the company Parques de Sintra – Monte da Lua, S. A. by Decree-Law No. 205/2012 of 31 August.

2012 September: Cessation of the EPAE shows.

2012 November: Beginning of works aiming to survey, identify and check the condition of stonework, and to test the reassembly of the greenhouses and pond from the eighteenth century.

2013 August: Dismantling of the seating left by the Riding School.

2014 Beginning of modern research: partial survey by ground-penetrating radar and archaeological surveys.

2017 Reconstruction completed. Inauguration of the Botanical Garden at the National Palace of Queluz.

2018 Award of Europa Nostra/European Heritage Prize in the Conservation Category.

Archaeological research

In November 2012, in addition to recovering the extant balustrades, other stonework and slabs from the Botanical Garden were brought back. Following their removal in 1983, they had become scattered around the garden in areas where material had accumulated or within flower beds. In order to conserve and protect them, they were transported and stored in the former vegetable garden next to the Botanical Garden, having first been cleaned and sorted, and then photographed and registered according to a plan involving PSML's technical staff and multidisciplinary professionals (fig. 14).

Following the identification of masonry from the Botanical Garden, the process of reassembling the greenhouses began. Using information from cartographic and iconographic sources alike, such as original plans, descriptions and historic photographs, the aim was to assess the potential for reconstruction and to identify any missing parts (fig. 15).

The proposal to carry out archaeological work before designing the intervention project is part of a multidisciplinary approach to the functional and heritage recovery of the Queluz Botanical Garden. The surviving stone elements and associated historical documentation justified this method. The survey programme was therefore based around the structures shown on historical maps (fig. 16). Its objectives were as follows:

- to identify the foundations of the Chinese House;
- to identify the foundations of the central pond, its water supply and drainage system, and to locate statue bases;
- to identify the layouts of the botanical and parterre beds;
- to identify the layout of the four greenhouses.

The archaeological work was carried out using single context recording and a full graphic and photographic record was made of all stratigraphic units. The intervention area was divided into three sectors: Sector 1, where the ring seating used to be, and where the small greenhouses would be located; Sector 2, corresponding to the area of the ring, where the fountain structures and large greenhouses would be located; and Sector 3, corresponding to the area of the Chinese House (fig. 17).

Sector 1

In Sector 1, four trenches were opened with the aim of identifying the greenhouses and comparing their dimensions with historical cartography and stonework collected throughout the Queluz Gardens. The sector is bordered by balustrades and works began with opening a trench to the east (Trench 1), which identified the structure of the flower beds built during renovation in the 1940s. It was also possible to identify the foundations of one of the small greenhouses, which was placed directly on the central structure of the original (fig. 18).

Excavation also showed that the slab, or paving, which framed this area, as well as the lateral parts of the balustrade, are later than the greenhouse structures and rest on the latter's foundations. Trench 2 was opened to the west in Sector 1, revealing the greenhouse foundation to be in excellent condition (fig. 19). This allowed us to extrapolate its configuration to that of Trench 1, where the remains had been badly affected by the construction of flower beds in 1940 (fig. 20).

Sector 2

This sector corresponds to the arena used for equestrian shows. The first task was to carry out ground-penetrating radar survey in order to identify the base of the central pond and the layout of the surrounding flower beds (fig. 21).

Subsequent excavation began with the opening of Trench 5 to the south-east, where the aim was to determine the configuration of the central boxwood beds. It showed that the construction of the arena had destroyed the original ground surface, creating a sump approximately forty centimetres deep, which was filled with geotextile and gravel of varying size. The sediment beneath the gravel was not excavated deeper than the level required for the final project.

It was concluded that it would be virtually impossible to identify the foundation of the central pond. However, Trench 6, dug in the middle of Sector 2, where ground-penetrating radar identified an underground water pipe connecting to the riding arena, revealed a side layer of

dark brown vegetation as well as small and medium-sized stones and mortar that seem to have resulted from the pond's destruction (figs 22–23).

Trench 7 was excavated on the north-western edge of the arena, where the historical map indicated the location of one of the large greenhouses. Once again, the area had been affected by the construction of the drainage sump. Excavation was stopped after determining that, due to the natural height of the ground, there were no further archaeological remains in the area.

To the north-east, Trenches 9–11 covered the area beside the balustrade at the edge of this part of the garden, which consisted of flower beds and tiled benches. The objective was to prove the existence of one of the large greenhouses that had covered the area outside the arena, in the hope that it would be possible to identify structures in an undisturbed location (cf. fig. 24). However, it was found that the area to the north, next to the balustrade, had been destroyed by the construction of a concrete formwork to alleviate the uneven ground between Sectors 2 and 3 and to serve as a base for the balustrade, which had been relocated when the riding arena was built.

The extension of Trench 9 to the south (Trench 10) showed that the base of the greenhouse was cut by a later drain and yet Trench 11 exposed foundations similar to those seen in Trench 2 in Sector 1 (fig. 25; cf. figs 19–24). The identification of these remains allowed us to identify two types of greenhouse whose masonry still exists, making it possible to reconstruct them (cf. figs 26–27).

Sector 3

This sector lies between today's north balustrade and the Garden House at the northern edge of the Botanical Garden. The purpose of the excavation was to determine the former extent of flower beds on the western edge of the garden and to identify any remains of the Chinese House that once existed there. A four-metre-side square (Trench 8) was located beside the opening around the mid-point of the balustrade that provided access to the riding arena. A modern services installation was already in place in the southwestern corner and a trench for electrical infrastructure was placed to the west.

A few centimetres below the surface, a well-defined foundation was identified, corresponding to the stone steps that made up the base of the Chinese House (figs 28–29). There was also evidence of ground levelling and, next to the step to the north, a channel or drain covered by large stone slabs.

Findings

During the archaeological works, some archaeological remains, most of them very fragmented, have been identified in the layers of rubble left from previous works. The collection includes stone, brick, earthenware and glazed pottery, metalwork, and animal bones. Particularly noteworthy is a collection of worked flint, which could indicate the presence of prehistoric activity nearby, especially given that the Botanical Garden is located close to the Jamor River, where the soil has good productive capacity.

Conclusion

The Botanical Garden at the National Palace of Queluz survived for almost two hundred years with little or no changes to its original design. It was therefore decided that the restoration project would respect the historical authenticity of all materials and reinstate all original elements of the garden fabric within the historic

layout, as identified through archaeological surveys and archival research.

The main objectives of the project were as follows:

- to enable the reconstitution, requalification and revalorization of the Royal Botanical Garden of Queluz;
- to restore the original eighteenth-century rococo garden, respecting its spatial composition and its relationship with the surrounding palace and other gardens in a way that is both playful and educational;
- to recognize that the Botanical Garden is a fundamental component of the Queluz Gardens, which requires a comprehensive approach to be fully appreciated;
- to safeguard the surviving architectural elements and to protect the original stonework moved from the Botanical Garden by restoring it to its original position.

With a complete historical research project carried out for the first time in Portugal, the conditions have been created for a well-founded project for the reconstruction of the Botanical Garden of Queluz. Records of all kinds, including manuscripts, maps, lithographs and photographs, supported this research. Availability of extensive documentation, including an index of plant species cultivated in the eighteenth century (using Linnaean taxonomy), has enabled the original botanical collection to gain particular importance.

Archaeological investigation was fundamental to the restoration of the Botanical Garden. The identification of the foundations and bases of former buildings and other structures has provided clear understanding of the relationship between the various parts of the garden, facilitating landscape design, engineering, architecture, conservation, and restoration projects. Through ingenious planning by the engineering team, a way has been found to preserve the original foundations and at the same time provide a stable and safe base for new greenhouses.

It has also been possible to identify traces of the ancient structures that once made up the Botanical Garden at the Palace of Queluz. In addition to discovering the foundations of the greenhouses and the Chinese House, the team has identified and reassembled the masonry that formed different architectural elements.

On the assumption that the Botanical Garden was crucial for the overall interpretation of the Queluz Gardens, the aim has been to restore the original recreational and educational character of the eighteenth-century garden while respecting its layout and interrelationship with its surroundings. Currently, the garden reproduces the original eighteenth-century environment, without erasing the marks of time and subsequent architectural changes.

Its cultural importance and authenticity of heritage conservation are also guaranteed by the development of the project.

Today, a visit to the Botanical Garden can feel like taking a trip around the globe without ever leaving the place itself. The Garden has become a living museum, with plant collections that will take one on a journey through different latitudes and regions of the world. Rebuilding the Queluz Botanical Garden has become a European model of restoring historic gardens after a natural disaster. For this reason, it was awarded the Europa Nostra / European Heritage Award in 2018.

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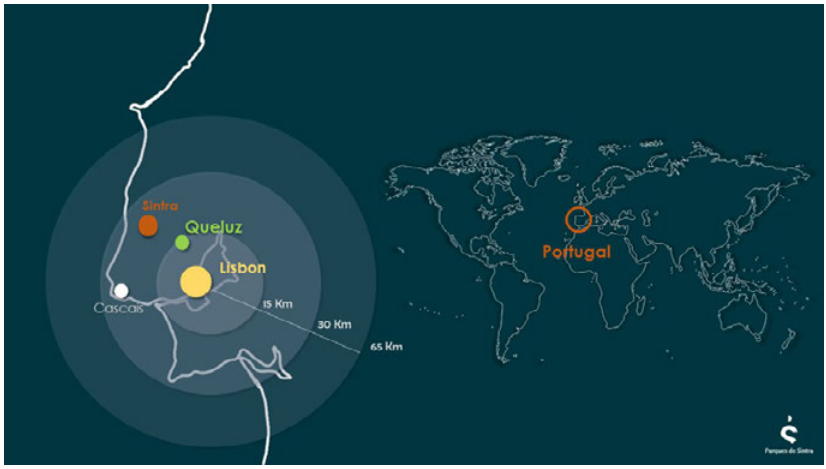


Fig. 1 Location of the National Palace of Queluz.

Source: PSML



Fig. 2 The National Palace of Queluz in its setting



Fig. 3 National Palace of Queluz: gardens and façades.

Source: PSML

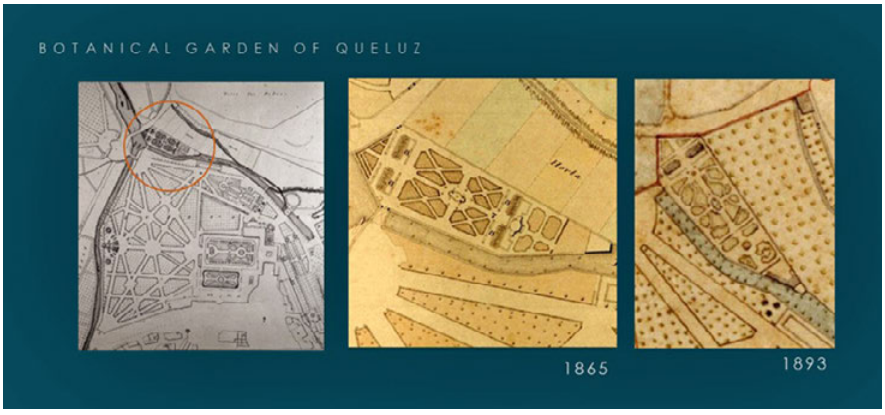


Fig. 4 Details from the survey plan of the Queluz Botanical Garden.

ANT-CR-1865/1893

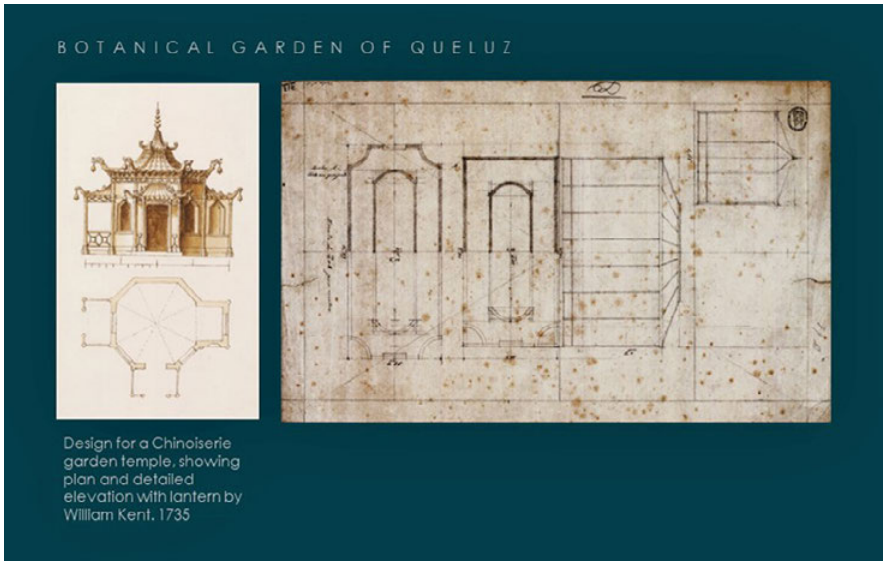


Fig. 5 Design of greenhouses and possibly the Chinese house.

Source: ANTT

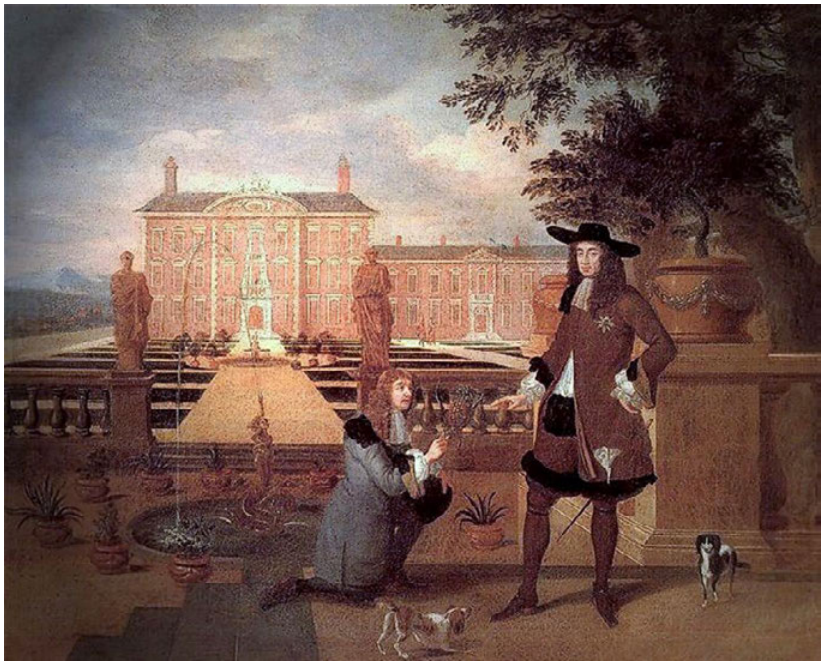


Fig. 6 Charles II receiving a pineapple from John Rose; artist unknown, 1670s.

Wikipedia

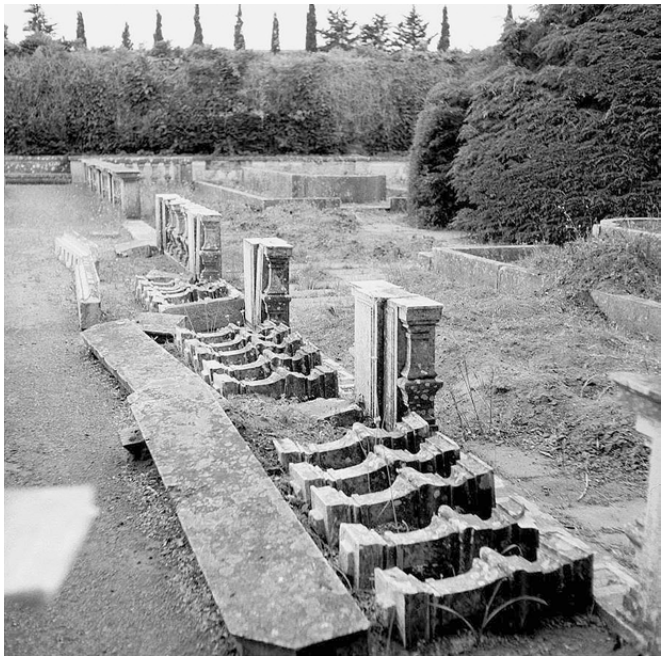


Fig. 7 The Botanical Garden after the storm of 1967.

SIPA Archive



Fig. 8 Botanical Garden after the storm of 1967.

SIPA Archive





Fig. 9, 10 The former Botanical Garden, used by the Portuguese School of Equestrian Art until 2012.

Photos: PSML

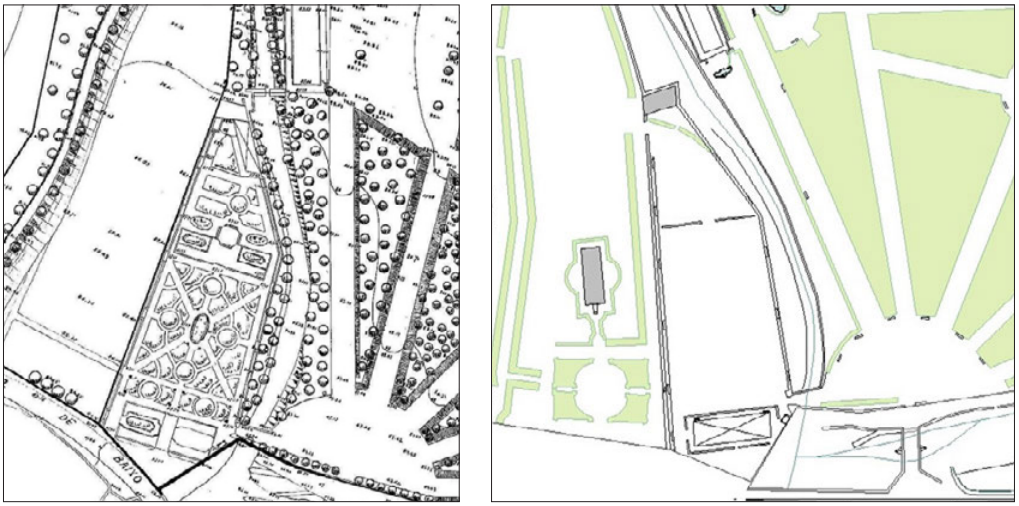


Fig. 11, 12 Topographical survey before (left) and after the construction of the riding arena.

Source: PSML



Fig. 13 Eighteenth-century balustrade after the removal of the EPAE benches, August 2013.

Photo: PSML



Fig. 14 Eighteenth-century balustrade and other stonework being stored after the removal of the EPAE seating, August 2013.

Photo: PSML

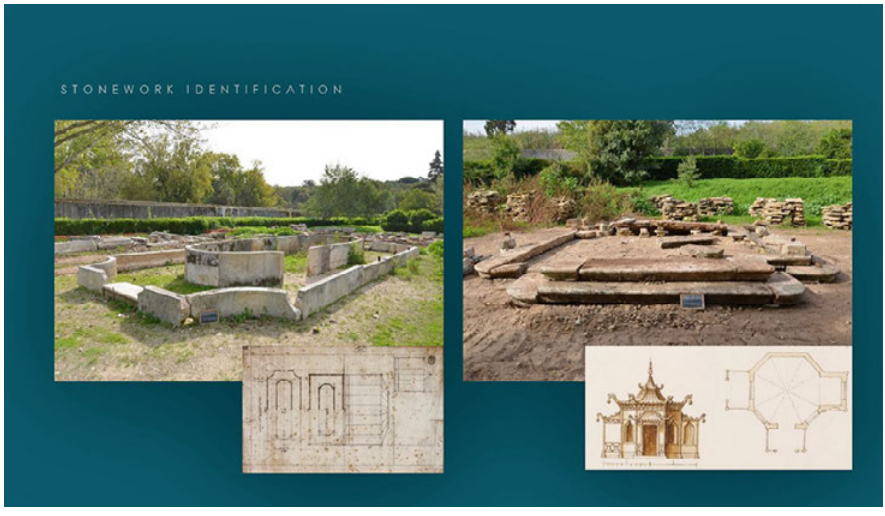


Fig. 15 Identifying the stonework used in the Greenhouses and the Chinese House.

Source: PSML/ANTT

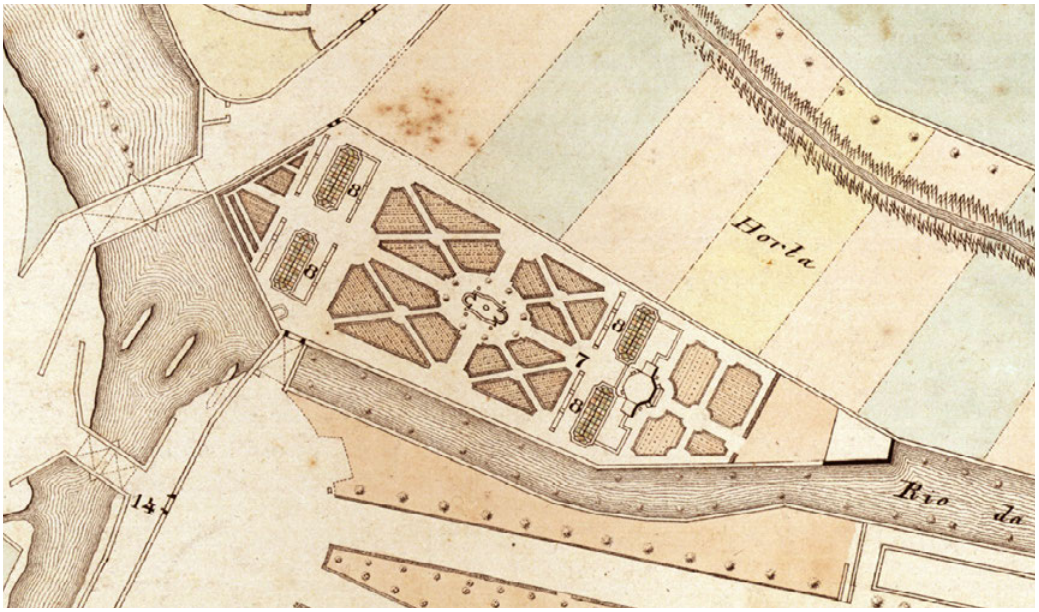


Fig. 16 Plan of the Botanical Garden showing the greenhouses, the Chinese House and flower beds.

(ANT-CR-1865)



Fig. 17 Plan of the archaeological trenches

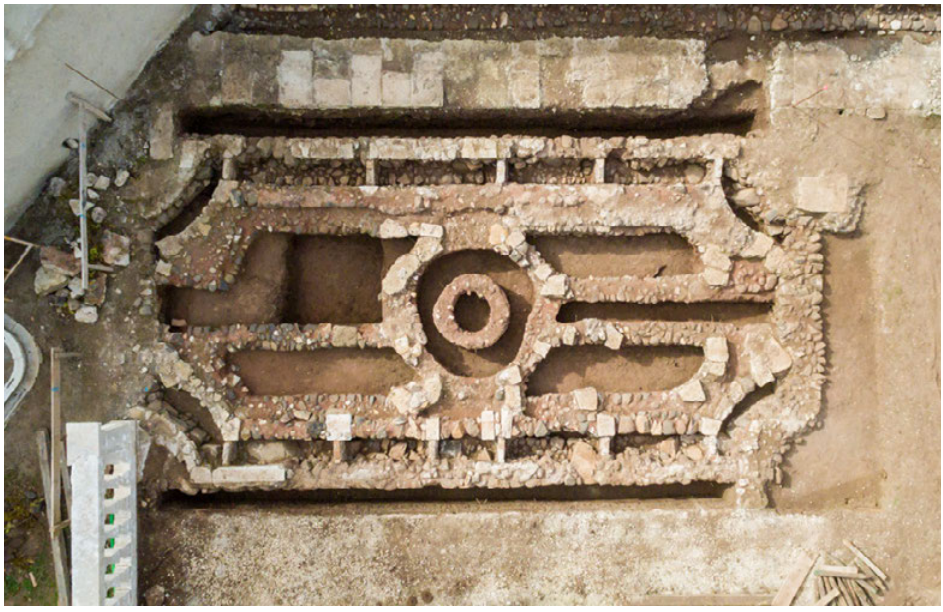


Fig. 18 Aerial view of the greenhouses in Sector 1: Trench 1.

Photo: PSML



Fig. 19 Aerial view of the greenhouse in Sector 1: Trench 2.

Photo: PSML



Fig. 20 Aerial view showing the greenhouses in Sector 1.

Photo: PSML



Fig. 21 Ground Penetrating Radar.

Source: PSML/UÉ



Fig. 22 Underground pipe in Sector 2: Trench 6.

Photo: PSML



Fig. 23 Reassembly of pond stonework.

Photo: PSML



Fig. 24 Foundations of one of the large greenhouses.

Photo: PSML



Fig. 25 Remains of the foundations of a large greenhouse, one of several.

Photo: PSML





Fig. 26, 27 Reassembly of the scattered stonework of large and small greenhouses.

Photos: PSML



Fig. 28 Foundations of the Chinese House.

Photo: PSML



Fig. 29 Reassembly of the dispersed stonework of the steps from the Chinese House.

Photo: PSML

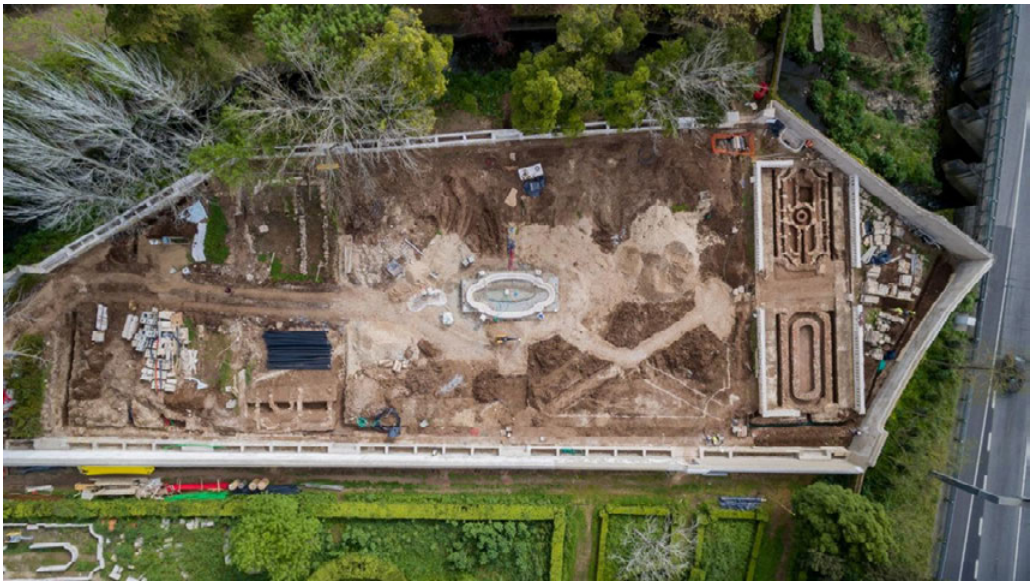


Fig. 30 Aerial view of completed archaeological works and reconstruction of the central pond.

Photo: PSML



Fig. 31 Aerial view of the completed archaeological work and the reconstruction of the central lake.

Photo: PSML



Fig. 32 Overview of the garden after the intervention.

Photo: PSML



Fig. 33 Overview of the garden after the intervention.

Photo: PSML



Fig. 33 Overview of the garden after the intervention.

Photo: PSML



Fig. 35 The pineapple plantation in the new greenhouses of the botanical garden.

Photo: PSML

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Multidisciplinary archaeological research and monument restoration at the Pernštejn Castle ornamental garden grounds (Czech Republic)

The garden grounds at the medieval Pernštejn Castle were founded in the baroque style in the eighteenth century and extended in Anglo-Chinese style at the beginning of the nineteenth century, but until recently they were in a state of disrepair. Comprehensive archaeological research has been an integral part of their restoration, aiming to gather information about the appearance and layout of the garden. Investigation has ranged from non-destructive geophysical survey by ground-penetrating radar through targeted trial trenches, to more extensive excavation. The results have contributed to the restoration efforts, helping to discern the original layout of the garden's flat areas. The findings have had a substantial impact on the intended appearance of the grounds as projected at the initial stages of restoration. Subsequent archaeological research, carried out simultaneously with the construction works, has confirmed the validity of the initial conjectures about the layout of the garden and provided additional details about its past appearance and chronological development. In the end, the restoration has been successful, not only preserving a vital piece of cultural heritage but also creating a beautiful historical space for the public to enjoy.

Introduction

The Pernštejn Castle is often called the king of Moravian castles. It is one of the largest and best preserved medieval castles in the Czech Republic. In its external form it still retains a largely late-medieval appearance. The surrounding park and gardens on the southern slope and in the valley below the castle have been its integral part (fig. 1).[1] However, they quickly

1 The forest park, which includes the monumental Taxus tree, has an area of approximately 10.6 hectares. The hillside part of the garden covers 4.71 ha. The parterre and the pond

fell into disrepair in the second half of the nineteenth century and the first half of the twentieth. In the second half of the twentieth century, under communist regime, some parts completely disappeared while others survived only in vestigial form. Therefore, the garden's original appearance and layout have faded from historical memory without documentation.

In 2015, design work began with the aim to restore the garden. However, right from the onset, conservators have struggled with the lack of information about the original appearance of the garden in the valley, where it has almost completely disappeared.[2] In the hillside section, the details and features were also unclear. This is when our work began. At first, it consisted of archaeological research and geophysical surveys during design work (January-April 2016).[3] In 2019, standard rescue archaeological research began. The goal was to document locations disturbed or revealed by the building, or to identify the heritage value of uncovered locations so that they could be incorporated into the garden's restoration project or at least preserved underground. The renovated gardens were opened in 2021.

Historical background of the Pernštejn Castle and its garden grounds

The gardens in Pernštejn were first documented perhaps as early as at the end of the sixteenth century when the fruit garden was mentioned, although its location remains unclear. The same is true of the baroque garden from the early eighteenth century – the only available information is that the orchard was located somewhere below the castle. Ornamental and kitchen gardens were also established. Although they could have been located in virtually any part of the castle, it is more likely that they were in the southern part. This could have happened during Franz Stockhammer's reign. The garden is likely to have been recorded in the first military mapping from 1764-1768. A more significant garden development probably occurred sometime toward the end of the eighteenth century, when an axially oriented vista was created in the eastern part of the slope, perhaps still in the late baroque style: the so-called Baroque axis. Today, it consists of a scenic terrace, a niche for the statue of Apollo, a Turkish bath, a pond, and other buildings. Some of these structures and adaptations could have been built as early as in the eighteenth century (fig. 1: 1–8), primarily the pond and the platform with roundels.

The principal period of garden development was the beginning of the nineteenth century when the extensive area of the aristocratic garden was established (fig. 2). This happened during the reign of the Schröffl family of Mannsberg. The owner of nearby Dolní Rožínka – Jan Nepomuk Mittrowský – was probably highly influential in the process, along with the sculptor Andreas Schweigl. The new, thirty-six-hectare complex was designed as an Anglo-Chinese Garden in the spirit of French sentimental gardens. Most of the garden elements were probably created in the first decade of the nineteenth century. Since then, many other buildings were added in the area.[4]

have an area of 8.93 ha. The Oriental Garden is 7.12 ha. A further 4.8 ha were absorbed by farmsteads in the twentieth century and are no longer part of the garden.

2 For more details on the history of the gardens, their exploration and restoration see Kalábová and Konečný 2021a and 2021b.

3 On archaeological research and geophysical survey see Dejmal et al. 2021.

4 Such as the spring-house (a wooden shed) in 1906 – Kalábová et al. 2003, 76.

Nevertheless, the passage of time has degraded the area: several garden buildings and pieces of furniture were abandoned or completely disappeared, along with countless landscaping elements and structures. This state of the garden created the need for archaeological research already in the early stages of the restoration project because the garden's historical appearance was no longer legible in many places, even when drawing on written and iconographic sources.

Research in 2016

Before we arrived at the site, two critical surveys were carried out in the garden. The first concerned building history and identified remaining or traceable objects in the park, also involving archival research.[5] Archaeological trial-trenching was conducted in 2010 and was accompanied by a partial geophysical survey using magnetometry. Three trenches were opened in a flat parterre, which at that time had the character of a meadow. Stone structures relating to the garden's division and water regime were found near the surface.[6] Although geophysical measurements were unsuccessful[7], the research results and the state of preservation of the structures influenced further progress.

As part of the Pernštejn Garden restoration project, our organization Archaia Brno z.ú. was approached to evaluate archaeological research through trial trenches at the end of 2015 (fig. 3, left). There was not much time to complete all necessary tasks. Research had two main goals: firstly, to verify the preservation as well as the form and levels of the historical setting of the individual buildings on the slope, and secondly, to attempt to uncover the original design and historical structures in the flat part of the garden. Research on the parterre began in the first week of January 2016. From the beginning, it was clear that due to the size of this part of the area, which has around six hectares, it would be impossible to meaningfully evaluate it by trial trenching alone in such a short period of time. Cooperation was therefore established with the Department of Archaeology and Museology at the Masaryk University. Together, we carried out a geophysical survey, which focused on the available section of the parterre. The survey revealed fundamental information about its historical appearance and thus gave direction to further fieldwork, which focused, among other tasks, on verifying the identified anomalies.

Since the previous magnetometry survey carried out in 2010 did not produce expected results, a different geophysical prospecting method was used for this time – ground-penetrating radar (fig. 3, right). The main task of the GPR survey was to identify structures related to the defunct gardens, such as stone elements, abandoned roads, historical or modern engineering networks, and obsolete watercourses or other water-related features. For this purpose, we used the single-channel system RAMAC X3M (GEOSCIENCE MALÅ) with a shielded antenna and a central frequency of 500 MHz. Under suitable conditions, this system facilitates scanning up to three metres below today's surface level while retaining very good horizontal and vertical resolution. However, due to several factors (including bad weather, ground conditions, and above-ground obstacles)

5 Kalabova et al. 2003, 76.

6 Archaeological excavation in the form of small trial-trenches was carried out by the National Heritage Institute ÚOP Brno in 2010: Vitula 2015.

7 An unsuitable method for this site – magnetometery was chosen for the geophysical survey in 2010.

it was impossible to survey the entire extent of the parterre, restricting works to a limited extent of its flat part. Even so, the survey area covered the majority of the parterre – an area of 0.71 hectares, where the survey revealed a large number of anomalies that, at first glance, seemed attributable to the defunct garden (fig. 4).

First, based on the results, the following division of the parterre was outlined. Three distinct linear anomalies were captured in the rectangular area adjacent to the pond from the eastern side. In two cases, it was a historical water pipeline; the third line represented a stone channel. All three elements powered the water system around the Chinese pavilion. The layout of the rectangular parterre under the hermitage was also revealed. A stone wall demarcated the entire area and mirrored the preserved rampart wall on the slope. The wall was partially restored during the renovation of the garden. However, another wall was not restored – one located in the middle of the demarcated area, dividing it longitudinally into two halves. Surprising results were yielded by a geophysical survey and subsequent archaeological excavation at the Chinese pavilion, where several significant anomalies were identified. The most important discovery was a meandering artificial stream and an adjacent lake, the existence of which was not suspected. The survey was accurate enough to not only reveal the course of the defunct watercourse, including bridge crossings, but also distinguish the clay banks from the rocky fill at its base. Measurements also revealed the course of adjacent paths, which were consistent with the artificial channel. However, it should be noted that in the eastern corner of the garden it was challenging to distinguish between the paths and the actual watercourse, while some of the anomalies interpreted previously as watercourses were in fact gravel walkways.

Since the interpretation of recorded anomalies is largely subjective, extensive trial-trenching was carried out to verify the measured results and to refine their interpretation, thereby helping to obtain a more comprehensive picture of the investigated site. The evaluation focused on the measured anomalies in the parterre as well as on the situation at the slope and in the first castle courtyard. A total of fifty trial trenches were excavated during the research in 2016. In conjunction with the geophysical survey, they provided fundamental information about the form of the garden and structural details of individual buildings and other elements.

Archaeological research in 2019

The 2016 survey work helped to redesign the entire garden. Reconstruction began in 2019, with a concomitant archaeological rescue investigation. The research lasted one year, during which numerous structures were uncovered in the slope, the parterre and the oriental garden (fig. 5). In conjunction with the previous geophysical survey and archival research, the results facilitated the reconstruction of garden's development.

Before the gardens

We must assume that throughout the Middle Ages and in the early modern period, there were no forests on the castle hill for defensive reasons. The hillside and the area beneath the castle to the south looked completely different. Today's road through the valley below the castle did not exist back then. Originally, there was a pond, perhaps dating back to the Middle Ages. Because of this, the road from Nedvědice to Dolní Rožinka passed

through the castle. The ponds below the castle probably silted up gradually and disappeared along with the original road by the end of the eighteenth century, at the latest.

The Baroque axis

As regards the Baroque axis (fig. 1: 1-8), research focused on its different parts. Small excavations took place at the niche with the statue of Apollo (fig. 1: 2) and at the "Rosarium" – an artificial hill originally planted with roses (fig 1: 3). Original ground levels were ascertained there and the original channel was uncovered in the form of a gully that drained the deeply embedded section of the garden path into the hillside. Lower down the slope yet still above the pool, the remains of a rectangular stone shaft were found, containing a cast-iron pipe leading from the stables in the first courtyard. A valve or other regulating device in the shaft may originally have controlled the flow of water into the pool and onto the cascade. Research has shown that the pipes in the shaft (and probably along the entire route) were changed at least once. We can assume that this happened in the middle of the nineteenth century when other buildings in the garden were also repaired. Water flowed through a gravity water system, via the castle courtyard, from a spring located one kilometre away in the village of Smrček. The same water supply system is still in operation and the original wooden pipes have recently been replaced.

Research has also focused on the pool (fig. 1: 3, 6). Vertical marble blocks formed its rim and the base was made of bricks. It is possible to show how the pool was constructed. Initially, a trench was dug, approximately one metre larger than the intended size of the pool. The excavation was reinforced on the outside in the north and east by a dry-laid wall. The remaining area of the excavation was then filled with clay to prevent water loss. The brick base and the marble rim were set into the clay bed. Water was supplied to the pool from the north – there was a clear opening in the stone rim for a cast-iron pipe that probably ran along the bottom to the middle of the pool. The outflow was handled by a cast-iron pipe, vertically recessed on the south side. The pool was also equipped with an overflow in the form of a circular hole or opening at the top edge of the stone rim. The pool had two construction phases. The stone rim was completely dismantled during renovation, probably in the nineteenth century. A new brick bottom was laid over the earlier base and the rim was re-established on top. The reconstruction is further evidenced by two-stage design of the supply pipe at the north, where the opening in the rim was widened, and original iron joints of the rim were found scattered in the backfill around the pool. However, these repairs were carried out relatively ineptly. The thickening of the base resulted in the raising of the stone rim, exposing the less heavily machined part of its outer edge, which was originally buried and not intended to be seen. Also, the pool was not restored in the shape of a circle but was slightly deformed and took the form of an oval.

An interesting discovery concerning masonry was made on the southern edge of the terrace featuring roundels above the Turkish Baths (fig. 1: 6). It probably represents the foundation of a staircase leading from the roof of the bath-house to the terrace. However, the masonry is probably older than the Turkish Baths and may come from an earlier garden phase, perhaps from the original eighteenth-century baroque garden.

Other evidence of earlier structures was discerned while investigating the

Turkish Baths (fig. 1: 5), where a gap in the eastern outside wall as well as a potential corner were uncovered, conceivably belonging to an earlier building. Inside, the original floor was removed and replaced with clay. It must have been previously made of stone or brick, as denoted by sharp-edged imprints left in the plasterwork. The inner faces of the north, east and west walls had been completely plundered, although dating this has been impossible beyond the fact that this must have happened when the garden was in use, possibly at a time when the original lavabo was removed.

An approximately 8.5 metres-long section of the cascade below the Turkish Baths was uncovered (fig. 1: 7). It was built with mixed stone and bricks. The lower part of the cascade comprised two levels built of marble slabs,[8] with individual pieces connected using iron clamps. While water from the lower level cascaded freely into the pond across the full width of the slab, the upper slab featured a raised edge. In its eastern section, a pin was identified, likely intended for the installation of a sculptural element – a gargoyle. The central portion of the cascade was heavily damaged; it is assumed that the water originally flowed over loosely placed stones, remnants of which were documented during the excavation. In the upper part of the cascade, there was again a level sill of marble, consisting of three slabs connected by iron couplings. The last slab was found dropped on the slope below the step. The back plate of the step has an oval-shaped edge, matching the stone block in the middle. This plinth probably held a sculpture from which water would originally gush. Part of this statue was found several years ago while conducting research on the building's history. The cascade has undergone several repairs and modifications.

8 The surrounding area is a source of the so-called Nedvědice Marble.

Parterre and pond

The Baroque axis was closed by a pond followed by a flat parterre (fig. 1 1: 6-8). The entire bottom and walls of the pond were filled with a layer of clay before the base was lined with large stones and the perimeter walls were finished. Local schist was used as a raw material. A large circle with a diameter of around seven metres in the middle of the base probably served as decoration, although it might not have been fully visible when the pond was filled.

Apart from the cascade, no other water supply mechanism was found at the pond. An overflow was discovered at the south-east end for draining water through a rectangular area into a wooden water pipe connected with the artificial stream in the oriental part of the garden. The wooden structure was probably replaced with cast-iron pipes after the end of its service life. The second conduit led towards the spring-house in the form of a stone channel.

The parterre is now mostly planted with pear trees and has been landscaped as a French geometric garden, complete with statues of Diana and Flora. The eastern part was previously divided longitudinally by a wall, which was surveyed but has not been restored (fig. 1: 9). A rectangular stone foundation (8.5 x 3.5 m) was found at the south-eastern edge of the parterre. It may have been a lookout or other stopping point created along the edge and overlooking the oriental part of the garden. An artificial watercourse in the Oriental Garden emerged a short distance below (fig. 1: 10).

Oriental garden

A surprising discovery was made in part of the garden now known as the oriental

garden. Initially, only the Chinese pavilion was identified, without any further context (fig. 1: 11, 8). Research has revealed other components of this part of the garden, chiefly a watercourse, which began at a tumulus comprised by a cairn (1.6 x 1 m) built with flat stones and located below the lookout described above (fig. 1: 10). A wooden pipeline beneath the structure directed water into an artificial stream or river around two metres wide. The bed of the watercourse was plastered with clay along its entire length. The sides and bottom were subsequently laid with stone. The watercourse had two functions. At first, it was a dry-walled channel with the depth of up to half a metre. Later, the riverbed was almost completely lined with stones but it is not entirely clear whether water was still flowing there. If this was indeed the case, the depth of water was probably only a few centimetres, with stones protruding above and causing ripples. Another possibility is that the riverbed was rather dry and only aesthetically evoked a watercourse.

The river followed a series of meanders that filled the space of the orientalised part of the garden. The Chinese pavilion was located in one bend. There was also one stomach-shaped lake of identical design to the main watercourse (fig. 1:13, 8). After flowing into the lake, the water continued over a low spillway or overflow marked by a large stone further east. The riverbed was partially damaged during the construction of a tank for a wastewater treatment plant. Somewhere below this recent building, a structural change was made in the garden's southeastern corner and its continuation was only visible as a stone-lined channel covered by stone slabs, leading beyond the original boundary of the garden and flowing into Nedvědička at an unknown point. In several places, potential crossings were marked by flat protruding stones and poorly preserved foundations, which probably served to anchor wooden bridges.

A network of paths was formed around the watercourse and beyond, enhancing the garden's appearance. All paths were built using similar methods, with a width of about one and a half metre and their base set into the ground using large stones. Smaller stones formed a central section beneath a finer upper level made from gravel. Garden paths made in this way were found only in the Oriental Garden.

Another distinctive feature of today's Oriental Garden is the spring-house[9] used as cold storage for live fish (fig. 1: 12, 8). The wooden structure contains a stone, rectangular tank that may have once been a concrete tub. It seems like an original modification that could date back to the beginning of the twentieth century when the building covering it was erected.[10] At that time, water was supplied to the spring-house through a cast-iron pipe from the west. However, investigation has shown that there had been an earlier system before it. When the spring-house was being recently restored, part of an older, recessed wall in the western part was uncovered. It was a brick structure and probably also a water reservoir supplied by a conduit from the west. This stone channel led from an underground pond but emerged at the surface in the Oriental Garden. It ran parallel to the wall, defining the rectangular parterre below the "Hermitage."

The slope below the castle

Investigation also covered the slope below the castle and outside the Baroque

9 Czech "Haltýř"; German "Fischbehälter."

10 Kalábová *et al*. 2003.

axis. Aided by trial-trenching and other methods, numerous remains of destroyed structures were found at the slope – especially staircases, rampart walls, and benches. While these findings are fundamental for the restoration of individual elements, the following summary discussed only those that are important for the development of the castle area. These include the discovery of the original staircase that led from the castle to the terraces. Remains of stairs along the outer face of the terrace retaining wall have been preserved in the western part, where the original entrance to the garden was located and marked by a special, covered staircase leading from Schroeffl's gardens (fig. 1: 19).

Several construction details uncovered in the area of the terraces, which were partially used as greenhouses, point to their complex development. In the masonry west of the so-called café garden, a remnant of the original gate was identified – corresponding to what is depicted in the aforementioned plans from the Nuremberg and Stuttgart archives.[11] The terraces themselves also had earlier phases. During the removal of the wall at the Second Terrace, an older surface was identified around half a metre lower than the present level. Although this earlier terrace cannot be dated due to a lack of finds, it clearly points to a more intricate development of landscaping on the southern slope of the castle .

Hermitage

The Hermitage lies at the end of the southern slope (fig. 1: 14). Its examination involved surface excavation of the entire building (fig. 9). Structurally, the building is connected with the cellar beneath, which is accessible from the parterre below. Investigation began in 2016 when several trenches were opened and it became clear that the building features some preserved interior plaster and a complex constructional sequence. Archival research has shown that in 1806 the Hermitage had four windows with stained glass of oriental (Chinese) style, a door to the attic and a turret with a bell. In 1847/1848 it was fitted with new windows, doors, and a roof.[12]

The oldest structure is the northern part of today's cellar or rather its stone vault, which is of simple barrel design. It is probably older than the garden created at the beginning of the nineteenth century and may be related to an earlier garden phase or the nearby farmyard or brewery. In the second phase, the cellar was extended southwards, as denoted by a noticeable mark in the vault. It was not until the third phase, however, that the entrance hall with a well was built, and the cellar was paved.[13]

The above Hermitage also has three construction phases (fig. 9, right). The earliest (Phase I) is probably represented by better masonry in the northern section. It includes the entire north wall and adjacent parts of the eastern and western walls. An original opening is preserved in the east wall, perhaps a window or a door. This building was probably not part of the garden from the beginning of the nineteenth century and appears to be older. Interestingly, however, it is younger than the first phase of the cellar.

The entire south wall and the remaining parts of the eastern and western walls

11 Dejmal et al. 2021, fig. 1, 2.

12 Kalábová et al. 2003, 122-5.

13 The cellar could also serve the manorial brewery. In 1596 only a courtyard was mentioned and the brewery was in the town of Nedvědice. However, in 1609 a brewery and a malt house are recorded at the castle. At the same time, there is no brewery near the town. Cf. Rohlík 1957, 307 no. 5; 374 no. 13.

represent the Hermitage's next phase (Phase II). The masonry is of poorer quality and bricks are also present. The inner face of the east wall is laid in a vertical position, aligning it with Phase I. The southern wall is shallowly founded. Structurally, this phase is also connected with two walls jutting out in the south towards the parterre. They may have supported balconies or staircases. These walls were also part of the third phase of the cellar. Several remains of openings for windows and doors have been preserved and the existing opening in the east wall was reduced to a window. Three other openings are located in the western wall. The holes were made at regular, one-metre intervals. The northern and southern openings served as windows at this stage, while the middle ones as doors.

Two openings were rebuilt as part of another reconstruction – Phase III. The central door opening was walled up and probably changed to a window. Conversely, the initial northern window opening was rebuilt into a door by demolishing the parapet.

We also discovered some details concerning the internal appearance of the building. For example, three levels of the floor were identified. We do not know the floor in Phase I. In Phase II, a mortar bed was laid in the new building as the base for a brick floor. This floor is synchronous with richly decorated plaster. However, the brick floor was subsequently removed and replaced by a wooden floor, perhaps in Phase III. After dismantling the bricks, trenches were dug into the mortar bed at regular intervals to place wooden joists supporting the boarded floor. It seems a backward step in terms of both the quality of artistry and craft. The last documented modification of the floor involved levelling it with yellow clay, which was applied after removing the wooden floor. This probably also happened in Phase III.

The discovery of preserved plasterwork was very surprising. Two layers survived. Although fragmentary, the primary, richly decorated plaster from Phase II survived on all interior walls. A fine, smooth layer applied over a rough base was painted with rich geometric patterns in black, red and white above a plain dado. On the longitudinal sides in the southernmost part the original pattern probably consisted of thin vertical lines of red and white, differing in height according to the geometric articulation of the upper fields. Two red stripes followed them in the form of a saltire or Saint Andrew's cross. The central part was occupied by broad, vertical black stripes with a white border. Thin stripes were again connected to them on the west wall. A cross featured again on the eastern side but its design was thinner. As part of Phase III, the original door opening was walled up and plastered over with rough lime plaster. Outside the building, the fragmentary plaster decorations that lack details probably belong to Phase II.

The brick structure between the middle and north openings in the western wall is the most difficult to interpret. It comprises two interconnected brick channels. The wider one leads to the original north window in the west wall and, later, to the door. The second one is only several centimetres wide and runs towards the middle, initial door opening. Rotten wood was present as part of the primary filling in both channels. Their construction probably belongs in Phase II. We believe that these remains may be part of the original trigger mechanism of a mechanical hermit, which historical inventories locate in the Hermitage.[14] It probably worked in such a way that after entering the door and

14 Kalábová 2016, 24.

stepping onto the porch, a wooden rod located in the narrower groove triggered the main mechanism in the larger channel.

Phase II of the Hermitage seems related to the garden from the beginning of the nineteenth century. Repair works from 1847/1848 are probably represented by Phase III. Unfortunately, we cannot date the origin of Phase I or the older cellar.

Material culture

Many artefacts were found during the excavations. They can be divided into three groups. The first predates the gardens and can be linked to the medieval castle. These findings include coins, arrowheads and pieces of armour, which probably comprise waste from the castle or were lost by its residents. The second group of artefacts is related to the existence of gardens. Again, there are lost coins but also buttons, other clothing elements, fragments of tobacco pipes, bullets, and even parts of a cast iron bench. The third group stems from the period after the destruction of the gardens. In addition to coins, this category includes, for example, tent pegs, a mess tin, and the remains of steel cans – evidence of camping in the former gardens below the castle.

Conclusions

The importance and uniqueness of presented research lies in its contribution to the restoration of the entire aristocratic garden at the Pernštejn Castle (fig. 10). Archaeology, which is often merely tolerated in large construction projects, was in this case actively involved in the reconstruction. The geophysical survey, evaluation by trial-trenching and subsequent large-scale excavation were critical in the restoration of the entire garden.

Basing on the results, it is at least possible to recognise part of the original layout of the garden's flat part. This has significantly shaped its design and look at the onset of renovation project. Further, it became possible to answer numerous questions concerning the design, construction and the state of preservation of various structures located in the garden area in the past. Today's restored gardens are visited by an average of 15-20.000 people per year and have already become an important part of the unique complex at the Pernštejn Castle.

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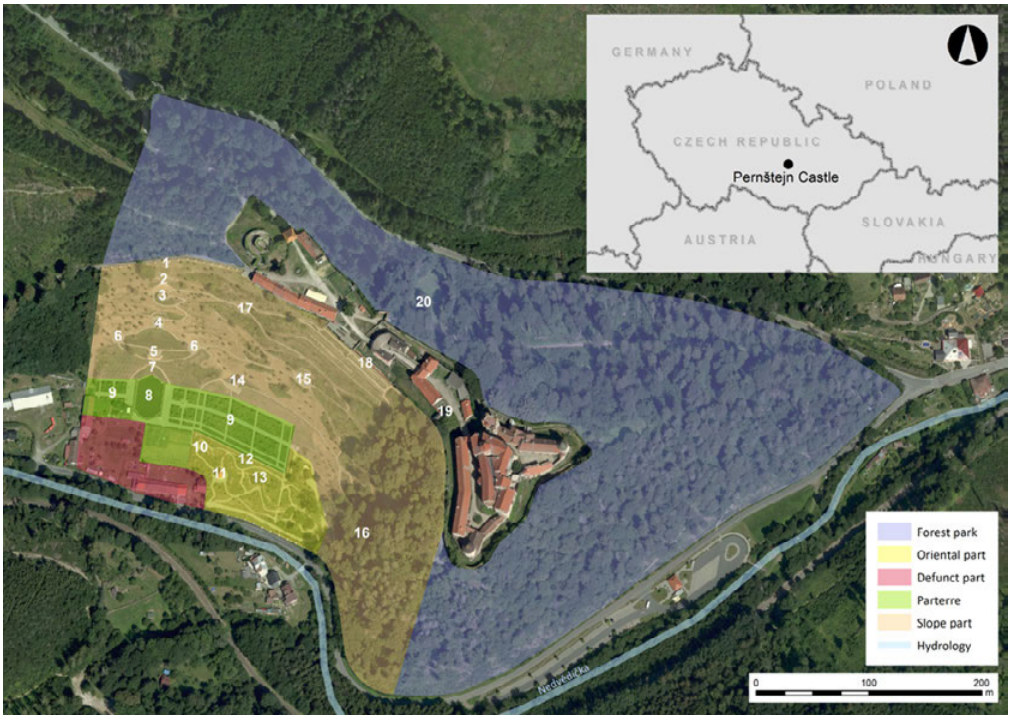


Fig. 1 Location of the Pernštejn Castle and general layout of the castle garden grounds.

1 – scenic terrace; 2 – niche with a statue of Apollo; 3 – rosarium; 4 – pool;
5 – Turkish baths; 6 – rondel with a statue; 7 – water cascade; 8 – pond;
9 – parterre; 10 – lookout and spring; 11 – Chinese pavilion; 12 – springhouse;
13 – lake; 14 – hermitage; 15 – obelisk; 16 – cenotaph; 17 – the "Paraplui" picnic
place; 18 – greenhouse terraces; 19 – Schröffl's Garden; 20 – Pernštejn yew tree.

Base map: State Administration of Land Surveying and Cadastre

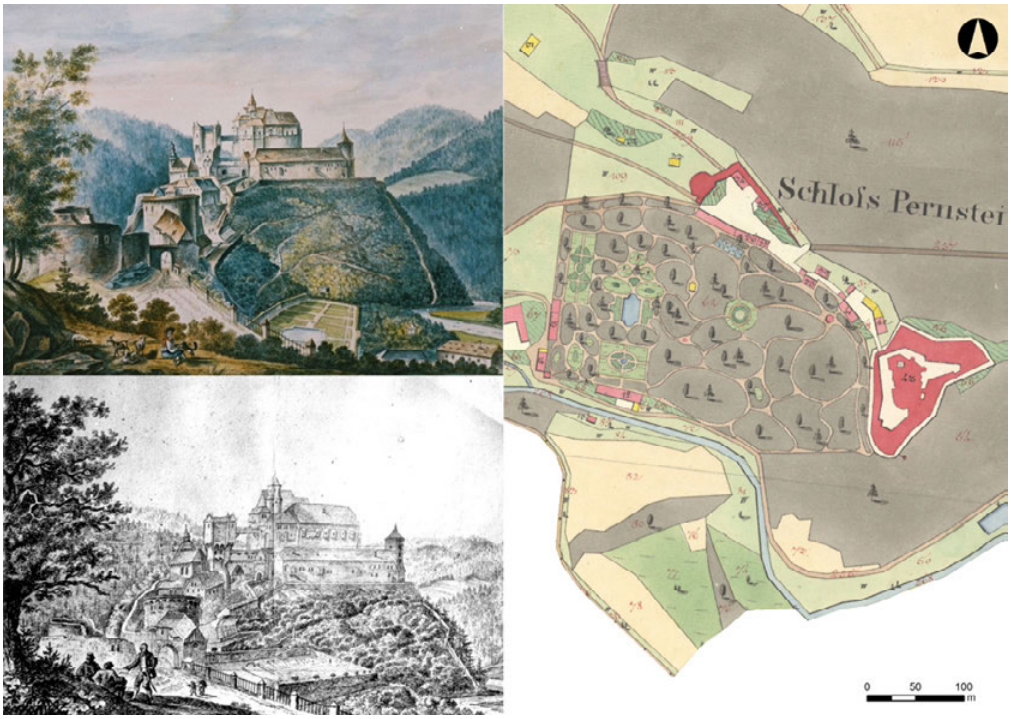


Fig. 2 Depictions of the castle and adjacent gardens in historical sources. Left: Franz Richter, 1817 (source: State-Castle Pernštejn); right: Imperial Obligatory Imprints of the Franciscan Cadastre from 1826 (State Administration of Land Surveying and Cadastre)



Fig. 3 Left: trial trenches at the parterre in late 2015. Right: geophysical survey by ground-penetrating radar in the first week of January 2016.

Photo: Archaia Brno, z.ú.

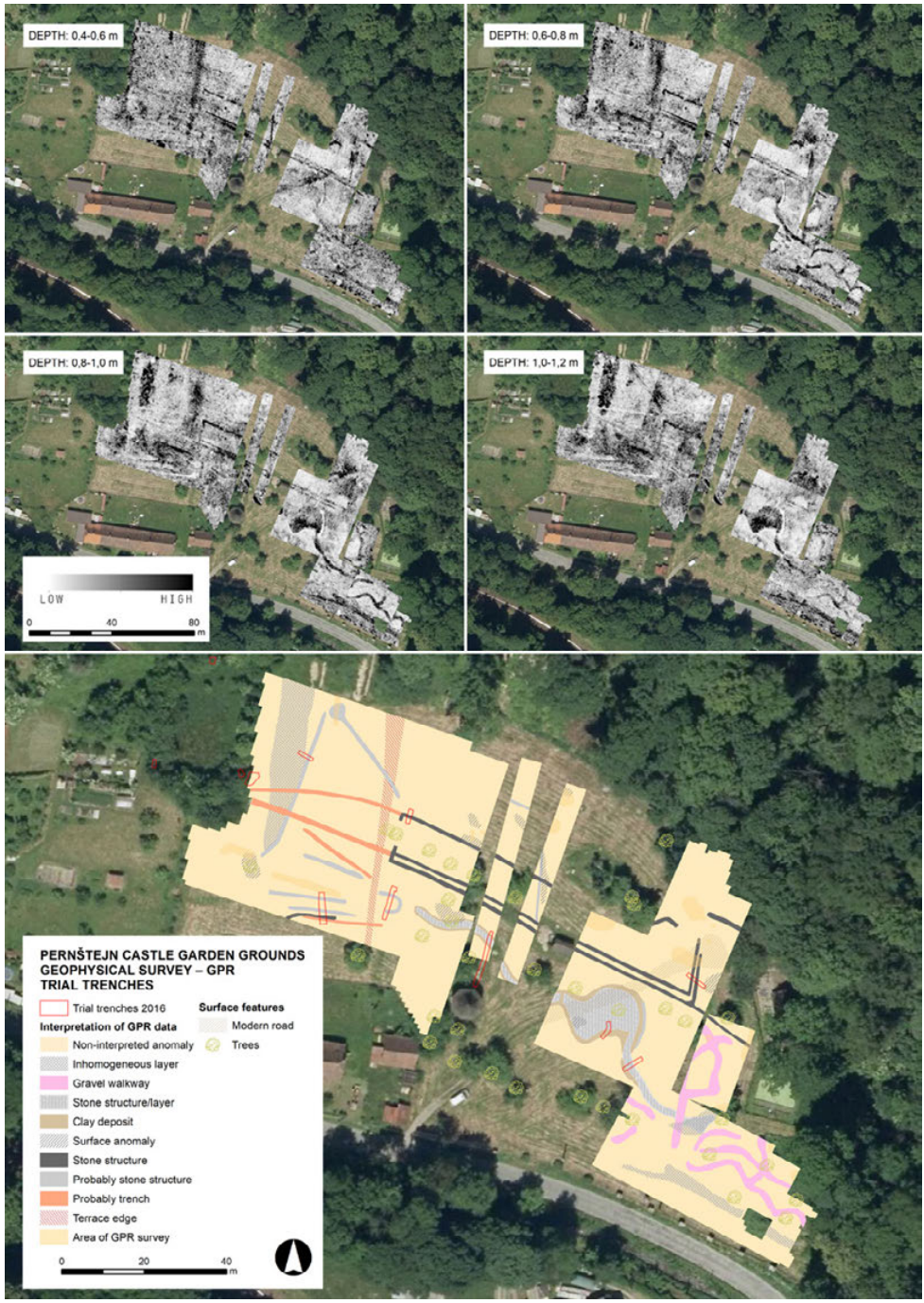


Fig. 4 Top: horizontal time/depth slices. Bottom: interpretation of GPR data. Base map: State Administration of Land Surveying and Cadastre; position of trial trenches conducted in 2015/2016 from Archaia Brno z.ú.

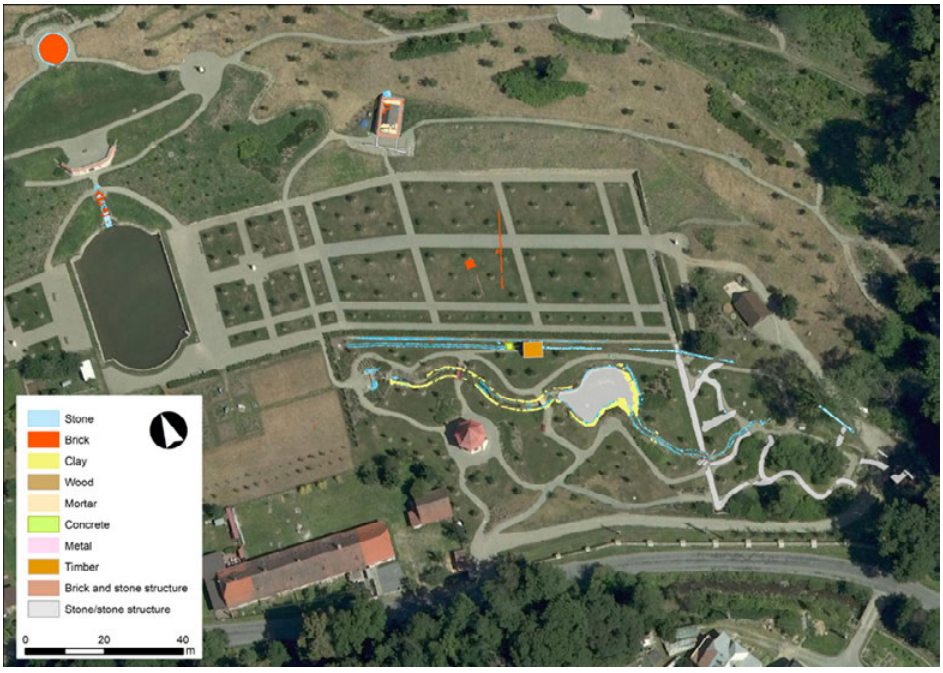


Fig. 5 Ground plan of structures identified during the archaeological excavation in 2019.

Source: Archaia Brno z.ú.



Fig. 6 Views before and after reconstruction. Left: the Baroque axis – view from the scenic terrace toward the pool, part of the pond, and the parterre. Right: Turkish Baths.

Photos: top – Kalábová-Šabatová-Szabó 2013; bottom – Archaia Brno z.ú.

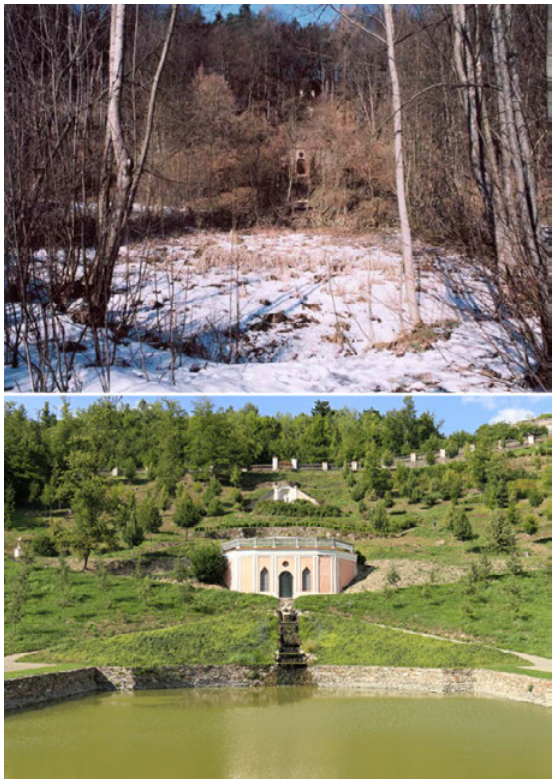


Fig. 7 Pond, water cascade and Turkish Baths before and after restoration.

Photo: top – Kalábová-Šabatová-Szabó 2013; bottom – Archaia Brno z.ú.



Fig. 8 Before and after reconstruction – the oriental part of the gardens with the Chinese pavilion, spring-house and adjacent pond, as discovered by geophysical survey.

Photos: top – Kalábová-Šabatová-Szabó 2013; bottom – Archaia Brno z.ú.

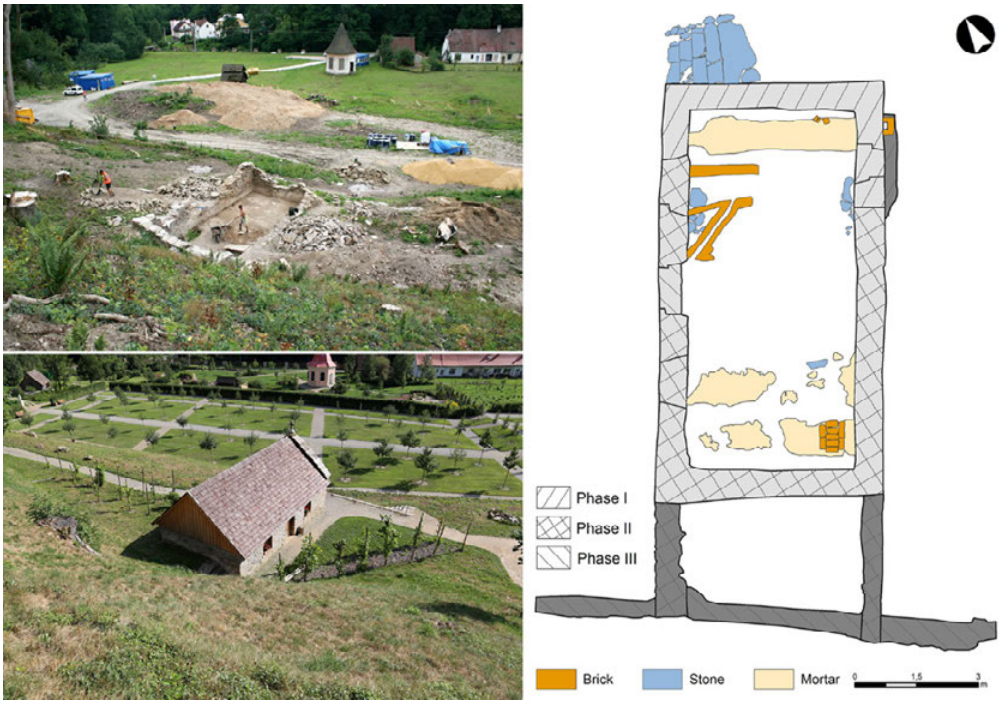


Fig. 9 Left: The Hermitage before and after restoration.
Right: ground plan after archaeological investigation.

Source: Archaia Brno z.ú.



Fig. 10 Pernštejn castle garden grounds before and after restoration.

Photo: Archaia Brno z.ú.; basemap: State Administration of Land Surveying and Cadastre

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Anna Andréasson Sjögren

Medieval gardens: insights from garden archaeology

One important result of the development of garden archaeology in Sweden is the way in which it has changed our understanding of medieval gardens. In my recently published PhD-thesis, I analyse remains from medieval gardens in thirteen towns and twelve rural settings that provide glimpses of gardens of many shapes and sizes. By combining archaeological sources with the scarce written and art historical sources available from the area, further knowledge of how gardens where viewed and utilised can be reached. Garden remains provide important insights into the ways in which gardens were created and maintained. To find out more, we need to develop hypotheses relating to the characteristic traits of different types of remains of garden features such as the remains of lawns and garden meadows.

ACCORDING TO WIDELY held views on medieval gardening in Europe, developed at the beginning of the twentieth century, it was the monasteries that carried on a tradition of garden design and advanced horticultural techniques after the fall of Rome in AD 476. In Scandinavia, this led to the related view that it was the monks in the Middle Ages who brought gardening as well as a multitude of cultivated plant species to the Nordic countries.[1] Today, however, new archaeological and archaeobotanical evidence provides reasons to question these assumptions, although they remain deeply rooted. For instance, if you open any modern Swedish Flora and look at its accounts of when different species were introduced, you find a clear pattern: species known from written Greek, Roman and Medieval sources are usually accompanied by the statement that they were probably introduced by the monasteries in the Middle Ages. Changing these assumptions will take some time, but thanks to the growing amount of macro- and microfossil evidence from excavations, a new more complex understanding of when different species and cultivars did in fact arrive in northern Europe has started to emerge.

1 Andréasson Sjögren 2025a, 5-8.

Currently, for example, the earliest Swedish finds of opium poppy (*Papaver somniferum*) and henbane (*Hyoscyamus niger*) date from the late Bronze Age, about 1100–500 BC.[2]

Research based on the available physical evidence has shown that there were at least two periods prior to the Middle Ages when the introduction of new plant species markedly increased. The earlier of these periods is the Nordic Roman Iron Age (AD 1–400), from which we have the oldest samples to date of carrot (*Daucus carota*), oregano (*Origanum vulgare*), parsnip (*Pastinaca sativa*), parsley (*Petroselinum crispum*), black mustard (*Rhamphospermum nigrum*), white mustard (*Sinapis alba*), and summer savory (*Satureja hortensis*). The other is the Viking Age (AD 800–1050), with the oldest known samples of apple (*Malus domestica*), sour cherry (*Prunus cerasus*), plum (*Prunus domestica*), sage (*Salvia officinalis*), caraway (*Carum carvi*), and coriander (*Coriandrum sativum*). It is becoming increasingly obvious that there are many species that the monks did not introduce to Sweden, because they were already present. Indeed, some species, like henbane and opium poppy, had been growing in the region for more than a thousand years. Archaeological finds clearly show that the history of plant introductions was a long and complicated process. For example, the same species can be introduced several times, and during the Middle Ages the introduction of new species was just as likely to occur through contacts between visitors and inhabitants of towns, or through aristocratic networks, as through the activities of travelling monks.[3]

Three decades of methodological development

In Sweden there are no surviving descriptions or depictions of gardens from the Middle Ages. However, since the 1990s, thanks to contextual methods of excavating and documenting as well as close multidisciplinary collaboration with specialists, including quaternary geologists and archaeobotanists, archaeological evidence of medieval gardens has grown exponentially.[4] For my thesis, *From Kale to Paradise: Medieval Gardens in Sweden* (2025), I carried out extensive research into the available Swedish archaeological evidence (published before the end of 2019) relating to medieval gardens (AD 1050–1525). Only direct evidence relating to specific gardens was included in the research.[5] The collected material comes from excavations in thirteen towns and twelve rural locations, and provides glimpses of gardens of several different types in a variety of environments. In a few cases entire gardens have been excavated, but more often the evidence relates to parts of a garden, such as a pond, some beds and walkways, or a path and a water feature. All in all, the evidence from town-excavations included more than twenty-five burghers' plots, three bishop's palaces, an early medieval fortified site, a high-medieval urban manor, four Dominican convents, three Franciscan convents, an early Benedictine and a late Birgittine monastery. The rural material included two village farms, one single farm, five royal or aristocratic palaces and castles, two large monasteries and two large nunneries.[6]

2 Heimdahl 2021, 50-51.

3 Heimdahl 2021, 26-51; Larsson and Ingemark 2015; Andréasson Sjögren 2025a: 126-130, 139-155.

4 Andréasson Sjögren 2025a; Heimdahl and Krupski 2024.

5 Andréasson Sjögren 2025a, 30-31.

6 Andréasson Sjögren 2025a, 138-155.

Historical archaeology and triangulation of source types

The new archaeological evidence for gardens also provides the key to studying the fragments of written and art historical material preserved since the Middle Ages in Sweden. By triangulating evidence, inspired by a material approach to all source materials and an assemblage perspective, it is possible not only to increase knowledge about the physical gardens but also about other aspects, for example, what different garden types were called in the area at the time, how they exchanged hands, how they were valued, and how they were used symbolically in art and literature.[7]

In the thesis, only sources that physically originated in or were made for use within the studied area were included. Chapter 6 contains studies of a selection of written sources, including both documents and normative, narrative and instructive written materials. Of the first category, mainly diplomas and town books are preserved, but there are also a few examples of late-medieval accounting books and property lists. The second category includes laws, manuscript sections on herbal medicine in Old Swedish, *The Revelations of Saint Birgitta*, translated literature, and preserved passages on Paradise, Gethsemane and the Garden of the Holy Sepulchre in Latin and Old Swedish. In a concluding section, all the written sources are summarised, analysed, and compared with the archaeological material and images, both chronologically and thematically.[8]

Chapter 7 of the thesis examines approximately 650 images preserved in church environments, depicting scenes taking place in gardens, with 100 images dating from the years 1100–1400 and the rest from 1400–1525. Most depict one of three Biblical garden environments: Paradise, Gethsemane at the Mount of Olives, and the Garden of the Holy Sepulchre, while around twenty images dated ca 1425–1525 show scenes in other gardens. In the conclusion to the chapter, the garden imagery and the garden elements are summarised, analysed, and compared with the archaeological and written sources. The final chapter of the thesis, Chapter 8, relates all three categories of sources to each other and to current knowledge of medieval gardens within a wider European context.[9]

Several garden types with different names

All gardens, regardless of type, are complex, ever-changing spaces, always fully integrated in built environments and everyday life. One reason that garden remains are difficult to find, excavate and interpret, is the fact that gardening is not one practice, but many. In the thesis, I use the term garden culture to describe the ideas, knowledge, language and values, that are reproduced when people interact with gardens. Just like gardens, garden culture varies and changes through time and space. It is not a set of rules, but it does frame and set limits to how gardens are used and viewed, while at the same time always leaving room for adaptation and change, based on the needs, circumstances and interests of individuals and households. All gardens referred to with a certain term did not look exactly the same or contain the same plant species. Such variability makes categorization difficult, but for the purpose of research we do need to divide, categorize

7 Andréasson Sjögren 2025a, 15-27.

8 Andréasson Sjögren 2025a, 15, 26-27, 215-230.

9 Andréasson Sjögren 2025a, 323-341.

and group material, and define characteristic features.[10]

The collected source material indicates that, within that the regional, medieval garden culture in the study area, several garden types were recognized, in which different prioritizations were made. To describe these garden types, I chose to use the terms occurring in the late-medieval written material that formed part of my research. The use of these terms highlights the difference between medieval and modern gardens with similar-sounding names, such as the Old Swedish *yrtagardher* and the Modern Swedish *örtagård*.[11]

In the *kalgardher* type of garden, mainly nutrient-demanding seasonal species like kale/cabbage (*Brassica oleracea*) were cultivated. The *traegardher* type of garden, on the other hand, was an orchard where fruit was grown. In the latter, digging and fertilization did not take place regularly in the same way for practical and aesthetic reasons, since that would have ruined the meadow vegetation under the trees. A third type, the *yrtagardher*, seems to have been quite variable, but with some common denominators, such as well-drained and lean soil, not dug or manured in the same regular way as the *kalgardher*. These conditions would have suited not only lawns and meadows but also beds of perennials. For example, sage (*Salvia officinalis*) is a semi-woody perennial that does not thrive in heavily manured and frequently dug soil, although it would have benefitted from calcium, phosphorus and other micronutrients from bone fragments and wood ash found in household compost, if provided in the right amounts with less digging.[12]

The *yrtagardha* mentioned in the studied written material are all linked to wealthy people, and are described as places where recreational use was important, although they could also provide specific produce. While preserved images suggest that the design of *yrtagardha* was similar to that of the *trægardha* but in a smaller format, *The Revelations of Saint Birgitta* suggests that the term *yrtagardha* covered a variety of shaped environments and cultivation practices. Here, the term is used in reference to one garden with flowering herbaceous plants, another one with young plants and small trees that need to be fastened securely before storm, and a third one with fruit trees, renewed by grafting rather than digging to avoid making the garden unpleasant because of open soil and pits. In the last case, the term *trægardher* is also used, alternately, to refer to the same garden.[13]

Written material also shows that the Old Swedish word *yrt* did not refer only to plants categorized today as herbs, spices and medicinal plants, but to useful herbaceous plants in a wider sense. According to *The Revelations of Saint Birgitta*, *yrtir* could be judged based on three criteria: fragrance, beauty and virtues, or powers/abilities. The virtues, in part, correspond to today's medicinal properties, but this comparison is not exact, since health and healing were perceived differently at the time. Powers, or effects, were attributed not only to species today regarded as medicinal plants but also to species such as cabbage and apple. Beautiful and fragrant plants were considered able to affect health not only through ingestion and ointments but through smell and sight. Physical visits to places that were

10 Andréasson Sjögren 2025a, 25, 334-337.

11 Andréasson Sjögren 2025a, 28, 223-226, 232-233.

12 Andréasson Sjögren 2025b.

13 Andréasson Sjögren 2025a: 189-191, 196-198; 223-226; Birgitta 2006, 145-146; Birgitta 2012, 60-63, 260-262; Birgitta 2014, 209; Birgitta 1861, 65, 291-292.

green, beautiful and fragrant with good air could preserve and restore health. In another example from *The Revelations of Saint Birgitta* the aristocratic owner of a garden visits it for three purposes: to walk, to eat sweet fruit, and to rest in the shade of a special fruit tree.[14] The fact that *trægardha* and *yrtagardha* could be used for recreation and hosting did not mean that their products were unimportant. Tasty and exclusive cultivars provided an effective way of making an impression on guests, and the range of foods you could eat and serve to household and guests were important, for personal identity as well as successful social relations.[15]

To promote health, the garden needed to be beautiful and pleasant in a divine sense. Beauty was dependent on how well something reflected God's perfect creation, through order, rhythm, symmetry, proportion, harmony, symbolism, light, and bright colours. Beauty was always pleasant, although not everything physically pleasant was beautiful. Beauty could maintain and restore health, while chaos and disharmony were not only disagreeable but harmful. Written in the 1260s, Albertus Magnus's encyclopaedic work on plants, *De vegetabilibus*, describes how to design a garden that promotes health. He begins by discussing the lawn in the middle of the garden, stating that nothing is more refreshing to the eye than green grass that is fine, thick and short. Fragrant and colourful plants should be placed around the lawn. There should also be trees providing pleasant shade, such as apples and pears, although not too close to each other since good air circulation was also important.[16] A similar view on the importance of green vegetation under fruit trees is found in *The Revelations of Saint Birgitta*, where grafting is presented as the best method to renew an *yrtagardher/trægardher* since it avoids disagreeable open soil and pits.[17]

As a source, *The Revelations of Saint Birgitta* is both complex and complicated. While the imagery in this work can be assumed to reflect the personal experiences of Birgitta Birgersdotter (Saint Birgitta of Sweden) ca 1300–1340, the language and choice of words reflects the context when the (re)translation from Latin to Old Swedish was made, in Vadstena Abbey in the 1380s, and the contexts where the oldest preserved copies were made, in the late fourteenth and fifteenth century.[18] Birgitta Birgersdotter (ca 1300–1373) was related to the royal family, being both the daughter and the wife of knights who were also members of the royal council. She was married and had eight children, managed a large rural household, and served as *magistra* and lady-in-waiting to Queen Blanche of Namur, who arrived in 1335 to marry the king of Sweden and Norway, Magnus Eriksson (1316–1374). Lady Birgitta could read and write, and went on pilgrimages with her husband to Nidaros (Trondheim) in Norway and Santiago de Compostela in northwestern Spain. When they returned from their last pilgrimage in 1342, her husband was ill. As a result, they decided to settle close to the Cistercian monastery of Alvastra in Östergötland. When he died in 1344, she stayed, and in the following years received a large

14 Andréasson Sjögren 2025a, 195-198; Birgitta 2015, 170-171.

15 Andréasson Sjögren 2025a, 218-221, 223-226, 334-336; Carruthers 2013; Eco 1986; Kjær 2020; Larsson 2010, 38-40; Skinner & Tyers 2018.

16 Andréasson Sjögren 2025b; Albertus Magnus 1867, 6.

17 Andréasson Sjögren 2025a, 194-196.

18 Andréasson Sjögren 2025a, 156-159, 189-191.

portion of her revelations. In 1349 she moved to Rome and continued her work to establish a new order for monks and nuns. Birgitta was never a regular nun, but her daughter Katarina Ulfsdotter (Saint Catherine of Sweden) became the first abbess of the first Bridgettine abbey in Vadstena, Östergötland, after it was established in 1384.[19]

The *yrtagardher* at Stegeholm

A large proportion of the medieval garden features excavated in Sweden so far consist of garden cultivation-horizons, regularly dug and fertilised with household compost. Other types of features, such as tree-pits, lawns and garden meadows are still very rare[20] but there are a few examples, two of which will be presented here. The first, from the Castle of Stegeholm, is a good example of how every garden is unique, and firmly situated in space and time. It also exemplifies how a shared garden culture sets frames, but at the same time remains flexible. Stegeholm Castle was situated on a small island in an inlet leading from the Baltic Sea to the town of Västervik on the mainland coast, west of the island of Gotland. The garden was situated south of the castle (fig. 1). All information about it arises from macro-remains found in layers of garden waste and re-layered garden soil embedded in waterlogged conditions, among other layers deposited in the shallow water next to the island. The garden remains were identified and dated to the fourteenth and fifteenth century based on their geological composition and finds by Dr Jens Heimdahl, a geologist and archaeobotanist with long experience working with gardens, who also analysed the botanical macro-remains from the soil.[21]

The construction of the castle probably started in the mid-fourteenth century. When it was first mentioned in a document in 1370, it was already in control of its own fief. At this time, it was granted to Albrecht II, Duke of Mecklenburg, who in turn granted it to lesser lords from the north German area. The castle was compact and rectangular; it was easy to defend even with a small garrison. Preserved documents mention a chapel and a *frustuga*, or ladies chamber, which in the Swedish context was a comfortable room to which access was restricted, where the lord and lady of the castle would spend time with family and selected male and female guests. The excavated bone material from the site reflects a varied diet, with a lot of meat and fish. The remains of boar, roe deer and red deer indicate hunting and, together with remains of birds like duck, hazel grouse and western capercaillie, demonstrate that exclusive dishes were served at the castle. Other remains showed that there were three types of dogs at the castle, one small with short legs, one of medium size, and one of wolfhound type. All pottery shards found came from imported goods, mostly from the Rhine-area, as well as some from the Netherlands and England. At the same time, finds of hops (*Humulus lupulus*) and bog-myrtle (*Myrica gale*) indicate brewing on the island, while seeds of flax and hemp have been interpreted as traces of textile production. Layers containing manure and bedding material indicate that cattle, horses and pigs were stabled on the island, although the castle also had a large farm on the mainland.[22]

19 Andréasson Sjögren 2025a, 189-191; Oen 2019.

20 Andréasson Sjögren 2025a, 121-137; Andréasson Sjögren 2025b.

21 Andréasson Sjögren 2025a, 89-91; Palm and Ring 2016; Palm 2017.

22 Andréasson Sjögren 2025a, 89-91; Palm and Ring 2016; Palm 2017.

Among the remains of plants found in the garden-related layers were a large number of typical weeds, but there were also seeds of perennials like columbine (*Aquilegia vulgaris*), belladonna (*Atropa belladonna*), sage (*Salvia officinalis*), oregano (*Oreganum vulgare*), asparagus (*Asparagus officinalis*), motherwort (*Leonurus cardiaca*), wild strawberry (*Fragaria vesca*), henbane (*Hyoscyamus niger*) and ground elder (*Aegopodium podagraria*). Samples of fruit and berries were also found: blackcurrant (*Ribes ingrum*), plum (*Prunus domestica*), blackthorn (*Prunus spinosa*), rosehips (*Rosa* sp.), fig (*Ficus carica*), raspberry (*Rubus idaeus*) and blackberry (*Rubus* ssp. *Rubus*). There were also seeds of the annual black mustard (*Rhamphospermum nigrum*), as well as biennials kale (*Brassica oleracea*) and turnip (*Brassica rapa*). All plant finds must be interpreted in context, individually and in combination. For example, the fig seeds, in this context, probably came from imported dried figs that were eaten and ended up in latrine waste, that was mixed into household compost heaps later used as fertiliser. Black mustard seeds could have been brought to the castle for direct consumption, but the seeds of kale and turnip cannot be explained this way. These vegetables are usually harvested long before they bloom, which makes it more likely that the seeds found are traces of on-site cultivation: either seeds that had been sown, or of plants cultivated for a longer time to produce seeds and continue the cultivation of selected cultivars. Seed production was an integral part of cultivation.[23]

Kale, turnips, and ground elder may seem odd in the mix but, if we take adaptation and choice into account, the garden could have been of the *yrtagardher* type with some modifications based on specific needs and preferences. A garden that did not just produce some things needed in the household but was also used for recreation, hosting and entertaining – probably on more or less the same terms as the *frustuga*. A space where the lord and/or lady spent time and welcomed family and select guests, separated physically and visually from, for example, the soldiers of the garrison. The remains at Stegeholm provide no detailed information about the spatial design of the garden. However, it is possible that columbine, belladonna, sage, oregano, asparagus, motherwort and wild strawberry were grown in an *yrtagardher*, perhaps around a lawn. The same goes for blackcurrant and rose bushes. Plum and blackthorn may have been grown as small trees in the small island garden, providing healthy shade, flowers in spring, and fruit in autumn. The spines, flowers and fruit of raspberry and blackberry may have been appreciated on trellises as well as plank fences around the garden. Ground elder may have been a valued early spring vegetable, providing easily accessible greens for the castellan's table at a time of year when there was little else, and it is possible that the kale and turnips were of special varieties, perhaps from someone's childhood home, and/or of importance in certain dishes. The vegetables may have been grown in beds at the edge of the *yrtagardher* or in a separated area. Either way, it is likely that the same staff took care of all aspects and parts of the Castle garden, including mundane tasks like the creation of compost.[24]

23 Andréasson Sjögren 2025a, 89-91; Palm and Ring 2016; Palm 2017.

24 Andréasson Sjögren 2025a, 89-91, 121-137, 148-151, 223-226, 334-340.

The *trægardher* at Vreta Abbey

The second example was most probably a *trægardher,* an orchard with different types of fruit where recreation is likely to have been an important component. Located at Vreta Abbey in Östergötland, Sweden, it was identified through reinterpretation of results from minor excavations carried out in 1998 and 2005, in combination with studies of maps and written sources from the seventeenth- and eighteenth-century.[25]

The nunnery of Vreta was founded in the 1160s with royal support and the king's sister Ingegerd Sverkersdotter as its first abbess. A new two-storey stone building was erected for the high-born nuns, placed as a northern extension of the choir of the abbey church (fig. 2, left). Directly east and northeast of the nuns' building was a garden. It still existed in the seventeenth and eighteenth century when it was documented in surveys and maps. By then it was called the Old Abbey Garden (*Gamla Kloster Trägården*). In 1619 it had been given separately as a small fief by Queen Christina (regent 1632-1654) to Stellan von Mörner, owner of a large estate in the parish, and his heirs.[26]

Curiously, in the mid-seventeenth century, both the estate and the Old Abbey Garden belonged to count Robert Douglas (1611–1662), general of the contingent that occupied the Krzyżtopór castle in 1655, the location of the garden archaeology conference. He was born in Scotland, but in 1646 he married the heiress Hedvig, daughter of Stellan von Mörner, and in 1655 started building a new great house called Stjärnorp. It burned down in 1789 but is still partly preserved as a ruin. In other words, it is very likely that the count had seen the garden at Krzyżtopór personally, and it is possible that Krzyżtopór was one of several castles that inspired Stjärnorp.[27]

When the Old Abbey Garden was first recorded in maps, it consisted of two parts separated by a fenced road (fig. 2, right). In the northern part there were beds for vegetables and herbs, and in the southern part, next to the former location of the nun's building, there was a meadow with fruit trees (*gräswal med fruktträn*). When excavated, the northern part was found to contain a thick garden cultivation horizon, easily recognised by its homogeneous composition and combination of finds, characteristic of soil to which household compost has been added regularly for a long time. The southern area was quite different. There were no traces of a cultivation horizon, only a layer of sandy humus, interpreted during the excavation as the original soil surface. This, however, is not surprising if the area was an orchard, with a ground cover of green grass and flowers beneath the trees. Digging and fertilisation would not have benefitted the perennial meadow-grass and meadow-plants, thriving in lean well-drained soil. The results can be compared with the soil conditions in another garden investigated in southern Norway at the eighteenth-century manor of Fossesholm, where the same differences were found between the beds in the formal garden and the soil in the adjacent orchard. In the few narrow trenches that were excavated at the Vreta Abbey, there were no pits that could be re-interpreted with certainty as tree- or planting-pits. But it is likely that more traces of the orchard could be found by carrying out a ground penetrating radar survey

25 Andréasson Sjögren 2025a, 108-111.

26 Tagesson et. al 2010; Andréasson Sjögren 2025a, 109.

27 Modén and Feldt 2010; Kuls 2014.

(GPR), followed by limited excavation employing new research questions and hypotheses relating to the likely appearance of the garden remains.[28]

Lawns as turf constructions

Garden archaeology has come a long way in Sweden in past decades, but there are still many aspects of gardens that require further research, for example lawns and garden meadows. It is probable that most medieval *yrtagardha* and *trægardha* of the type created to encourage healthy recreation contained an area with a lawn or meadow shaded by fruit trees. *The Revelations of Saint Birgitta* indicate that the green ground cover was important enough to make grafting a preferred method when renewing the trees in these, since it avoided digging that would have made the garden unattractive. The limited knowledge gathered from excavations, including the evidence from the Vreta Abbey, points in the same direction. It is likely that there were ways to manure only the trees without creating too much damage to the flowering meadow below. However, it should be noted that according to medieval writer Albertus Magnus less fruit was quite acceptable in *viridaria*, or gardens of health, since fruit production was not the most important feature in these gardens.[29]

In *De vegetabilibus* (dating from the 1260s) Albertus Magnus also gave precise instructions on how to make a lawn. He began by stating that the lawn needs compact, lean soil: *humo macra et solida*. It should be noted that the often-used translation of this passage by architectural historian John Harvey (1981) contains a mistake, since the Latin word *macra* means lean, not rich.[30] The difference is important since it determines which plants can thrive in the constructed environment. First, you carefully weed and level the ground and treat it with boiling water to make sure all seed and roots are gone. Next, turves of carefully selected sheer grass are collected, laid out and compacted thoroughly by trampling and beating with wooden mallets until the turves can hardly be distinguished from each other. If you follow this process, the grass will grow back sheer and beautiful like green cloth.[31] In England, there are surviving royal accounts that show how cartloads of turf were procured when lawns and grass benches were made or renovated in royal gardens. Possibly, a 2012 GPR survey of the "Pleasance" at Kenilworth Castle, a separate enclosed garden in the marsh constructed by King Henry V, may indicate that the heavily compacted soil of lawns can be found via this method.[32]

Collecting and laying out selected turf has remained a common method to make lawns well into modern times. If grass was also sown in medieval gardens, and if so how, and to what extent, is still largely unknown. In Sweden, the earliest written sources that mention the sowing of lawn grass are from the eighteenth and nineteenth centuries.[33] An interesting example of large-scale sowing of imported grass seed from Central Europe seems to be related to the establishment of green ground covers in the more or less wooded environments of landscape parks founded between 1750 and 1920.

28 Andréasson Sjögren 2010; Andréasson Sjögren 2025b; Tagesson 1990 and 2006; Tagesson et al. 2010.

29 Albertus Magnus 1867, 636; Andréasson Sjögren 2025a, 97-98, 194-196; 2025b.

30 Harvey 1981, 6.

31 Albertus Magnus 1867, 636; Andréasson Sjögren 2025b.

32 McLean 1981; Jamieson and Lane 2015.

33 Andréasson Sjögren 2025b; Seiler 2020: 94-97, 101-105.

Studies by botanist Dr Torbjörn Tyler of Lund University have provided new insights on this subject through surveys of the grasses and plants still growing at 700 such sites. In some ways his research resembles historical garden archaeology, in that it is based on physical evidence, the relict plants, which he relates to other types of sources, among them written evidence.[34]

Another interesting passage on lawn-making was written by the French gardener André Mollet. In *The Pleasure Garden* (1670) he states that the best turf comes from pastures where sheep graze. The grass is cut with a lawn slicer in straight lines, rolled up, rejoined in the garden, and beaten down with lawn beaters (fig. 3). This method has been tested in practical experiments at the Gunnebo manor in Sweden as part of the dissertation project developed by Dr Joakim Seiler and published in 2020. An interesting clue about which type of grass Mollet meant by his reference to sheep pasture is the Latin name of the species Sheep's Fescue, *Festuca ovina* (*ovium* means sheep in Latin) given by Carolus Linnaeus (1707–1778). In 1803, this species was described by another botanist, J. W. Palmstruch (1770–1811), as a short grass with delicate narrow blades that thrives on dry, lean soil and is suitable for lawns because, when rooted, it forms a thick turf that is easy to keep.[35]

To find and study more types of garden remains we need to develop hypotheses relating to their characteristic traits, based on what is known of their construction, management and use throughout history. From an archaeological point of view, the lawns described by Albertus Magnus and André Mollet were turf constructions. If undisturbed by later activities, it should still be possible to distinguish the turf layer, which has been brought in and laid out, from the thoroughly prepared soil beneath, especially if the micromorphology of the layers can be studied by a specialist. We can expect the soil to be lean and compact, with no digging or manuring occurring after the first thorough digging, weeding, and levelling carried out during construction. If the lawn was irrigated, we can expect to find traces of this process, such as remains of water fleas (*Daphnia* sp.) in the soil. There may also be macro- and microfossils and phytoliths. It thus becomes necessary to pursue careful, contextual excavation methods as well as interdisciplinary cooperation, including expertise from fields like archaeobotany and geology as well as specialists who study the maintenance of historic gardens using historical sources and experimental methods, such as Dr Seiler and his team at Gunnebo.[36]

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Map (Figure 2, right): 05-vre-45. Storskifte 1775, Vreta klosters socken *[Great partition of 1775, the parish of Vreta kloster]*, Lantmäterimyndighetens arkiv

34 Tyler 2024; Solberg et al. 2013.

35 Mollet 1670; Mollet and Lundquist 2007; Palmstruch 1803, 78; Seiler 2020, 92-93.

36 Andréasson Sjögren 20025b; Seiler 2020; Heimdahl and Krupski 2024; Malek 2013.

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Fig. 1 The ruins of Stegeholm, Östergötland, from the east. The island was connected to land by bridges to the north and south. The only prominent castle doors were facing the east and the Baltic Sea. The medieval garden was situated south (left) of the castle. The island was smaller in the Middle Ages.

Photo: Leif Gustafsson, L. G. foto, 2007. CC BY-SA 4.0 DEED

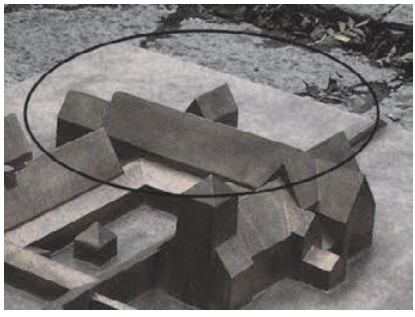


Fig. 2 Left: Bronze model showing the Vreta Abbey at the end of the Middle Ages. The black oval marks the nun's building with the garden area beyond. Photo: Håkan Svensson, Xaua, 2003. Right: Detail from a 1775 map (05-vre-45). The Old Abbey Garden is marked C.



Fig. 3 Left: Laying the turf and using the turf-beater on the Mollet lawn at the Gunnebo manor in the autumn of 2017. Right: The Mollet lawn at Gunnebo in May 2018.

Photo: Joakim Seiler

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Aja Guldåker

From the mind of the priest Jacob Nicolai Wilse to copper engravings depicting Norway's oldest documented garden.

Various aspects of surveys of Norwegian historic gardens

Timber has been one of Norway's largest exports since the mid-sixteenth century, creating opportunities to come into contact with the latest trends concerning gardens and other areas of scientific interest. The Nordic countries benefitted from the exchange of knowledge, especially the upper class, priests and teachers who communicated by mail and travelled in Europe for commercial and educational purposes. Seeds and seedlings were sent by post and studied in Norway's Siberian-like climate. The first known person to create a formal landscape garden in Norway was Jacob Nicolai Wilse, a Danish priest who worked in Spydeberg, east of Oslo, between 1768 and 1786. He commissioned copper engravings showing views of the garden, and documented various scientific observations. Over two hundred years later, archaeological investigations were carried out to clarify the garden layout and to determine if the engravings could be trusted. The results are discussed together with findings from similar contemporary and later gardens.

LANDSCAPE OR GARDEN archaeology was not a possible area of specialization at Lund University when I studied archaeology in the mid-1990s. In spring 2004, a short course was offered, covering green cultural heritage at the Swedish University of Agricultural Sciences. An archaeological survey of a garden in Norway was announced as part of the classes and volunteers were sought.

I travelled to Norway's historic gardens that year and participated in the excavation at Bogstad Manor, north of Oslo, learning there about garden archaeology. Two days before the trip, I received a phone call from the director of the

estate, asking if I would consider leading the survey rather than just participating. It was my first encounter with garden archaeology.

Today, I work at Kulturen in Lund, a cultural history museum in southern Sweden, where my main focus is medieval urban archaeology with an integrated view of green issues. Garden archaeology is carried out in the form of consultancy and has no national boundaries. A single, context-based method is used for making surveys and the work is always done in cooperation with local actors such as landscape architects and clients, who are often small local museums.

This article offers a brief overview of almost twenty years of garden archaeology in Norway. Although the sites differ considerably in terms of location and period, they share certain similarities, which makes it clear that contacts must have been established among creators of gardens, both at a national and international level (fig. 1).

Bogstad Manor – a Masonic English landscape park from the eighteenth century

A farm was built at the site of Bogstad in prehistoric times and was in use until the early Middle Ages. It was abandoned for a long time after the arrival of Black Death in 1349–50. Under the Catholic rule of the Hovedøya Monastery, it was a tenant farm. Following the Reformation in 1536, however, it was transferred to the Crown, along with the rest of the church estates. The history of Bogstad Manor began in 1649, when it was acquired by the first private owner, the bailiff Morten Lauritzen, who passed it on to his descendants, the Leuch family. During the recurring wars of the seventeenth century, Lauritzen made large loans to the state, which were not repaid. As a result, he was rewarded with deeds to Bogstad and other farms in Sørkedalen. Thus, the Nordmark Estate was created, which included both agricultural and forest properties. It provided the basis for sawmills and the timber trade, industries that developed rapidly in the seventeenth century.

There were four generations of Leuchs in Bogstad.[1] The last owner, Morten Leuch, managed Bogstad Manor from 1756 to 1768. He moved one older building into the garden and used it as a meeting place for Freemasons. The building may date back to the Middle Ages, a period that attracted general interest in the mid-eighteenth century. According to Madeleine von Essen, who studied archives to outline the history of the garden in Bogstad, it was common in England to use Gothic buildings as hermitages in gardens. Jan Peder Anker, a relative of the Leuch family, took over in 1772. Although he later became Norway's first prime minister, he was previously a skilled industrialist and authorizing officer who owned and managed Bogstad as an ironworks and forestry operation with great economic benefits. As a politician, he took part in negotiations with the Danish and Swedish royal families in 1814.[2]

The vicar Jacob Nicolai Wilse, himself the owner of a small formal baroque garden, wrote an entry for a German publication in 1783, describing his visit to Bogstad Manor before 1776. On this occasion he was shown around by Jan Peder Anker. Judging from the account, Anker had not yet redesigned the baroque garden as an English landscape park. For example, the travelogue does not mention ponds. What is interesting, however, is that there is a connection between Wilse's baroque

1 Von Essen and Espeland 2009, 16.

2 Von Essen and Espeland 2009, 16.

garden at Spydeberg and Bogstad. In fact, experiences were exchanged in terms of garden design and plants suitable for the Nordic climate.[3]

Both Morten Leuch and Jan Peder Anker were members of the Masonic Order, a secret male organization whose symbols could be inscribed in the garden.[4] The symbolic language of the Freemasons is still unofficial and only members can fully recognize such elements in a garden. Thus, only a limited number of wealthy initiates can read a masonic garden.

The ponds at Bogstad may have existed before Morten Leuch's time. An inspection report from 1765 mentions two old, overgrown fish ponds, which were later found to have been cleaned.[5] The ponds surveyed in 2004 may have been cleared before the mid-eighteenth century, meaning that any sediments and archaeological finds from before 1765 were probably removed. The main purpose of the archaeological survey was to obtain information about the ponds that existed in the late eighteenth century. A map from 1817 shows three ponds shaped like the letter 'S' but contains no mention of their depth or the material used to make them. Thus, we have no clue whether there were stones on the edges, what happened when water levels were high, or whether there was an overflow system to redirect excess water.[6]

Despite descriptions found in historical sources, only proper excavation works can reveal the construction of the ponds and prove they really existed. At Bogstad, a ground radar survey would have been helpful in locating the pond system along with possible inlets and outlets. High resolution elevation data would also have been excellent. However, the survey was undertaken in 2004 when these methods were not commonly available in Norway.

Participants in the excavation came from a variety of professional backgrounds but all shared an interest in garden history. They included students of landscape architecture, archaeologists, garden historians and professional landscape architects from both Norway and Sweden (fig. 3).

The extent of the ponds was established after discovering a stone wall that turned out to have been used as a cascade and a terracing element in the dam system. In one pond, a wooden box was found. Several interpretations were proposed. One suggestion was that the roots of water lilies were placed in the box to protect them from freezing in winter. Another idea was that the box could be filled with fish in order to maintain a close source of fresh food. No soil samples were taken for macrofossil analysis as this was not included in the costs of the survey.[7] Today, soil samples are always included in the cost estimate when a survey is planned. Seeds from cultivated plants, imported plants, processed plants, and soil improvement efforts, together with the presence of small aquatic animals, may indicate irrigation or the presence of running water, and can lead to further discussion about the use of the site.

In 2005, participants began to explore the supposed site of a small house by the lake Bogstavannet. Several paintings showed a small building located there, but differing in their depiction of its size and design, which raised the question

3 Von Essen and Espeland 2009, 49.

4 Von Essen and Espeland 2009, 53-54.

5 Von Essen and Espeland 2009, 33.

6 Olofsson Breckoff 2004.

7 Olofsson Breckoff 2004.

whether there been a building there at all (fig. 2). Upon survey, several foundation stones were found under the turf, revealing a small house. An old local tradition of using stone pillars for levelling the ground was used to construct this building, indicating deeper history, also in relation to gardening.[8]

Thulstrupløkken – a royal public park on the Bygdø Island

Bygdø Kongsgård, or Ladegaardsøens Hovedgaard as it was known before 1878, was planned and designed as a public park for the residents of Christiania (Oslo) in 1837. The initiative came from King Carl Johan when he bought Ladegaardsøens Hovedgaard from the Norwegian state in 1837. Today the area is managed by the Folk Museum and consists mainly of a pasture with some trees. One area is called Thulstrupløkken, named after Dr Magnus Andreas Thulstrup (1769–1844), a Norwegian physician who would occasionally rent the King's land.[9]

An unusually large number of historical maps are available for this area, with fourteen plans from 1816–1921. It is unclear whether all the plans were realized; however, there was determination to find out more about the pathways, their construction, location and material.[10]

A garden archaeological survey was carried out in 2005 by volunteers from a variety of backgrounds. Several archaeologists took part but most participants were landscape architects. Several trenches were opened, revealing many different types of paths forming a spider's web and having no clear dating (fig. 4). Eventually, analysis of stratigraphic relationships along with comparison of materials and construction methods helped to situate the pathways both spatially and temporally (fig. 5).

Spydeberg vicarage – a small formal Baroque garden from the eighteenth century

Jacob Nicolai Wilse was a Danish vicar in Spydeberg in the years 1768–1786. He also worked as a scientist and was active in the building of the new nation. In order to develop an overview of the area, he drafted a map of the parish, including his own garden, although the scale he used made it very small (40×50 mm). For this purpose, certain copper engravings and written sources were also used for the purpose of reconstruction. The Spydeberg vicarage is now known as Norway's best documented garden from the 1700s. The main building, barn and garden were listed in 1991 by the National Heritage Board. In 2007, the Spydeberg vicarage was bought by a foundation, which is now responsible for its management (fig. 6).[11]

The 1770s were a period when Norway wanted to separate itself from Sweden. Negotiations that took place inside the buildings could have been continued in a more relaxed atmosphere while strolling in the garden. The area was also used for research and experiments organized around specific plant zones and areas of interest. Contacts with scientists seem to have been an important element in the eighteenth century as practical studies were carried out in the gardens, where special areas were designated for this purpose. Spydeberg was also one of two places in the country to report weather data to international societies in 1789.[12] Wilse also contributed to German

8 Olofsson Breckoff 2005.

9 Fredriksen 2012.

10 Guldåker 2005.

11 Guldåker 2012.

12 Guldåker 2012.

publications, describing his experiences of a visit to Bogstad Farm in 1776.[13]

One of Wilse's scientific contacts was the Swedish botanist Carl von Linnaeus, who sent him plants to see if they could survive in the Siberian-like climate of Spydeberg. Parts of the garden were therefore used for experimentation.[14]

Wilse was inspired by the Danish scientist, Tycho Brahe, an eccentric investigator who put the island of Ven on the world map in the sixteenth century. On Ven, Tycho established one of Europe's first institutions for empirical research.[15]

In 2011, turf was lifted at Spydeberg in order to establish the structure of the vicarage garden. It was important to determine the location, width and material of the paths, as well as the size of the garden and the design of its buildings and ponds. The area was not suitable for ground-penetrating radar; instead, narrow trenches were dug to avoid damage to the existing garden. Many structures were discovered along with the top material of the paths. In one area of a small pond, soil samples were retrieved from bottom sediments. Analysis showed that the pond had been cleaned, suggesting that the water was used for drinking as well as irrigation. It means that this was not a duck pond, as some previously thought. Seeds of basil thyme (*Acinos arvensis*) and raspberry (*Rubus idaeus)* were also found there, probably originating from the kitchen garden.[16]

As a vicar, Wilse received visitors in his own house, which probably had private and professional functions. Outside it was a turning-point for carriages, where visitors could either enter the house or walk into the garden. Was the garden open to everyone? Two postholes mark the position of the gate, meaning that the garden was closed and an invitation was required. The next location is the 'science hill' where weather observations were made and reported to international forums. The hill was close to the building and dedicated to scientific use. It was also situated higher than the rest of the garden. From a distance it would look good to see Wilse working on the hill (fig. 7).[17]

In 2013, survey covered the location of a small summerhouse and a carp breeding pond. Excavations were carried out to establish the scale and material of the summerhouse and surrounding gardens, as well as the small spawning pond. When I returned to the site in 2018, the summerhouse was already rebuilt on the basis of findings from the archaeological survey, but the fence and the pond were yet to be reconstructed.[18]

The above-mentioned engravings show different views of the Spydeberg vicarage and its formal garden. Although they seem to provide lots of information, it remains doubtful whether they are reliable. Written sources indicate that Wilse was not entirely satisfied with the engravings when they returned from Hamburg, where they were made.[19]

At a reconstruction seminar held after the excavation, it was discussed whether all structures shown in the engravings really existed. Opinions differed whether reconstruction works should follow copper engravings or archaeological findings.

13 Von Essen and Espeland 2009, 49.

14 Guldåker 2012.

15 For more on the Danish scientist Tycho Brahe, see: Om Tycho Brahe - Landskrona stad, https://www.landskrona.se/uppleva-och-gora/kultur/tycho-brahe-museet/om-tycho-brahe/.

16 Guldåker 2012.

17 Guldåker 2012.

18 Guldåker 2012.

19 Guldåker 2012.

The 40×50 mm miniature map proved accurate and helped to establish clear boundaries of the formal garden. Today, visitors can walk along paths that were hidden under grass since the eighteenth century, while the crunch of gravel can be heard along reconstructed garden routes, similar to the ones Wilse followed in 1779.

Ner-Killingberg – a teacher's garden from the 1890s

Living outside urban centres has been common for most Norwegians. Nevertheless, by the end of the 1880s there were national and international influences on gardening and its adaptation to local conditions.

In 1834, a log house was built on a high hill just outside the small village of Leksvik, 64 kilometres north-east of Trondheim, with a wide view over the fjord and the nearest village. When the teacher Johan Killingberg moved to the farm around 1890, the log house was filled with colorful paintings in the spirit of national romanticism.[20]

The ornamental garden at the farm was probably created in the late 1880s, when it was uncommon to develop such elaborate farm gardens. It was laid out in landscape style on terraces along a steep slope to the south, with rich greenery in between. Little was done to the garden after 1920 and it is likely that planting material and remnants from before 1920 have survived there. The garden was important both for the household and for Johan Killingberg's work as a teacher, because it was the place where he trained his students of gardening in the cultivation of both berry and ornamental gardens. In the 1950s, the farm was abandoned and the garden fell into disrepair. Recently, a small museum was established at the site and a voluntary association looks after the buildings and garden.[21]

The museum holds few historical sources about the garden. A photograph from 1910 shows a well-dressed family standing in front of the main house, with the garden, flower beds and paths in the background. The museum also has a 1961 aerial photograph showing the farm. A large Douglas fir flanks the main house, while the kitchen garden appears to be in use, although the farm had been already abandoned for some years. There are also several written sources, which provide some idea of what the garden looked like before it was abandoned. There is, however, no known map showing the layout of the garden.[22]

In 2013, an archaeological excavation was carried out in the overgrown garden. Its aim was to find out more about the structures, materials and construction. It was complicated because the terrain limited the possibility to move around, either by excavator or on foot. Self-seeded trees and bushes also limited the survey. The first step was to clear the vegetation in a controlled manner. After that, work began to facilitate moving around in the garden. The site was terraced with natural rock outcrops here and there. High-accuracy RTK/GPS technologies were employed to determine pathways and patterns of wheelbarrow or horse-drawn transport. An excavator was then used to dig trenches and find traces of possible footpaths, along with paved roads and cultivation remains. The end result was a map showing the different patterns of movement, together with stairs and seats carved in natural rocks. Studying and measuring movement patterns in difficult terrain was an interesting but

20 Guldåker 2014.

21 Guldåker 2014.

22 Guldåker 2014.

challenging way to understand and recreate the historic garden at Ner-Killingberg (figs. 8, 9).[23]

Using archaeological methods it is possible to find buried deposits that show what happened over a long period of time. This can give structure to a garden without a map, and helps in subsequent reconstruction by showing how much mass needs to be removed. The report presents a complete section outlining all layers, along with a description. A version was then developed in which all later cultural layers were removed, leaving only those contemporary with the garden. This was supplemented with photographs showing the gravel material, the collected plant seeds, and the boundaries of overgrown beds. Ultimately, this became a reference for the landscape architect developing the subsequent reconstruction proposal (fig. 10).[24]

Parts of the garden are now being reconstructed by volunteers associated with the nearby museum at Ner-Killingberg. The site of the museum in the countryside, far from the larger city of Trondheim, has made it a focal point for local events. Today, after the buildings were restored, it is used for concerts, community celebrations and other events. There is also a large area outside and clearing the vegetation opened fantastic views of the Trondheimsfjord.

Ulefos Hovedgaard – an English landscape park from 1810

Ulefos Hovedgaard in Ulefoss, Telemark, was built in 1807-1817 and is considered Norway's most important Empire-style building. Since 1989 Ulefos Hovedgaard has been managed as a foundation, with the owner Niels Cato Aall playing a central role. Telemark Museum runs it in cooperation with local groups that help with gardening and other maintenance tasks. Ulefos Hovedgaard is situated on a hill above Eidselva, north-west of the small village of Ulefoss. To the south and east of the main building there is a terraced garden in English style from the early nineteenth century. The garden is not listed but the buildings are. The English landscape garden was laid out in 1810–1815 by Niels Aall and the Swedish gardener Peter Holmström.[25]

In front of the south façade, which features colonnaded portals, there is a semicircular terrace, 2.5 metres high. The view that extends from the village and especially the upper terrace towards Norsjø is magnificent. The terrace has a more formal character than other parts of the park. On the slope to the south and east, the landscape park spreads out with lawns and winding paths beneath mature trees, mostly oaks. One of the oldest smoke-heated greenhouses in Norway is located at the main farm. The park is continuously maintained, albeit in a simplified form.[26]

Much of Telemark is covered in forest, which is occasionally interrupted by water in the form of rapids and lakes. Only several fields and meadows break up the hilly terrain. In prehistoric times, wood from the forest was a resource mainly used by farmers for their own needs. In the Middle Ages, merchants from the Netherlands arrived to exploit the timber supply, and bought large quantities of it. The nearby pine and spruce forests were felled and floated down to the harbors to be turned into beams and tables. From the sixteenth century, production was expanded when the water saw made

23 Guldåker 2014.

24 Guldåker 2014.

25 Guldåker 2015.

26 Guldåker 2015.

the processing of logs more efficient and a number of sawmills were established in Telemark.[27]

The Great Fire of London in 1666, which destroyed more than 13,000 houses and 87 churches, created a huge demand for wood. The supply of timber in England was limited and led to a lively trade with Norway. A Dane called Jacob Aall travelled to London and earned an income by importing Norwegian timber. In 1712, his son Niels travelled to Norway so that the company could better control the supply of raw materials. Niels Aall soon realized the importance of associating with prominent figures in legal and social circles. His knowledge of English, Dutch and French facilitated establishing contacts in the timber trade.[28]

At the turn of the century, Niels Aall's grandson, also named Niels (1769–1854), could already look back on a long-standing and profitable family business. The period after the French Revolution was profitable for Norwegian merchants, as they were able to meet the high demand for timber cargoes and ship accommodation. As part of his inheritance, Niels was given the Ulefos farm with its four sawmills, four mills, and several houses by the rapids. He was also given several loading berths, ships, ship charters, as well as a number of farms and forests in Telemark.[29]

Despite the impending hardship, Niels fulfilled his dream of a summer house on the hillside behind the Ulefoss farm. The summer house would rise above the working area of the sawmills, and the site would offer a magnificent view of the entire region. The building would radiate patriotism, position and strength, but at the same time would be a convenient, modern building as well as a place for experiencing nature. The construction of the summer residence began at the end of the 1800s. Both the exterior and the interior were strongly influenced by European styles. Large quantities of building materials were transported up the rapids, as wood was to be replaced by stone. Since there was no widespread tradition of building in stone, skilled craftsmen had to be hired. The entire project was expensive, even though waste material was used in the form of slag from the ironworks.[30] The construction of the park around the summer residence probably began at the same time as the construction of the house at the turn of the century. A lot of stone was needed for the house and the terraces. The natural rock face had to be altered to create large flat areas to the south and east of the building.[31]

The English landscape style was popularized in Norway after some delay. It was adapted to local conditions and inspired by the cultural landscape, also coinciding with a strong national romantic movement. After the eighteenth century, when much inspiration came from symmetrical baroque gardens, there was a desire to return to a more natural idea of parklands, which was more suitable for the Norwegian environment. Trees would no longer be planted in straight rows and paths would meander through the park to create new views and lines of sight. Seating scattered along the paths was an important feature, and a tradition of garden furniture developed that had not been very prominent before. Ornamental borders in baroque style were often replaced by useful plants. In the case

27 Guldåker 2015.

28 Sellæg 2007, 19ff.

29 Sellæg 2007, 41ff.

30 Sellæg 2007, 54ff.

31 Sellæg 2007, 60ff.

of Ulefos Hovedgaard, the baroque ideals and the English landscape style seem to have complemented each other. The upper terrace in front of the Garden Hall in the main building was more in keeping with the baroque requirement for symmetry, with tapestry borders shaped in organic forms, while the park to the east and south of the hilltop was akin to a romantic English landscape park.[32]

In 2015, an archaeological survey of the garden was undertaken. One aim was to clarify earlier designs of the park, such as edges and transitions between gravel and cultivated soil. The main priority, however, was to identify the boundaries of existing path systems in the park, to determine the paving and construction of the paths wherever possible. The existing main path was found to have a lateral offset with a ridge in the centre for water drainage. Several other pathways were located beneath the existing turf. Material samples were collected. A stone staircase was located at the point where some protruding stones were noticed in the turf (fig. 11). Stone steps were part of the layout of the park but were then covered with a layer of soil. Several paths in the orchard were found to be 1.50 metres wide with kerbs at the sides filled with clay. One trench revealed a filled-in carp pond with an adjacent paved path between the pond and the orangery. An earlier structure emerged, boasting a more organic form, with clear evidence of soil improvement measures using charcoal as a nutrient and gravel to loosen the thick clay soil. A three-way junction in the path system was documented, with a paved gutter on one side, meant to direct rainwater.[33]

32 Guldåker 2015.

33 Guldåker 2015.

The Fossesholm mansion – an eighteenth-century baroque garden

The garden at Fossesholm was probably laid out during the period of Jørgen von Cappelen's ownership from 1763 to 1785. After 1822, when Fossesholm was divided into two farms, it seems to have been used more extensively, also as an orchard. The only known historic map of Fossesholm is from 1789 and shows a large garden divided in two parts south of the farm; in the upper part, the cartographer placed a small building on a round island surrounded by what appears to be a small moat. Historical sources indicate that there was a garden at Fossesholm even before Jørgen von Cappelen arrived at the farm. The first mention of the garden comes from 1741, when the manor was to be divided into two parts of equal agricultural value.[34] Over two decades later, after Jørgen von Cappelen took over, an inspection report from 1764 mentions that there was a fenced kitchen garden with fruit trees and two hotbeds.[35] The garden is also mentioned in passing in an inspection report from 1765 (fig. 12).[36]

The garden at Fossesholm Manor is probably the best researched eighteenth-century garden in Norway. At the time of writing, results of archaeological excavations conducted in 2022 and 2023 are still being processed. Earlier excavations were carried out by other archaeological contractors in 2009, 2011 and 2016.[37] Subsequently, two ground-penetrating radar surveys were carried out by two different contractors

34 Andréasson 2011, 5.

35 Von Essen 2010, 18ff; Sørensen 1982, bind II, vedlegg: 51.

36 Andréasson 2011, 5.

37 Andréasson 2010 and 2011; Karlberg 2016.

in 2012 and 2022.[38] The report that is being compiled takes into account the previous surveys in an attempt to provide a total overview of the garden site. However, because of different methods used in research, the results cannot be fully integrated.

The ground-penetrating radar surveys were of great assistance in the 2022–2023 excavations, although the results have not been reported. The 2012 GPR results have been made available, and the operator has interpreted the encountered anomalies. Unfortunately, there is no mention of depth, so only one interpretation is presented. However, the advantage is that the data is GPS-positioned, allowing it to be matched with other findings. The 2022 ground radar survey has been presented in a series of images at different depths, but no interpretation or GPS positioning was included. The survey from 2022 also covered a much larger area than in 2012, allowing researchers to determine the original extent of the garden.

Drainage pipes were documented in several places during the archaeological excavation of 2011, while the ground-penetrating radar revealed anomalies at the same location in 2012. The 2023 archaeological excavation revealed that there was drainage at the bottom of a long, narrow, cultivated area with a wide gravel track on one side and terraced land on the other. This revelation means that the reconstruction has to follow different elevations and configurations. The ground-penetrating radar survey in 2022, in turn, provided information that the drainage extended much further south and that there were parallel anomalies. Suddenly, here was an answer to the distribution and structure of the garden over a large area, without the need to excavate. Similar anomalies were revealed by the ground-penetrating radar survey in 2022, showing that there were several terraces built in a similar way. By understanding the structure of one site through ground-penetrating radar and archaeology, it became possible to understand other areas.

Soil samples taken during the 2022 survey contained spruce needles. In fact, these trees were used at several eighteenth-century sites in the north and may have been used at Fossesholm.[39] Red-berried elders (*Sambucus racemose*) were also common in soil samples. These shrubs are ornamental and produce red berries at the end of the summer. The plant is indigenous and was used in garden facilities already during the seventeenth century.[40]

Builders of the new nation

Creators of all gardens described above had several things in common. They were all prominent men. They were all educated and well-connected, both nationally and internationally, outside Norway. Many came from wealthy families who had made fortunes in forestry, sawmills or ironworking. The eighteenth and nineteenth centuries were shaped by strong national romantic currents, which determined what was to become the new Norway. The various gardens can in part be seen as symbolic exclamation marks, not only showing extensive knowledge of European trends but also adding Nordic features.

38 Löcker et al., in prep.

39 Nilsson and Westerlund 2019, 6.

40 Wahlsteen 2007, 34.

Methods and expertise required to carry out archaeological surveys of gardens

Firstly, a ground-penetrating radar survey should be carried out if the surface allows. The depth of any anomalies should be recorded and positioned using GPS.

An inventory of existing vegetation should be made to identify any older plants that may have survived from the original site. The person carrying out the inventory should have a background in horticultural history as well as botanical knowledge.

Archival studies of historic maps, photographs, letters and other evidence related to the site should precede an archaeological survey.

A survey of recesses, heights, stones, edges and other features that may indicate the remains of a garden should also be undertaken. High-resolution elevation data can help to find many traces of an old garden. Shadows and elevations can indicate ditches, roads and planting beds.

Fieldwork and reporting of survey results require the participation of an archaeologist with sufficient knowledge of garden history. With the right excavation methods and sampling, it is possible to learn a lot; with the wrong methods, crucial evidence may disappear as soon as the excavator touches the ground.

Working closely with persons responsible for reconstruction ensures the quality of reconstruction process. Different professionals look at the same garden with different eyes and their unique insight can provide specific information.

An archaeologist can provide an interpretation of the structures found. However, this may involve several phases. It is up to the client to use the information and decide about the reconstruction.

I would like to thank all the clients, museums and landscape architects who have welcomed me in Norway for almost twenty years. I would also like to thank Riksantikvaren (the National Heritage Board), who have successfully promoted the study of historic gardens and contributed to their protection.

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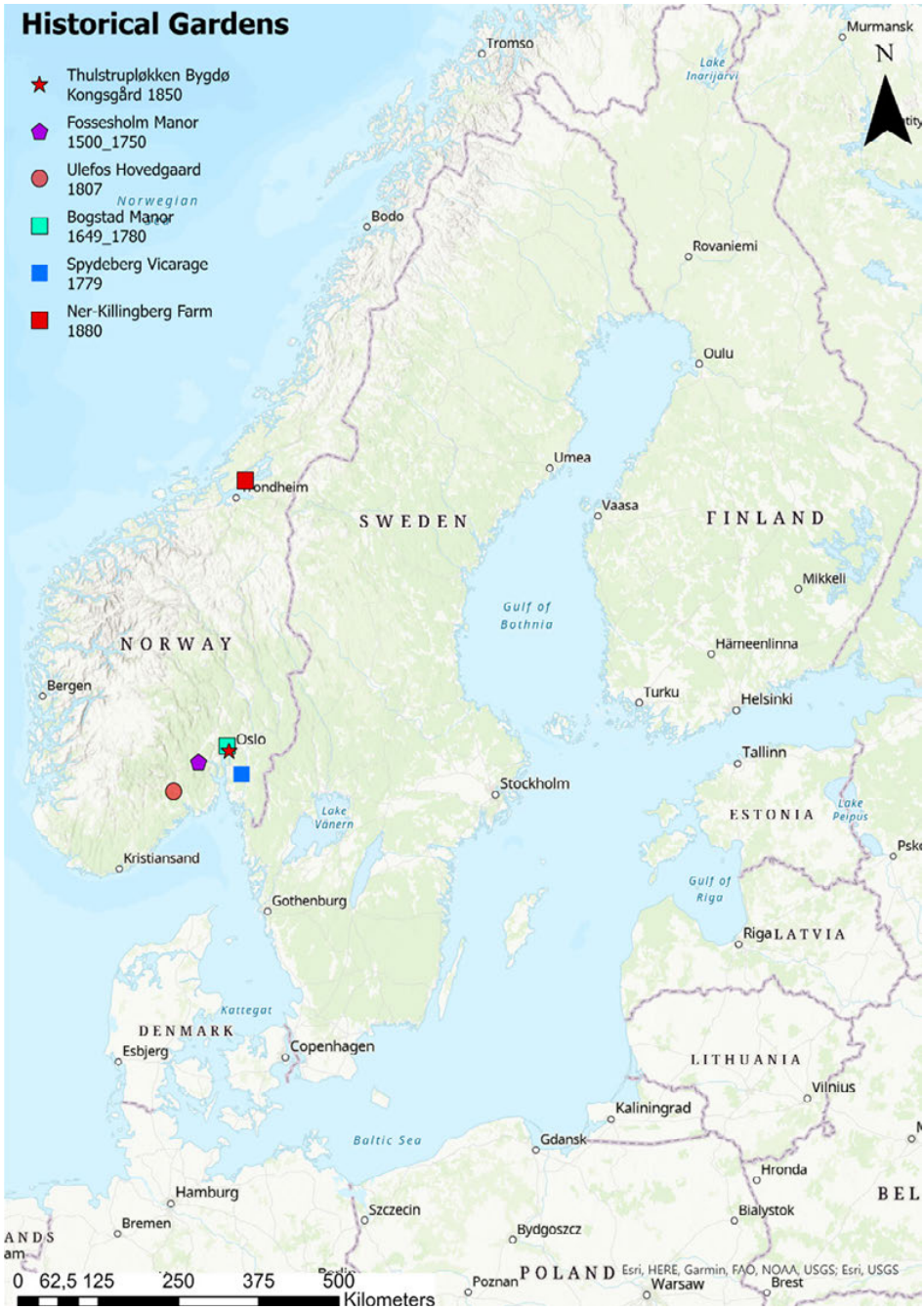


Fig. 1 Map of Norway showing historical gardens discussed in the text.

© Esri. Basemap with complementary GIS layers by Aja Guldåker



Fig. 2 Earliest known painting of the Bogstad Farm by Elias Meyer, 1754.

Source: Oslo Museum CC BY SA 4.0 https://digitaltmuseum.org/021045471156/bogstad-gard-gouache



Fig. 3 Participants discussing the archaeological excavation of ponds at the Bogstad Farm in 2004. The stone packing turned out to be the terracing of the pond and a cascading wall.

Photo: Jacek Robert Leski, 2004

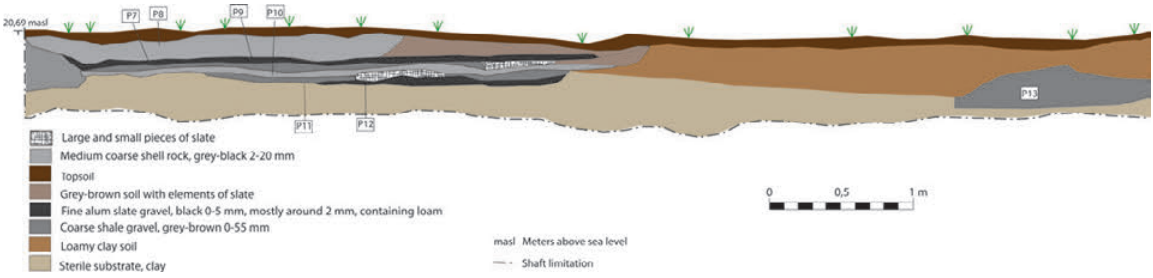


Fig. 4 Thulstrupløkken. Section drawing showing paths from different periods.

Drawn by Aja Olofsson Breckoff



Fig. 5 Thulstrupløkken 2005. An undated historical photograph showing a tree in a roundel with two benches as well as a path. The tree was still there in 2005 but without the seats and pathway. Details from the undated photograph are copied and superimposed on a modern photograph (cf. Arnt Hauen, Det gamle *Christianias folkepark Havekunst*, 1951, 29).

Photo: Aja Olofsson Breckoff, 2005

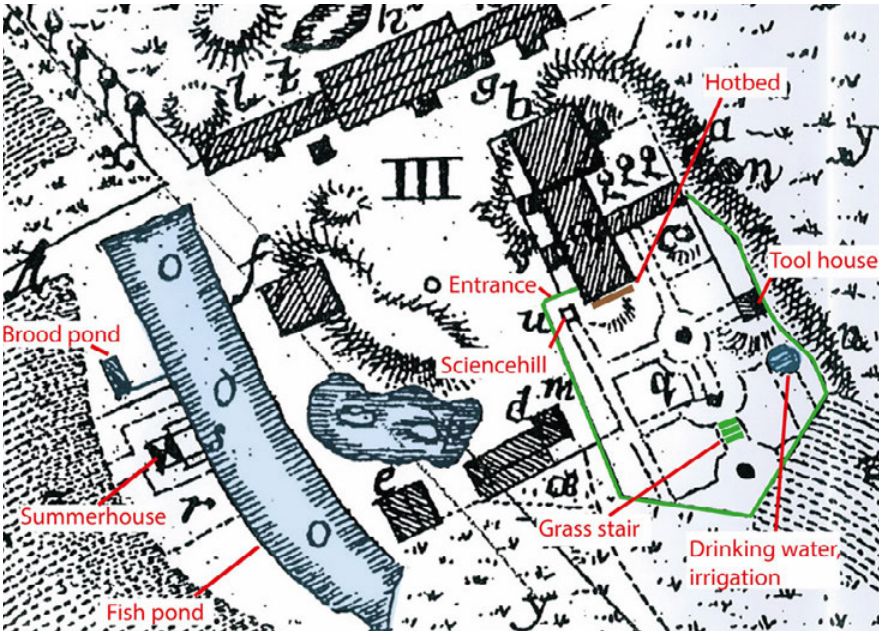


Fig. 6 Detail from Wilse's parish map from 1779. The actual depiction of the vicarage garden is only 40×50 mm in size

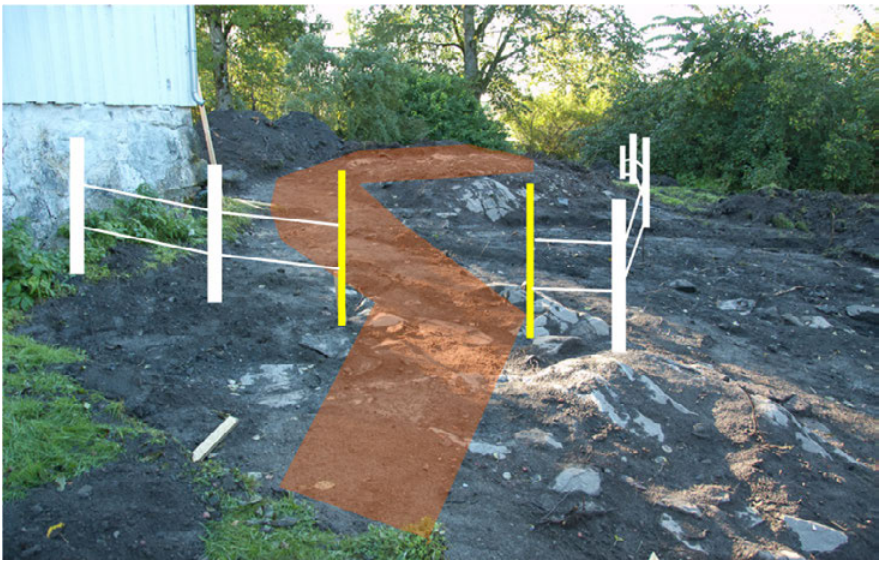


Fig. 7 Two postholes indicated the entrance to the garden; Science Hill in the background.

Photo: Aja Guldåker, 2011



Fig. 8 The buildings at Ner-Killingberg occupied the top of a hill above a complex of terraces at different levels. In the absence of an existing map, the garden had to be surveyed anew.

Drawing by Aja Guldåker

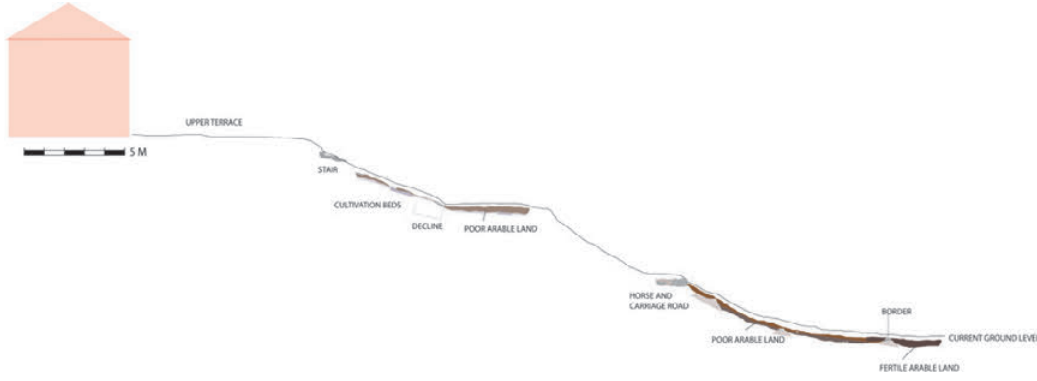


Fig. 9 Profile of the terraces at Ner-Killingberg showing stone edges, possible paths and cultivation areas.

Drawing by Aja Guldåker

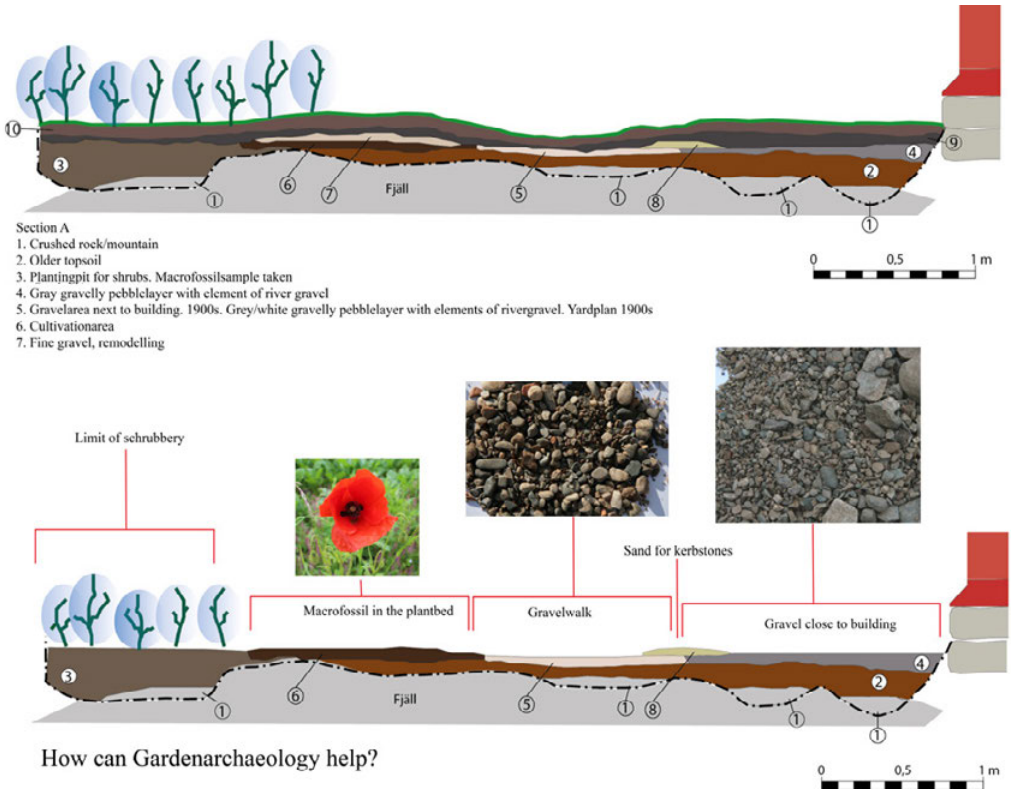


Fig. 10 How can garden archaeology help? The section at the top shows the existing culture layers; in the section beneath, the later layers have been taken away to improve the understanding of the situation around 1900 when the garden was intensively used.

Image: Aja Guldåker, 2013



Fig. 11 Remains of former steps connected to a gravel path at Ulefos Hovedgård.

Photo: Aja Guldåker, 2015

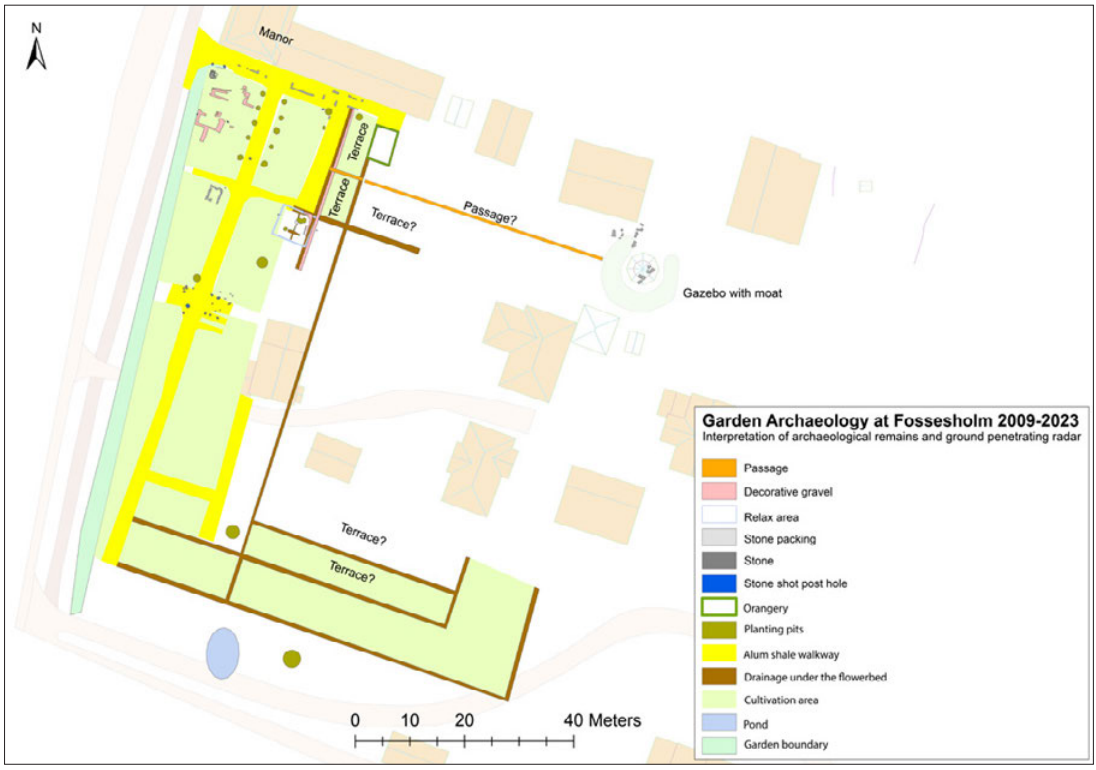


Fig. 12 Fossesholm manor during the eighteenth century as interpreted from the remains recorded between 2009–2023 and ground-penetrating radar surveys in 2012 and 2022.

Drawn by Aja Guldåker, 2023

Cécile Travers – starting from a background as a general archaeologist (École des Hautes Études en Sciences Sociales – EHESS – diploma in medieval archaeology), she gradually specialized in landscape heritage (Master's degree in „Historic Gardens, Heritage and Landscapes", with Monique Mosser, at the École Nationale Supérieure d'Architecture de Versailles – ENSAV / Sorbonne). Since 2006, she has worked as an independent archaeologist with public and private clients in charge of the restoration of historic parks and gardens, and created her agency ARCHEOVERDE in 2011

Cécile Travers

The case of a late-eighteenth-century Anglo-Chinese park: How archaeology has revealed the technical genius of eighteenth-century designers

The late-eighteenth-century park at Méréville in France is a rare example of a European garden in the Anglo-Chinese style, incorporating picturesque scenes with various structures and grottoes. Water was an important element of its design. The course of the River Juine was altered to form meandering streams crossed by bridges, and two lakes were created. Archaeological investigations conducted as part of current restoration works have shown how the landscape was changed. The results contribute to a better understanding of the historical hydrology and provide technical details concerning drainage and river bank construction.

THE VILLAGE OF MÉRÉVILLE is located seventy kilometres south of Paris (fig. 1), in the upper Juine Valley that cuts across a sixty-metre-high agricultural plateau of Beauce, forming a steep, wooded and humid area.

Méréville is known for its Anglo-Chinese park built in the late eighteenth century in a style that has few remaining examples in Europe, and for its nineteenth-century watercress beds. Local people have demonstrated that they can make the most of Juine and its marshy grounds, in terms of both usefulness (watercress) and pleasurableness (leisure park).

Méréville Park is a picturesque park (also known as an "Anglo-Chinese park") designed and built between 1784 and 1794 by the architect François-Joseph Bélanger (1744–1818), with the contribution of the landscape and ruin painter Hubert Robert (1733–1808), for Jean-Joseph de Laborde (1724–1794), a wealthy sponsor and great lover of gardens.

The park's composition is a tribute to idealized and sublimated nature. It features artificial rock fills, waterfalls, and river bends. Further, it contains garden *fabriques* that thematically reference ruins and antiquity: the (mock) broken wooden bridge and the Ancient Temple. Finally, there are artificial caves that testify to the fascination with the underground world of origins, while the western hillside boasts artificial riprap and a covered gallery.

The park is decorated with water in all its forms – dormant, flowing, and gushing – which serves as a common thread and punctuates walks with artificial rivers and waterbodies as well as waterfalls (fig. 2).

The Essonne Département, which bought the area for the symbolic price of one euro in December 2000, wanted to make Méréville a heritage showcase of eighteenth-century picturesque gardens and a nature conservation site. As Méréville Park is a listed historical monument located in the Area of Natural Ecological, Floral and Faunal Interest (ZNIEFF), the Département faced the difficult task of restoring historical scenes related to water by integrating issues of preservation, diversification and enhancement of the natural environment.

Before restoration, it was necessary to:

- locate the remains of eighteenth-century hydraulic structures and study their technical characteristics;
- understand how they were integrated with the hydrogeological environment;
- compare field data with archival data (critical analysis of sources).

These tasks fall into the field of garden archaeology. A garden is a human construction. The technical interventions related to its creation and maintenance (earthwork, planting, masonry, etc.) leave traces in the ground. Archaeology allows us to:

- access these traces to understand the technical and aesthetic character of garden structures from a given period;
- bring tangible elements into the restoration project.

In Méréville, available iconography reflects a radical transformation of the landscape, including its topography and hydrology, in the years 1781-1785/86 (fig. 3). Before Laborde and Bélanger designed the park, there was a regular garden there, with architectural terraces, regular water features, a naturally straight river and wet meadows (cf. map of 1781). It was then turned into an irregular park with serpentine rivers, lakes, waterfalls, recreational lawns and tens of thousands of trees from around the world planted in clumps (plan assigned to Bélanger, 1785-86).

The Napoleonic cadastral plan (1831) is an essential document that describes the original state of the remodelled park and its landscaped components (bridges, paths, *fabriques*, caves, rivers, lakes, waterfalls, islands, mill, vegetable garden, tree clumps, etc.).

We carried out two archaeological campaigns in 2014 and 2015 and made twenty-four trenches in search of the original riverbank and lakeside arrangements as well as missing bridges and paths (fig. 4). The aim was to characterize the eighteenth-century structures and to better understand the hydrological network established at that time, thereby providing tangible and operational data for the purposes of the restoration project.

The trenches across the north and south shores of the Grand Lac (fig. 5) were found to contain:

- a dry stone bank wall with an inclined top, lined with a watertight clay core;
- a drainage fill of crushed limestone;
- original peat excavated on the left to form the basin of the lake, and on the right to spread the drainage fill.

All of these observations indicate that extensive earthmoving was carried out before planting. We assume that water could flow freely between the lake and the crushed limestone, and that both contributed to the internal drainage and hydraulic balance of the park.

In trenches across the south shore of the Petit Lac we found:

- a dry stone bank wall with an inclined top, similar to the one in the Grand Lac, but without a clay core;
- original peat excavated on both sides: on the left to form the lake and on the right to enrich the soil.

Our interpretation is that this differential technical treatment reflects a reasoned and sustainable management of natural water flows (fig. 6). At the foot of the eastern and western hillslopes there are permeable walls that allow the gravity flow to enter both lakes. In the meadow, waterproof walls conserve levels in the water bodies and protect the soil (as well as root growth) from wetness.

The bank walls of the Juine river were built using the same principle. We discovered a wall without a clay core, meant to retain soil while allowing drainage. Its inclined top created the illusion of a natural riverbank. On the right river bank (towards the Great Meadow), a dry stone wall without a clay core was found, whereas on the left bank (towards the Grand Lac) – a dry stone wall with a watertight clay core.

Taking the above into account, we have formulated the following two hypotheses:

- upstream of the Grand Lac, the designers provided watertight walls, lined with a clay core, to prevent lateral water loss, both upstream and beside the Grand Lac;
- downstream of the Grand Lac, they provided permeable masonry to allow underground flows through the drainage fill on the surface of stripped peat.

Beside the bridge known as the Grey Bridge, an eighteenth-century bank wall was found 1.5 metres off the current bank (fig. 7). We know that in the nineteenth century the mill became a sawmill. The original bridge was transformed into a dyke-bridge with a movable valve to increase the amount of water going into the mill diversion channel. Our interpretation is that, due to lack of maintenance, this new device has gradually led to silting and then to the shrinkage of the upper river bed, ultimately causing the historical banks to disappear. They were found later, during the excavations. As a result of these interventions, the hydraulic balance created in the eighteenth century was disrupted.

The ground also contains many aqueducts designed to direct water from one place to another. One underground aqueduct was discovered to connect the millhouse waters with the Grand Lac (fig. 8). It is a perfectly watertight masonry pipe with an internal duct coated with hydraulic mortar made using lime and crushed terracotta. This kind of mortar, which is specific to hydraulic structures, has been

known since antiquity and was used until the nineteenth century.

We also found masonry drains, known as *pierrées*, which captured groundwater from the eastern hillside and directed it to the Grand Lac.

Drawing on the above results, we have finally developed an idea of the work that was done prior to the plantations in the eighteenth century in order to ensure the sustainability of the Méréville Park. These interventions include:

- extensive stripping of the peat surface layer at the bottom of the valley (cited in archival documents and observed during investigation);
- application of crushed limestone fill as a draining underlayer, where water could circulate deeper without interfering with plantations (also cited in archival documents and observed in stratigraphy);
- artificial rivers and lakes dug into the peat (once soaked in water, the peat acts as a watertight base, without the need for an artificial bottom);
- construction of dry stone bank walls, with or without a clay core, built with an inclined top to create the illusion of natural banks;
- placing masonry drains to direct groundwater from the surrounding hillsides into the artificial waterbodies and rivers.

Aside from the quality of its aesthetic components, the success of the Méréville Park results from:

- empirical knowledge of local hydrogeological conditions;
- overall consideration of land use and potential;
- considerable but well-optimized financial resources.

Eighteenth-century designers never sought to dam the water, which was naturally present and abundant at the site. On the contrary, thanks to their intuition and empirical knowledge of hydrogeological processes, they were able to develop elaborate and ingenious technical solutions without cement or the help of any consulting office. This made it possible for the large, irregular park to exist and be admired by visitors for a hundred years.

The water balance was only broken in the twentieth century as a result of unfortunate and thoughtless actions – dismantling the park, planting and then removing a poplar grove – which were often motivated by profit and conducted in total ignorance of the invisible balance that had been created in the eighteenth century. It is the imperceptible equilibrium that archaeology is trying to highlight today. However, there are still many questions about how it worked.

This archaeological survey demonstrates that a garden is a technical structure, made of soil, water and plants, developed in a specific hydrogeological context. Thus, to be complete, its archaeological study requires a thorough, geoarchaeological approach adopted since the 1990s by French garden archaeologists.

The specificity of French garden archaeology consists in the adoption of methods developed in landscape archaeology (geo-archaeology) and search for anthropogenic modifications of soil under the garden's surface.

It is only this kind of deep approach that allows us to reveal and understand the preliminary works required to ensure the sustainability of the garden, including modification of the topography, drainage works and sediment inputs – works that were carried out before planting and the construction of the garden's visible components.

This “invisible” technology, specific to each garden or site, is almost never mentioned in the archives but constitutes essential knowledge for anyone aiming to restore a garden by taking into account all of its components, both aesthetic and technical. Understanding this is a prerequisite for the viability of the restoration project.

The restoration of the hydraulic structures at Méréville began in 2022, after twenty years of multidisciplinary studies and reflection. Works already carried out include:

- restoration of the ecological continuity of the River Juine by the mill diversion channel;
- enhancement of Petite Cascade du Pont des Roches;
- dredging the Grand Lac to restore its reflective qualities;
- construction of a submerged dyke between the River Juine and the Grand Lac;
- restoration of the Petit Lac and the scene of the Grande Cascade;
- reconstruction of Pont aux Boules d’Or.

Work is still in progress but the park of Méréville will be soon reopened to the public to the great satisfaction of European specialists in historic gardens.

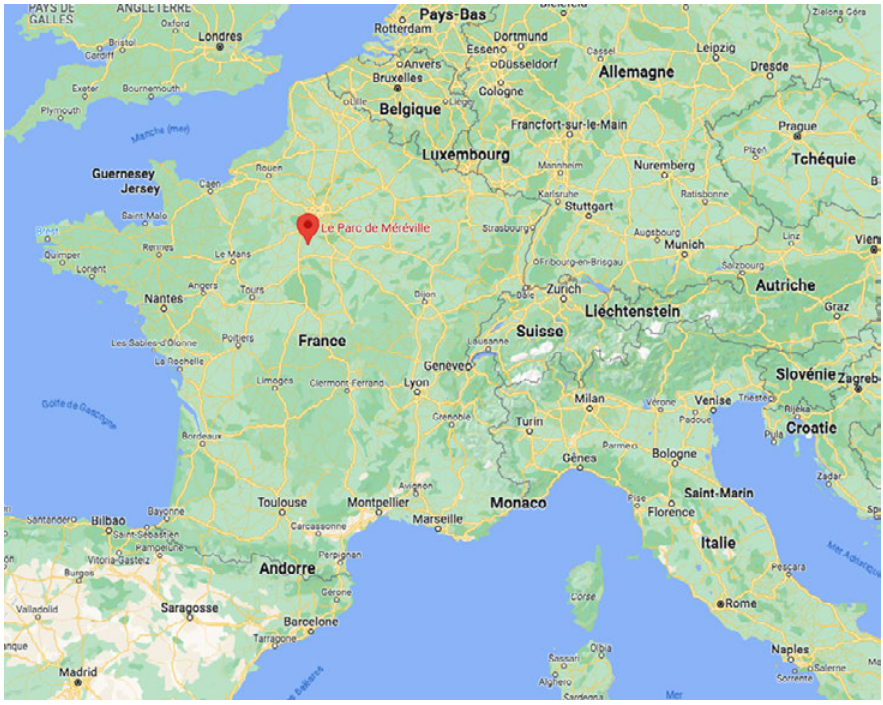


Fig. 1 Site location.

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Fig. 2 The Grande Cascade pictured in an oil painting *Peintre peignant le pont en bois du parc de Méréville* by Hubert Robert (1733-1808). National Museum, Stockholm, NM 2795.

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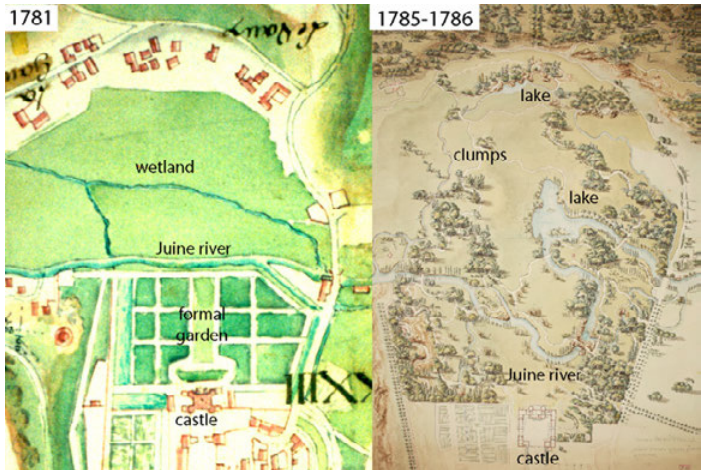


Fig. 3 Transformation of the Méréville landscape between 1781 and 1785/1786. Left: detail from *Plan d'intendance de St Pierre et de Méréville*, 1781 (Archives départementales de l'Essonne, C35/21, © Conseil départemental de l'Essonne); right: extract from *Plan aquarellé* attributed to François-Joseph Bélanger (Wallraf-Richartz-Museum & Fondation Corboud, Cologne, B 47, © Wallraf-Richartz-Museum).

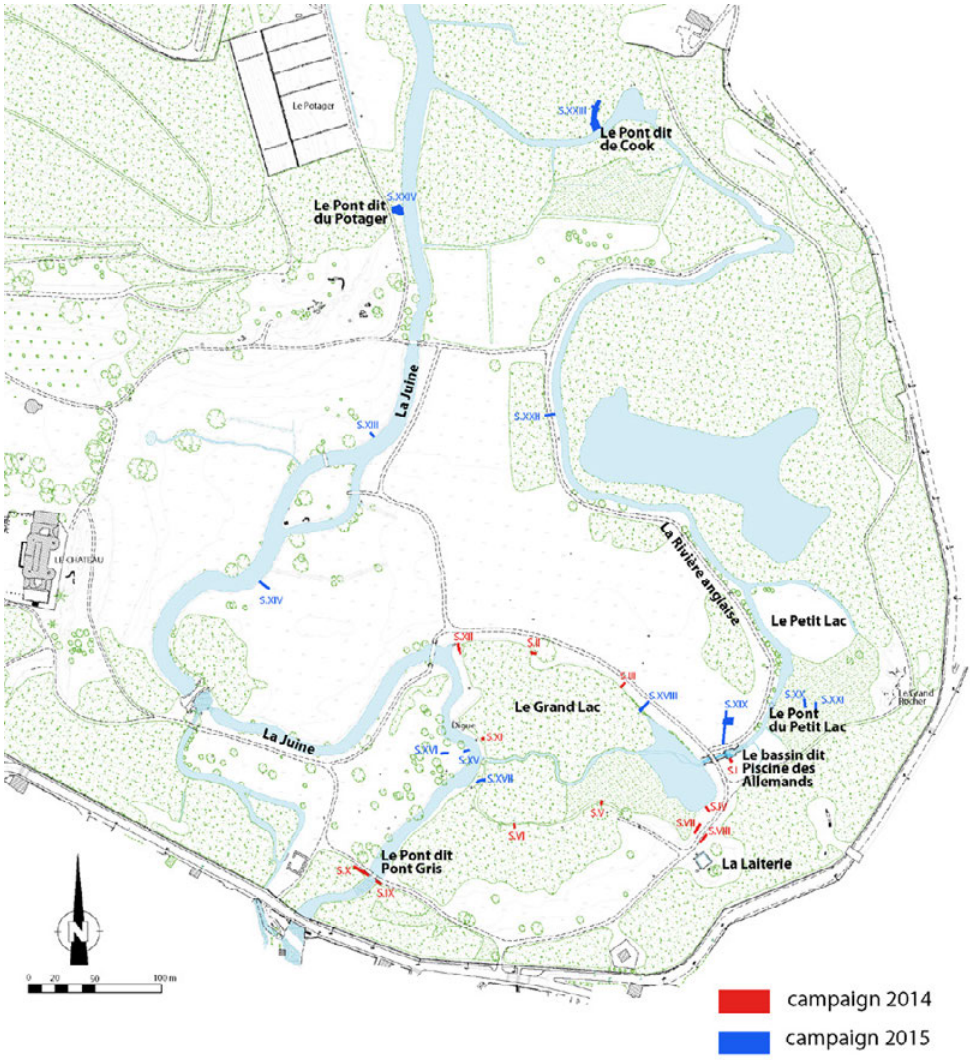


Fig. 4 Location of archaeological trenches and other soundings carried out between 2014 and 2015. Plan: Geomexpert SAS

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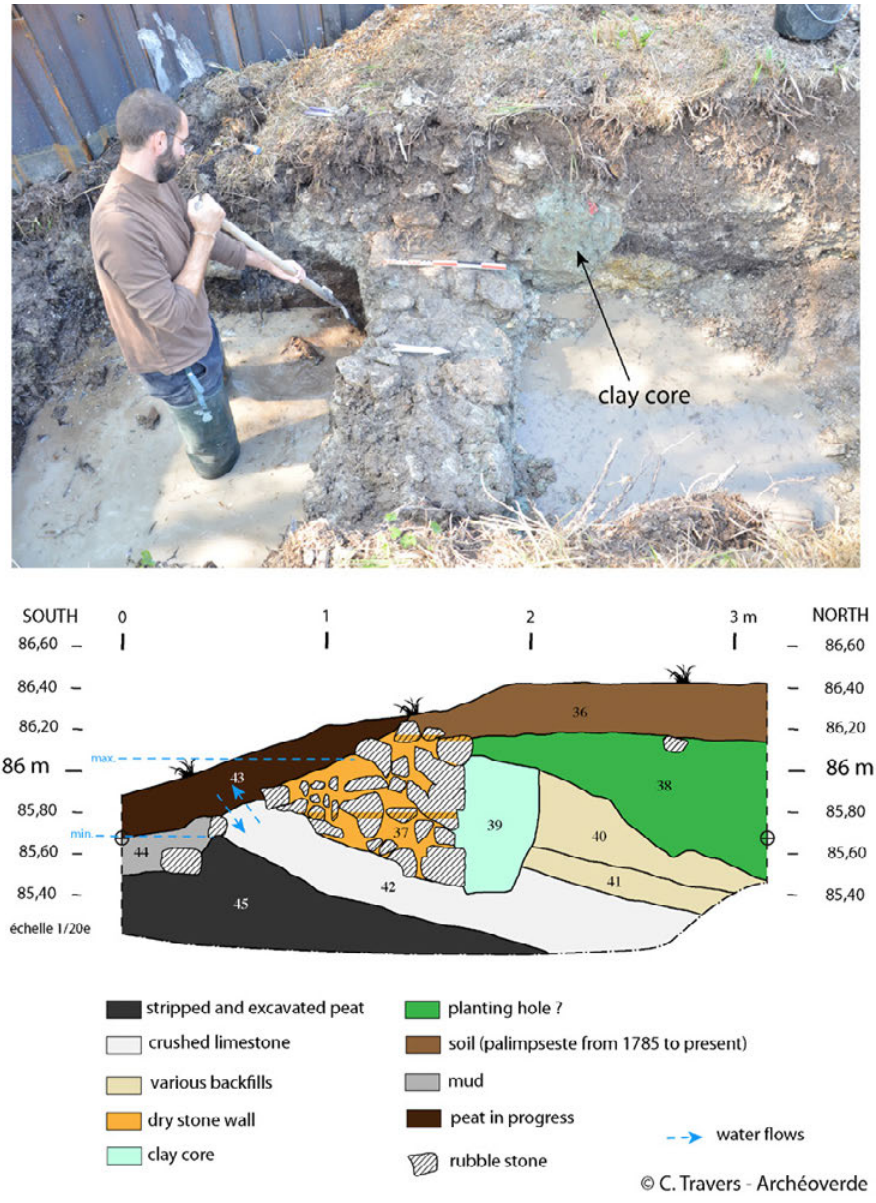


Fig. 5 Section of the north shore of the Grand Lac.

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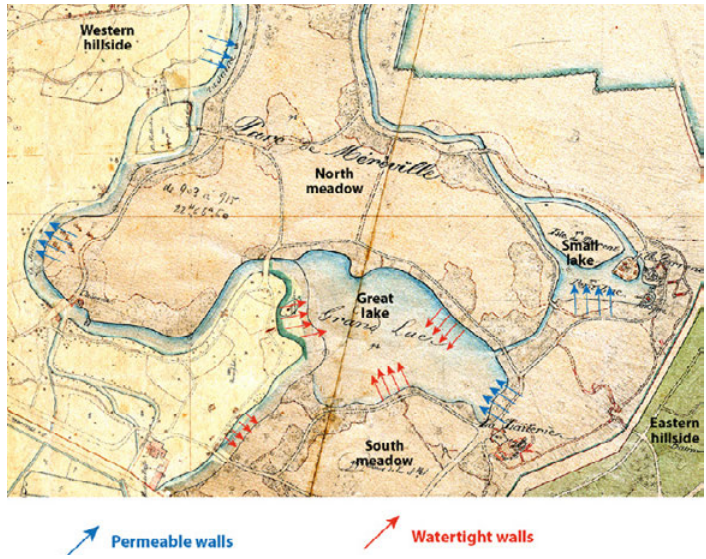


Fig. 6 Differences observed in the treatment of individual water edges and banks related to the 1831 Napoleonic cadaster plan of Méréville (sheets C2 and D5); Service du cadastre d'Etampes (91). Photos: N. Gouiric.

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Fig. 7 The historic retaining wall at the bank of the River Juine, found during the excavations.

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Fig. 8 Watertight masonry conduit between the Mill and the Grand Lac.

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Carlos Caballero – holds a PhD in Geography and History from the Complutense University of Madrid (1997) and is an archaeologist and independent researcher. He has participated in numerous archaeological projects, particularly in preventive archaeology, including interventions at the Ría de Palacio in Aranjuez, the old Hospice of Madrid, the Mint of Segovia, and the church of El Carmen in Madrid. His work also extends to historic gardens, such as the Dukes of Osuna in Vistillas, Campo del Moro, and several sites in Aranjuez, including the Parterre, Príncipe, Patio de Pescadores, and Hospital de San Carlos, as well as further excavations at the Mint of Segovia. He was a member of the coordinating team for archaeological and paleontological works during the expansion of the Madrid Metro network (2003–2011) and served as editor-in-chief of El Nuevo Miliario, a journal specializing in Roman roads, from 2005 to 2025.

Carlos Caballero

Archaeological excavations in Jardín del Príncipe at Aranjuez (Spain)

Archaeological interventions carried out between 2015 and 2023 in two different parts of Jardín del Príncipe in Aranjuez (Spain), namely in the gardens of Pabellones del Embarcadero and Casa del Labrador, have helped to understand the evolution of both gardens, especially to corroborate information from certain documents while refuting other details. Interdisciplinary methodology involved the participation of geologists, botanists, biologists, landscapers, engineers, architects, historians and archaeologists, providing a broader perspective on the gathered data.

AS A DISCIPLINE, garden archaeology is developing slowly in Spain, largely basing on the legal protection that historical gardens enjoy thanks to the Spanish Historical Heritage Law of 1985. At first glance, it seems to aim at resolving purely archaeological questions rather than investigating garden history. However, since the beginning of the twenty-first century, particularly following the conference "Archaeology of Gardens and Crop Fields" held in Barcelona in 2006, this field is expanding and adopting the methodology used in other parts of Europe – in France[1], Belgium[2], the Netherlands, and England.[3] Indeed, a volume of shared experiences collected in the excellent handbook published by Malek in 2013 also contains a Spanish contribution.[4]

In Spain, the origins of such studies can be located in the notes made by Lucia Serredi in the years 1982-1985, along with her proposals (preserved by Patrimonio Nacional) to recover Jardín de La Isla and Jardín del Rey in Aranjuez. These proposals were followed by a historical

1 Allimant-Verdillon 2014; 2015.

2 Dix et al. 2012.

3 Dix and Parry 1995.

4 Casares and Tito 2013.

study prepared by Serredi and José Luis Souto prior to the recovery of the garden at Infante Don Luis Palace in Boadilla del Monte.[5] A small intervention was also carried out on La Isla de Aranjuez towards the end of the twentieth century[6] as well as another in Jardín del Rey in Aranjuez, close to the Royal Palace.[7]

The archaeological projects described here build on these developments. They were realized in different parts of Jardín del Príncipe (Aranjuez, Madrid): one in Pabellones del Embarcadero in 2015–2016 and the another in Casa del Labrador in 2021 and 2023 (fig. 1).

The first project was undertaken in the oldest part of the Prince's Garden, which was created in the eighteenth century. It was carried out in the context of restoration works conducted by Patrimonio Nacional at Pabellones del Embarcadero, located in a bend of the Tagus River. The project involved the participation of professionals with different backgrounds, which facilitated continuous and fertile exchange of information regarding projects developed elsewhere.[8] Participants included geologists developing their own project, forestry engineers, agricultural engineers, palaeontologists, palynologists, dendrologists, architects, surveyors and historians, in addition to personnel from several construction companies and twenty five students from the Gardening Workshop at Patrimonio Nacional in Aranjuez.

The garden is a small, quadrangular enclosure of around fifty square metres, with a central fountain and small pavilions in the corners, which face each other across a space presided over by a larger building known as the Royal Pavilion. Successive alterations have changed the garden's original appearance and its restoration has been the goal of the project developed by Patrimonio Nacional.

One of the main causes of change was flooding by the Tagus River, attested historically. It was particularly damaging in the 1940s. The geologists developing their parallel research project called the floods "catastrophic."[9] To reduce the effects of flooding, it was decided in the mid-twentieth century to raise the land level at the bend of the river by adding material and thus increasing its height by up to 0.4 metre. However, it was the construction of two large regulating reservoirs at the head of the river in 1956 that eliminated the chronic flooding in the central section, which had badly affected the Prince's Garden.

Restoration works began with the recovery of four identical pavilions, and also facilitated documenting the original pavements. The latter were covered by ceramic tiles arranged at an angle and delimited by a perimeter mirroring the shape of each pavilion. In plan, they showed the internal arrangement of each building.

Works planned by Patrimonio Nacional were not limited to recovering the four pavilions (the largest, the Royal Pavilion, had been already restored) but also aimed to completely remodel the garden, which appeared abandoned. The project was based primarily on a plan made in 1784 by Boutelou, preserved in the Palace's General Archive, and an anonymous painting from the end of the eighteenth century (or beginning of the nineteenth), which is owned by the Prado Museum but is now kept in the Salamanca Museum.[10]

5 Serredi and Souto 2001.

6 Luengo and Millares 1998.

7 Añón 1989.

8 For examples from Norway, see: Moe et al. 2006.

9 Machado et al. 2015.

10 Espinós et al. 1984.

Since it was proposed to remove mid-twentieth-century accretions, an archaeological investigation was carried out to identify structures attributable to the creation of the garden at Pabellones. Excavations focused on the four identical pavilions, east and west entrances to the garden, the paving in front of the Royal Pavilion, and the entire south-eastern third of the garden, which was completely stripped. Additionally, several surveys were carried out in the remaining area (fig. 2).

Initial excavations covered the perimeter of the pavilions as well as east and west entrances. These works confirmed the existence of several different phases in the evolution of the garden surrounding the pavilions. Further, after verifying the depth at which archaeological remains were found, it was possible to establish the level of the garden's usage. Then, under archaeological supervision, all the contributions made in the mid-twentieth century were removed; they practically covered the entire surface. Excavations were carried out using manual methods in the south-eastern third of the garden, including the area around the fountain, which was dismantled together with the central sculpture (probably a representation of the River Tagus) after the project was completed. This also affected one of the planters found in Boutelou's plan (fig. 3), which was assumed to lie outside the current garden beneath the paving at the plaza accessible from Embarcadero Street. It was also possible to define areas intended for planting as well as to differentiate them from paths.

Remnants of a planter were discovered, similar to one located further west and also represented by Boutelou. It must have been forgotten when the ground level was raised. All that remains is a brick structure, almost four metres across and more than 1.5 metre deep, with an elaborately curved shape. It had been largely destroyed in the mid-twentieth century, coinciding with the modifications made to the garden to alleviate the effects of flooding.

The dimensions of the excavated structure, particularly its depth, as well as the water-inlet in one corner, have led us to conclude that, in addition to being used for planting, as represented by Boutelou in 1784, at some point it must have been a water container. Perhaps together with its western twin, it was sufficient for the maintenance of the flower garden designed in the eighteenth century.

The excavation also uncovered another structure recorded in Boutelou's plan, namely part of a circular wall that linked all the pavilions and divided the garden into sectors. The section around the pavilion in the south-eastern corner of the garden was also identified, confirming that Boutelou's plan is reliable. A curving foundation was regularly punctuated by square limestone bases with openings characterized by brick thresholds laid along the edge at the centre, as is shown on the drawing made by the head gardener of the royal site in the eighteenth century (fig. 4).

Apart from recovering and recording structures from the original garden, whose state of preservation was unknown, the archaeological study helped to draw conclusions that were later corroborated by a palynological study carried out at the same time. The study of pollen, together with the work of geologists and archaeologists, allowed us to formulate the hypothesis that there were at least three levels of use at the Pabellones Garden: the original level dating back to the last quarter of the eighteenth century; the nineteenth-century

level featuring a series of modifications in the design of the garden, also visible in historical surveys[11]; and the level encountered at the onset of the investigation, following the raising of the surface in the middle of the twentieth century (fig. 5).

The second archaeological investigation took place in Casa del Labrador, which was built around the turn of the eighteenth and nineteenth century by Juan de Villanueva and Isidro González Velázquez. It is located in the central third of Jardín del Príncipe (fig. 1). Works involved comprehensive restoration of the building, and several interventions in the surrounding gardens (fig. 6).

Casa del Labrador lies in an area characterised by changes in the course of the Tagus River. A portion of its ancient meanders remain fossilised in the landscape. Some of them were abandoned naturally, while others, such as the channel in front of Casa del Labrador, which gave rise to the Palomeros Island, were drained as a result of human action. The location of the building on an island with a sandy substrate led to numerous foundation problems[12], which Patrimonio Nacional sought to correct through the intervention that begun in 2021.

Originally, the building stood isolated on the Palomeros Island, between the main channel of the Tagus River and a short channel known as La Ría. It was accessed from the south by three wooden bridges that were built at the same time as the house, allowing the various paths from Queen's Street to cross the canal.[13]

To the south of La Ría, on both sides of the path leading to the door in Queen's Street, there was what Alberto Sanz has called a landscape garden[14], while a labyrinth was located to the west of the fork from Casa del Labrador, leading across the garden towards Queen's Street. It has been preserved without alterations since the beginning of the nineteenth century, and can be seen on the 1865 plan of Instituto Nacional de Estadística (fig. 10).

To the north of Casa del Labrador, between the building and the main channel of the Tagus River, lay the garden known as the Hexagon, where several paths converged on a central plaza. It was designed by Pablo Boutelou[15] and is known chiefly from the 1810 plan made by Santiago Loup, which details only several areas in the garden layout (fig. 9), although its overall limits are discernible today from aerial photographs. The interior of the Hexagon was substantially remodelled throughout the nineteenth century, although its boundaries were preserved, while a series of flower beds were added in the vicinity of Casa del Labrador, forming a semicircular plaza behind the building (fig. 10).

Among the conducted works, two tasks should be mentioned. The first concerned the archaeological control of a new installation trench dug in front of the rear façade of the building. The stratification revealed two lower levels formed by river sand and a gravel bar, representing typical water-borne deposits (fig. 7, UE 104 and 105). They are therefore of natural origin, formed by the action of the two arms of the Tagus River, which originally bounded the Palomeros Island where Casa del Labrador is situated.

The following succeeding strata (UE 102 and 103) correspond to the use of the area as a garden, with UE 102 being the latest level of horticultural use.

11 Harris 1908; Sancho and Martínez Atienza 1991.

12 Jordán de Urríes 2009a.

13 Jordán de Urríes 2009a.

14 Sanz 2010.

15 Jordán de Urríes 2009b.

Historical sources allow us to assume that this level corresponds to the one shown in the 1865 plan edited by Instituto Nacional de Estadística (fig. 3). By that time, the earlier design had already been changed, as exemplified by the Hexagon, turning the area behind Casa del Labrador into an unadorned open space that was smaller than today.

On the opposite side, in front of the building, a 170-metre long utility trench was dug to connect with Queen's Street. Its excavation was carried out under archaeological supervision (fig. 6). The most significant results were obtained in the section, nearest to Casa del Labrador, on a meadow currently located in front of the building (fig. 8). Apart from modern water pipes encountered in the initial crossing of the meadow, one major discovery was that of a deposit of river sand, which was traced for just over nine meters within the trench. This sandy level had looser texture in the central section of the area and seems to be a water-lain deposit indicative of river dynamics.

Archaeological works facilitated obtaining new data on the historical evolution of this part of Jardín del Príncipe. The presence of sandy, fluvial levels in the final section of the trench has revealed that a river must have crossed there, corresponding to La Ría, which ran in front of Casa del Labrador according to the 1810 plan drafted by Santiago Loup (fig. 9, bottom left), and is shown as the main arm of the Tagus River in Aguirre's plan of 1773 (fig. 9, top left). Between the end of the eighteenth century and the beginning of the nineteenth, three wooden bridges were built across the estuary, providing access to the house, which was initially located on the Palomeros Island.

In 1828, La Ría was removed "for hygienic reasons" and turned into a meadow or lawn currently in front of Casa del Labrador. One might think that the path bordering it on the south side could mirror the layout of the channel (cf. fig. 6). However, neither historical sources (in particular, the plans by Loup and Instituto Geográfico Nacional), nor the results of archaeological research confirm this. The presence of a sandy layer near Casa del Labrador at the end of the utility trench suggests that this used to be a river estuary. Its width of about nine metres would justify the construction of bridges, as is indicated by an image from 1798. This would be excessive in the case of a channel not wider than the current pathway.[16] Furthermore, according to the plan by Domingo de Aguirre, the channel that bounded Palomeros Island to the south was the main arm of the river, which means it could have been of notable width.

As for the current pathway that permits traffic to circulate around the meadow in front of Casa del Labrador, it was possibly laid out parallel to the channel before this arm of the river dried up. As a direct consequence, the layout of La Ría, which delimited Palomeros Island from the south, must have been quite similar to its depiction in Santiago Loup's map, both at its junction with what is today the main channel of the Tagus River (as reflected in the plan of Instituto Geográfico Nacional), and in its location a short distance from the house. Its route may therefore be mirrored in the plan of the garden by the current path that runs parallel to the estuary.

Although the reliability of plans such as the one by Santiago Loup has been called into question, particularly in reference to the schematic cartographical depiction of large areas in Aranjuez[17], our

16 Jordán de Urríes 2009b.

17 Chias and Abad 2021.

investigations confirm that detailed parts of his map deserve to be taken into account. In the case of La Ría, he reproduced the layout of the arm of the Tagus River similarly to Domingo de Aguirre. Although the plan of Casa del Labrador is inaccurate, Loup's representation remains a valuable source of information about the immediate environment of the building, despite other areas of the Prince's garden not being precisely rendered on his map.

Final note

Between May 2024 and April 2025, Patrimonio Nacional carried out the final phase of the archaeological excavation and restoration of the Pavilion Garden, confirming the results presented in this article and substantially expanding the information obtained in the previous phases of the archaeological intervention.

Acknowledgements

I would like to thank Yolanda Bruna, landscaper at Patrimonio Nacional, for sharing with me her hypothesis about the situation of La Ría, which was later confirmed by archaeological studies, emphasising the value of multidisciplinary projects.

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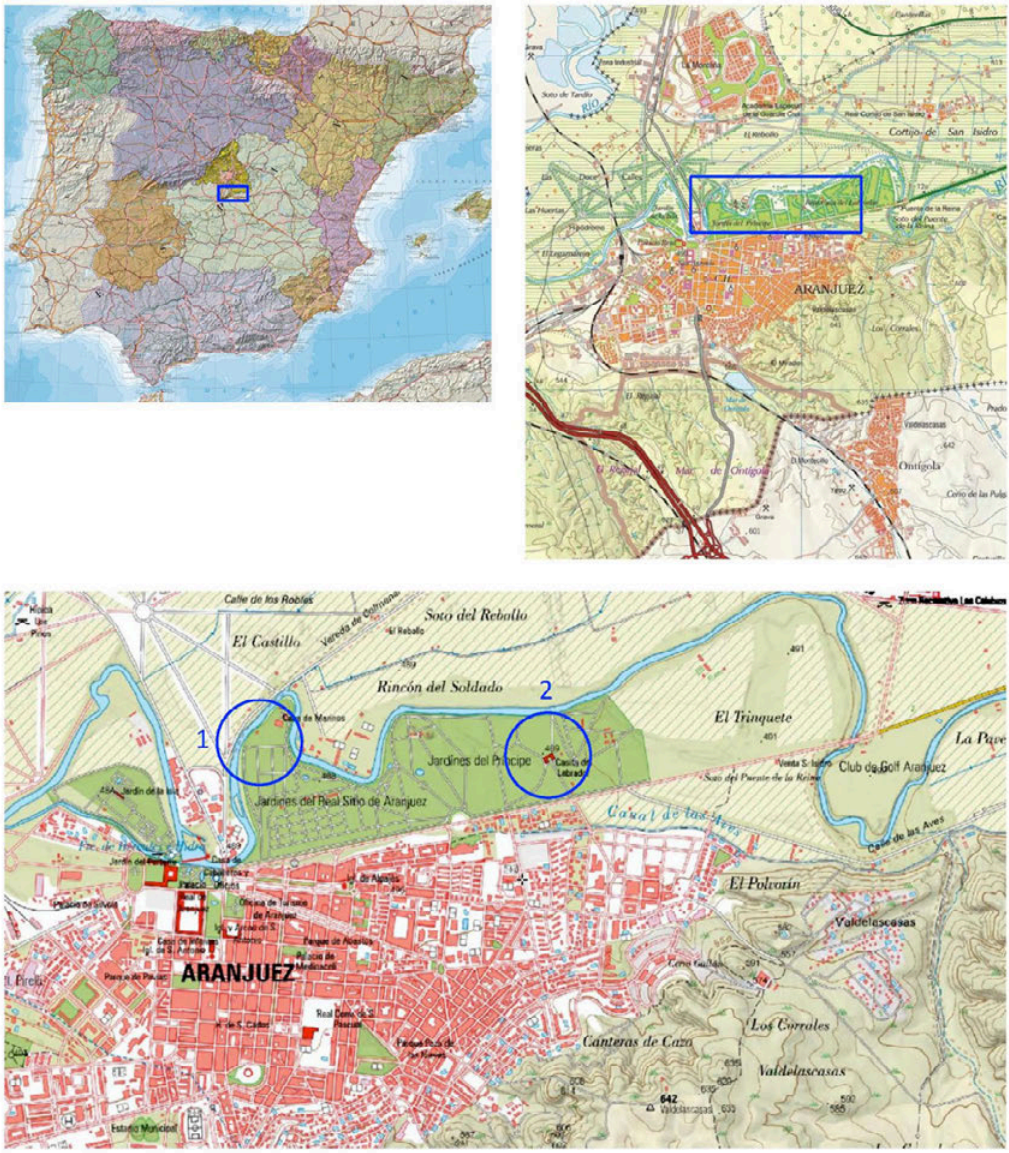


Fig. 1 Site location: 1. *Pabellones del Embarcadero*; 2. *Casa del Labrador*

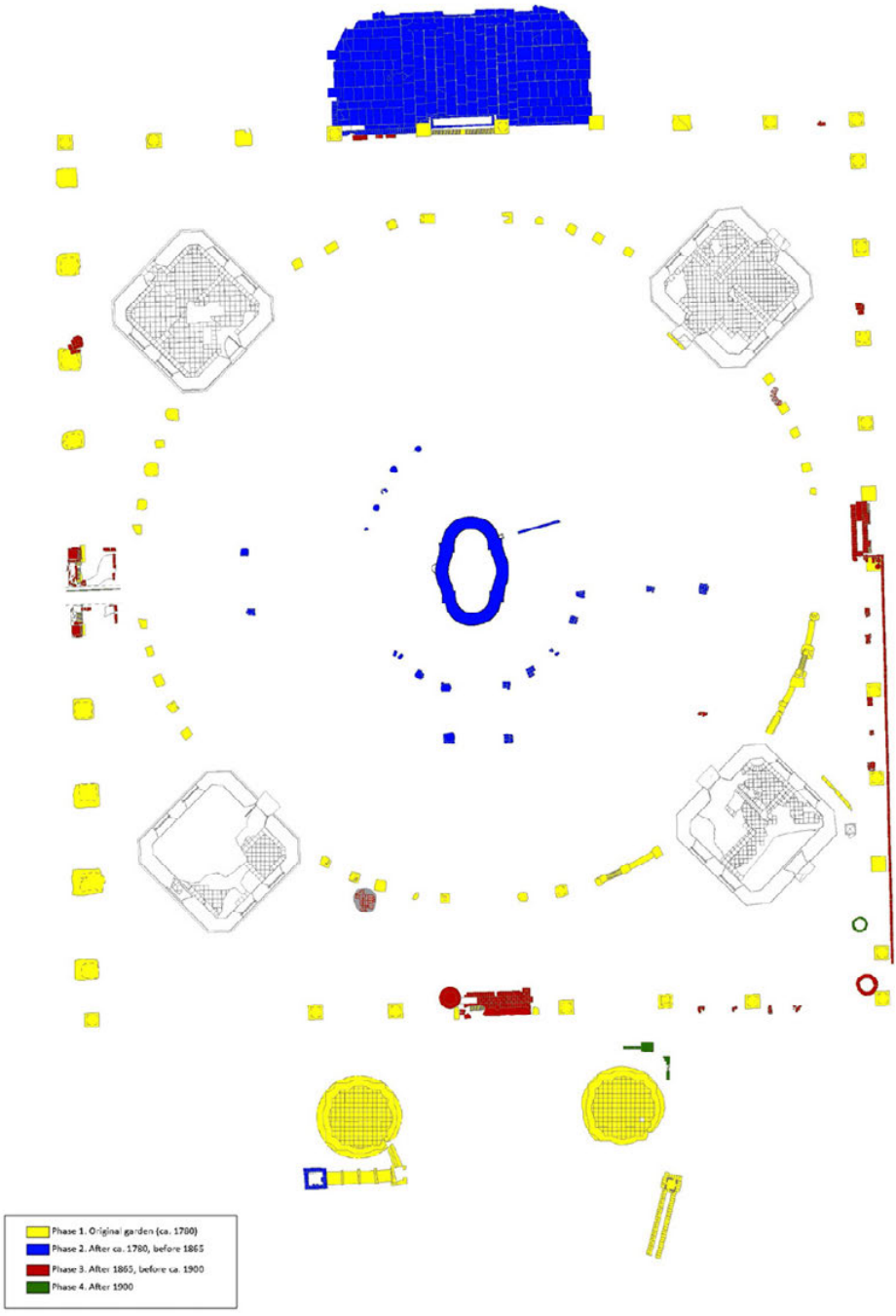


Fig. 2 General plan of the excavated areas in the Garden of the Pavilions.

Drawing: Carlos Caballero / NAOS Consultoria Territorial. Base plan: Patrimonio Nacional

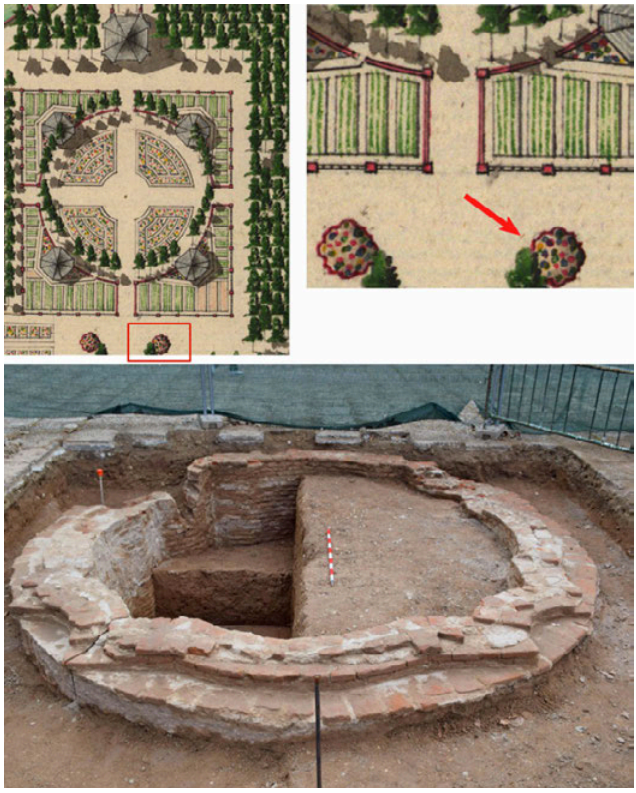


Fig. 3 Detail of Boutelou's 1784-plan of the Prince's Garden showing the four pavilions and the excavated planter next to the southern entrance, as also seen in the photograph below.

Plans: Archivo General de Palacio



Fig. 4 Detail of Boutelou's plan with the wall discovered during archaeological excavation.

Plans: Archivo General de Palacio



Fig. 5 Heightened pilaster base following increase in ground level in the 1940s. Below, geological section showing flood deposits beneath the yellow line. On the right, general interpretation of the stratification recorded in the excavation

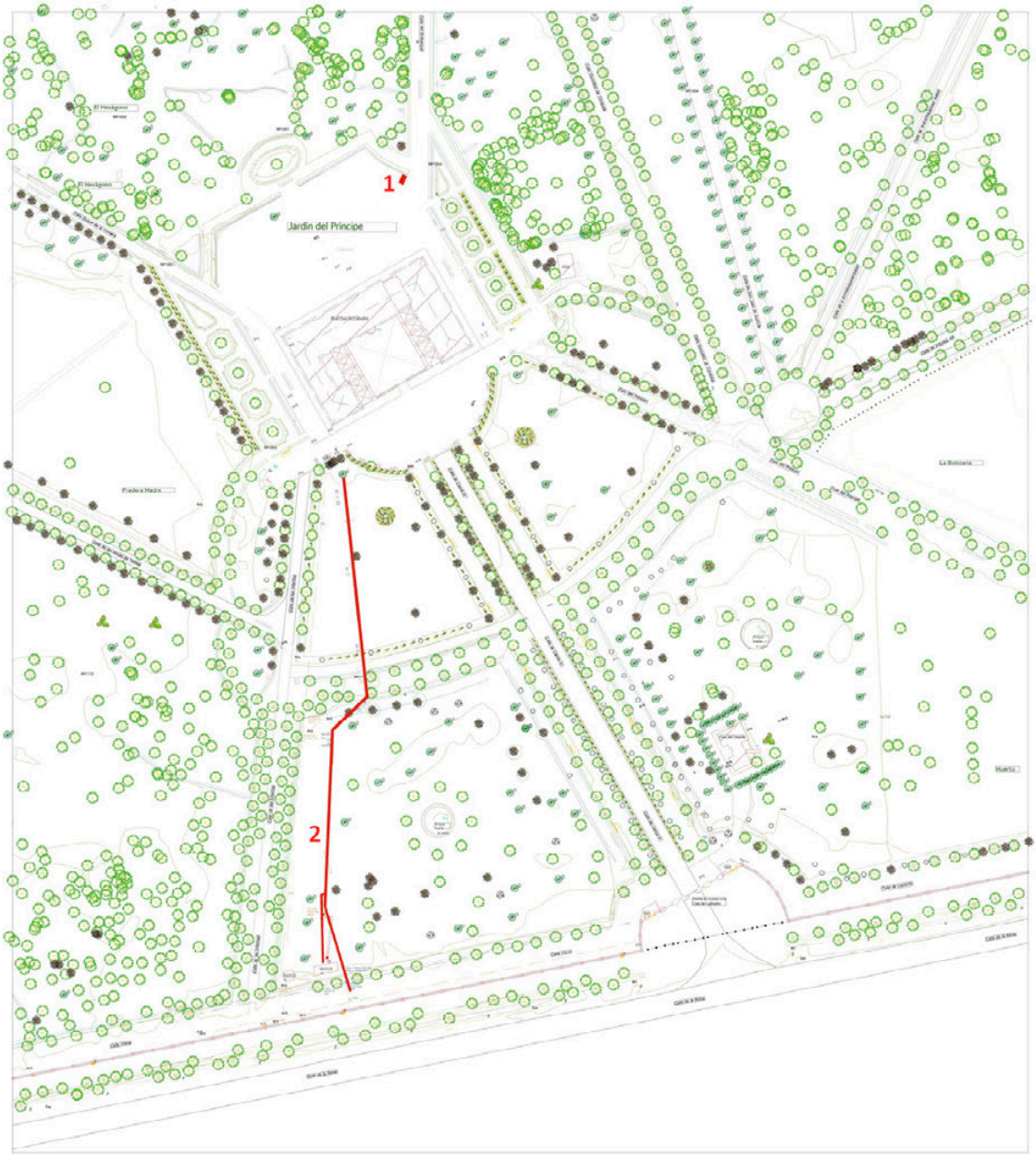


Fig. 6 *Casa del Labrador*: location of the excavated tank-site (1) and connecting services trench (2).

Base plan: Patrimonio Nacional

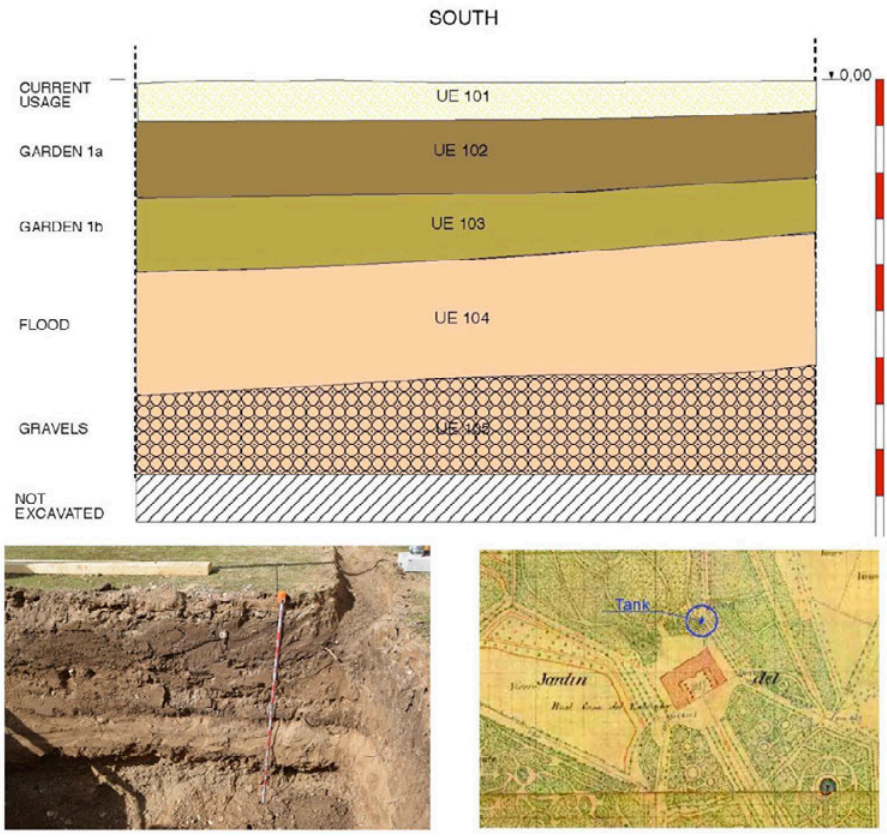


Fig. 7 Excavation trench in the garden behind the *Casa del Labrador* with its location superimposed on the 1865 plan.

Plan: Instituto Geográfico Nacional



Fig. 8 Location of the trench crossing the meadow in front of the *Casa del Labrador*



Fig. 9 Left: Plans by Domingo Aguirre, in 1773 prior to the construction of the *Casa del Labrador* (top), and by Santiago Loup in 1810 (below). Right: Trench sections showing sandy deposits interpreted as evidence of the channel known as *La Ría*.

Historical plans, Instituto Geográfico Nacional

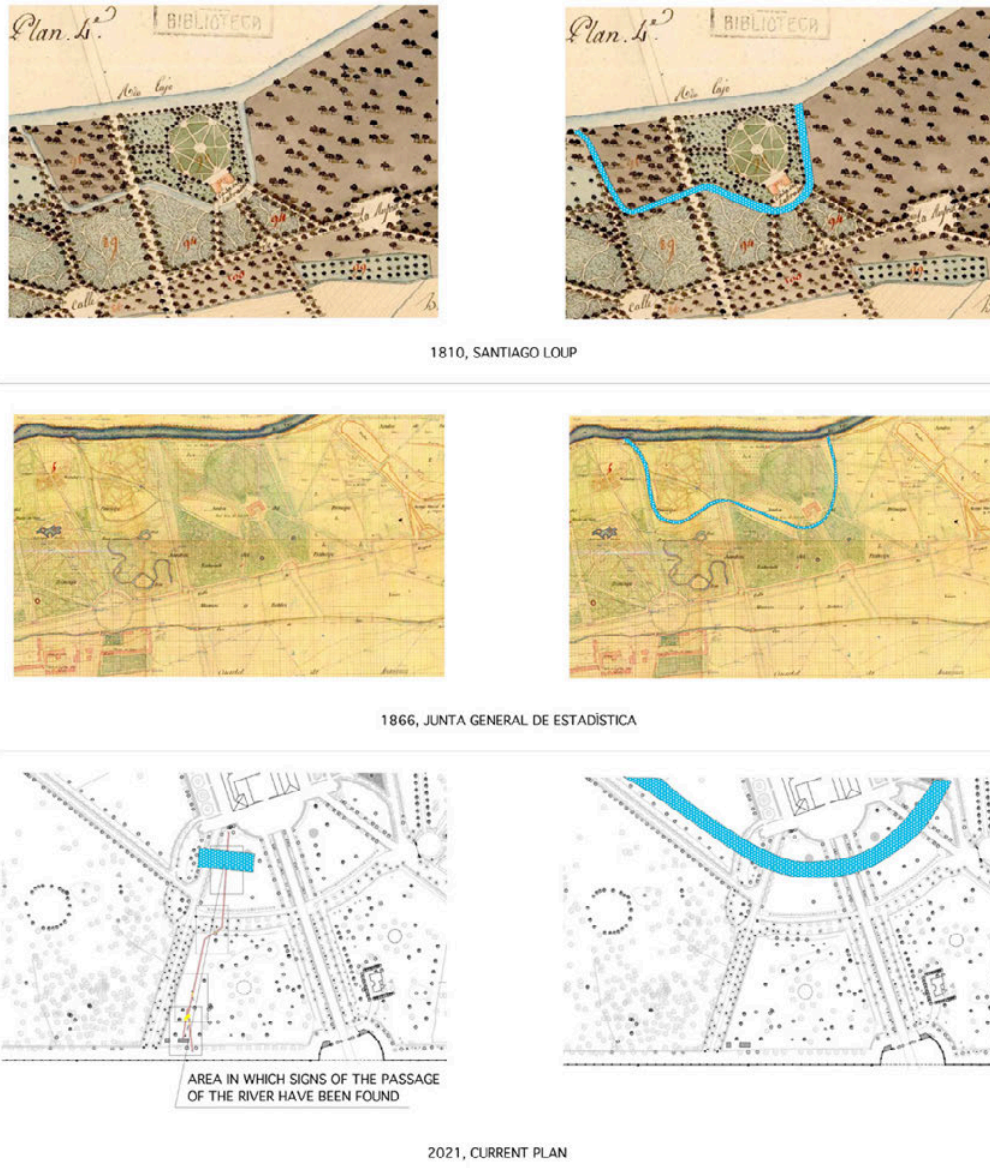


Fig. 10 Interpretation of the *La Ría* passage in relation to plans of 1810, 1865, and the present day.

Historic plans: Instituto Geográfico Nacional; modern base plan: Patrimonio Nacional

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Alexandru Mexi, Mihaela Iuliana Ciornei

Garden archaeology as a tool for the research and preservation of historic gardens around Bucharest

This paper presents current garden analysis and in situ research conducted at historic sites, particularly in Florești, Prahova county, with the intention to increase the understanding of the history and evolution of several gardens, and to decide on the best strategies for their conservation and future restoration. The research includes important garden archaeology work, including drone footage, geomagnetic surveys, and manual excavation. The results have led to the discovery of planting layouts, alleys, foundations of ancient buildings, tunnels, low bridges, water channels and other installations. Combined with tree surveys, archival research, architectural and landscape analysis, they help both garden owners and heritage professionals to decide on the best ways to preserve these monuments and develop restoration projects. Although much more is needed to properly preserve and restore these sites, important measures have already been undertaken, many of which are based on conclusions drawn in the area of garden archaeology.

Introduction

The number of historic parks and gardens in Romania is significant. Apart from municipal public parks, almost all historic palaces, castles, manors, churches and monasteries scattered throughout the country had, at some point, a designed surrounding landscape (fig. 1), although only some are listed as historic monuments.[1] Relating exclusively to Romanian garden heritage, there are over 160 individually listed parks and gardens (fig. 2) but many more are protected by heritage legislation due to their direct connection

1 See: https://monumenteuitate.org/ro/map.

with listed buildings, urban ensembles or even archaeological sites.[2]

Garden heritage faces numerous issues. The most pressing ones are related to the historic perimeter and the state of conservation of existing gardens. According to a recent investigation undertaken in the Mureș county in central Romania, only 13% of existing palace, castle or manor gardens survive in original form, 38% are fragmented, and 49% have been lost due to deforestation and other types of development. In terms of conservation, 4% are in good state, 17% in medium condition, and 79% show an advanced state of degradation and are in need of urgent conservation and restoration works.[3] Although presented research relates exclusively to the Mureș county, its results can be extrapolated to the national level. While in some parts of Romania historical boundaries remain intact and the state of conservation is better than in others, results may nevertheless be considered as generally valid.

Despite the issues facing Romanian garden heritage today, public and private interest in the conservation and restoration of historic parks and gardens is rising. Funds are being allocated and projects are developed. Lack of historical research and on-site analysis are being recognized as issues by those in charge of conservation and restoration projects. Owing to the advanced state of degradation, many historic features such as alleys, furniture, earthworks, water channels, planting schemes, and even buildings have disappeared or are difficult to identify. In this light, garden archaeology emerges as an important research tool for the proper development of preservation projects.

Garden archaeology in Romania

Like landscape architecture[4], garden archaeology is a new profession in Romania. For this reason, only a handful of garden archaeology surveys have been carried out so far. The first ones were undertaken in two listed palace parks: at Bonțida (Cluj county) and in Florești (Prahova county). More recently, particularly after the COVID-19 pandemic, other historic gardens, including ones in Luna de Jos (Cluj county), Bulci (Arad county) and Dănești (Vaslui county), have been investigated in connection with conservation and restoration projects, involving both invasive and non-invasive archaeological surveys.

Research in the historic park at Florești

As Maria Paleologu remarked in 1980, in Romania studies dedicated to landscape heritage are almost absent and the existing information is insufficient or unverified. This is also the case with the listed historic park at one of the largest and most imposing palaces of the Prahova Valley: the “Little Trianon” Palace in Florești. Information concerning this site is either contradictory, false or incomplete. Beginning with the author and date of the initial landscaping and continuing with the implementation of a “restoration project” dated 1912 (fig. 3) together with references to hydro-technical and electrical systems, the history of the park

2 Mexi 2020.

3 Cf. De Roo et al. 2021. English version: https://projects2014-2020. interregeurope.eu/ innocastle/library/#folder=2594.

4 The first school of landscape architecture opened in 1998 in Bucharest and the profession was officially recognised in 2014 when it was introduced in the Romanian Code for Occupations. Although landscape architecture works, particularly garden design, were conducted before 1998, they were undertaken mainly by horticulturalists and architects.

presents many problems. In 2014, some of these issues were investigated and partly resolved using bibliographic, archival and comparative studies alongside field investigations that have intensified since 2018, particularly thanks to the use of garden archaeology.[5]

The Cantacuzino estate at Florești, located nearly 80 kilometres north of Bucharest, covers more than 150 hectares and represents one of the largest and most complex historic properties in southern Romania. Surrounded by a stone wall, the estate features natural terraces formed over time by the nearby Prahova River. It also boasts elements of architectural and artistic heritage (including a water tower, water channels, stone and concrete bridges, etc.), and is divided into several areas, including promenade park, vegetable gardens, and a large hunting park. Although the domain belonged to the Cantacuzino family for over three centuries, its landscaping began only around the 1830–1850s. Regionally renowned landscape gardeners Carl Friedrich Wilhelm Meyer and Émile Pinard were instrumental in its design during the nineteenth and early twentieth centuries. Meyer, known for designing the first public gardens in Bucharest, most likely contributed to the initial layout of the park in the mid-nineteenth century. Pinard was later hired to remodel the park to align with the newly erected palace, or "Little Trianon." The construction of the palace, which is the largest and most impressive building at the site, began in 1911 but was halted two years later following the death of the owner, Gheorghe Grigore Cantacuzino (figs. 4-5).

The park's history is entwined with the palace's construction and subsequent events, including both World Wars and the communist era, which have led to its ruination. The death of Gheorghe Grigore Cantacuzino in 1913 and the beginning of the First World War halted the landscaping works designed by Pinard the previous year. Post-war neglect, compounded by communist and post-communist rule, led to the significant deterioration of the entire site and most of its built and natural components.

Apart from the palace park's tumultuous history, there are several uncertainties surrounding the development of the "Little Trianon." More research is required to shed light on the entire estate, particularly on the history and evolution of the park. One research instrument applicable here is archaeological investigation.

Archaeological research was initiated in 2019 as part of a complex research programme aiming to understand how the park has evolved and why it went through different transformations. By seeking traces of past works, buildings and plantings, it hopes to demonstrate what remains and how such evidence can be conserved and restored. At the same time, the programme seeks to identify current challenges facing the park and how they might be tackled by drawing up a conservation and restoration schedule and managing the accommodation of new functions and activities such as horse riding competitions, concerts and other events meant to enhance the value of the site and contribute financially to its restoration.

The research programme dedicated to the historic park was launched in 2016 and began with archival and bibliographical studies, including tree surveys (fig. 6). Since 2019, systematic works in garden archaeology have employed non-invasive techniques using drone footage, georadars and LiDAR scanning, in addition to regular excavation (figs. 7-9).

5 Mexi 2021.

Comparative, historical, and on-site analyses have been also conducted to verify, complement, and validate archival information. Key aspects have been scrutinized through archival research and field investigations, including the question of the landscape architect responsible for the initial layout and the 1912 "restoration" plan as well as different layers of the park's palimpsest.

Summary of results

Historical information was primarily sourced from a document titled *Floresti. Propriété de son Excellence Monsieur I. G. Cantacuzène. Restauration du Parc*, found in the Romanian National Archives (fig. 3). This plan, designed by the French landscape gardener Émile Pinard in 1912, served as the basis for archaeological investigation. A theoretical reconstruction of the park's development was aided by aerial images captured during the initial documentation phase. Following their interpretation, several trenches were dug, both by hand and mechanically. They were laid out in areas where the topography suggested former landscaping (figs. 7–9).

Trenches in front of the palace revealed old pathways. Finds included pieces of decorative terracotta and fragments of large, glazed, ceramic vases that served as garden ornaments, in addition to tableware of the highest quality. The paths themselves were generally paved with small, flat river stones, and had curbs formed by larger boulders. Excavations closer to the palace provided more evidence about its history, including unique information not found in existing records. Some of the findings were related to the heating system, while others concern tableware as well as clear signs of looting, probably in the early 1950s.

Following the discovery of pathways, other research was conducted in the area of the water tower, terraces, waterfalls, and the lake. What had been thought to be a land elevation turned out to be a rocaille or rockwork feature with a small basin (fig. 10). It was connected with a romantic grotto entered from the opposite side of the hill, facing the water tower. In the grotto, the masonry is covered with small rocks and pebbles (fig. 11). Careful cleaning of the rocaille showed how the flow of water was managed in the past. A series of channels was uncovered, indicating that water from the basin flowed towards the lake and revealing a hitherto unknown artificial waterfall (fig. 12).

Further research was conducted around the lake. Excavations have shown that it was cement-lined at the confluence of the channels that carried water in and out (fig. 13). Although they concentrated mainly near and around the lake, the archaeological surveys and other investigations have contributed significantly to the discovery of numerous channels or conduits in different areas of the park.

It is intended that research will continue and other areas of the park will be surveyed in the near future, where ancient glasshouses, paths, gazebos, tree-lined avenues and flower beds, etc. are presumed to have existed. The results will contribute to the understanding of the park's complex history and components, informing the ways in which conservation and restoration may be carried out in the future.

Conclusions

The state of Romania's garden heritage is a complex tapestry of preservation challenges and emerging opportunities. Despite the significant number of historic parks and gardens scattered throughout the country, many face issues related to

the loss of their historic boundaries and reduced extent, along with a poor state of conservation. The findings from a series of recent investigations highlight a concerning picture, with a large proportion of sites either lost or are in advanced stages of degradation. However, there is a growing interest, both public and private, in conserving and restoring these cultural assets. The emergence of garden archaeology as a vital research tool is a significant development in this regard. Although still in its early stages in Romania, archaeological surveys at sites like Florești, as well as at other historic sites throughout the country, have begun to shed light on the evolution of these landscapes and provide crucial insights for conservation efforts. By combining archival research, field investigations, and contemporary archaeological techniques, researchers are unravelling the history and development of parks and gardens, uncovering their lost features and informing restoration projects.

The case of the Cantacuzino estate in Florești exemplifies the multifaceted approach required for comprehensive understanding and preservation. Through complex archaeological surveys, researchers have unearthed remnants of the park's history and landscaping works ranging from pathways and garden ornaments to planting designs, water features and underground structures. These discoveries not only contribute to the historical narrative of the site but also guide conservation interventions. The research is meant to continue in the future, including additional surveys of specific park areas. These efforts will contribute to the understanding of the park's complex history and components, guiding future conservation and restoration efforts.

Such early landscape archaeology investigations in Romania have bolstered and validated findings from theoretical studies, enabling the research to advance through successive stages with irrevocable physical evidence. This further underscores the significance of such practices in examining historic parks and gardens – a class of historic monuments that are still insufficiently and inadequately researched in Romania.

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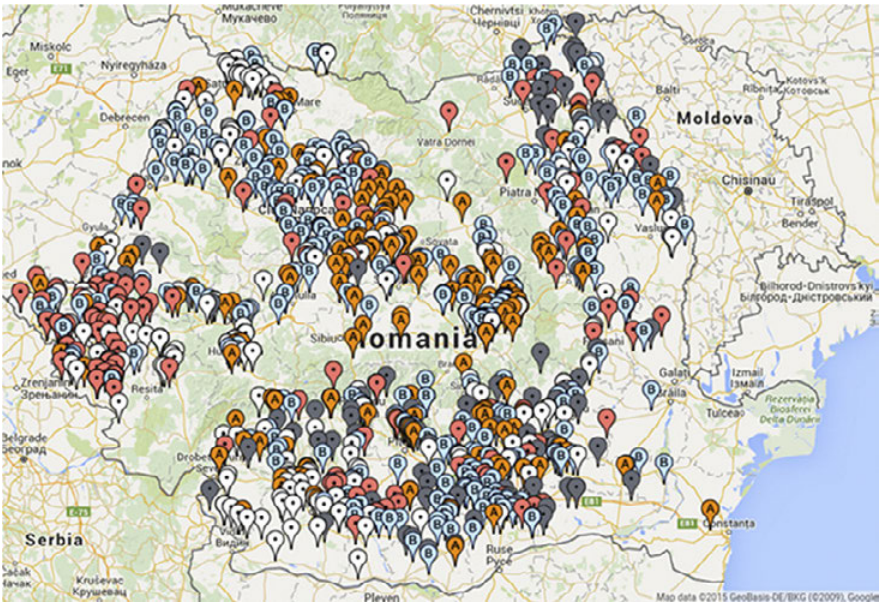


Fig. 1 Map of historic castles, manors and palaces in Romania, including ones that are listed, not listed or have been destroyed.

Source: https://monumenteuitate.org/ro/map

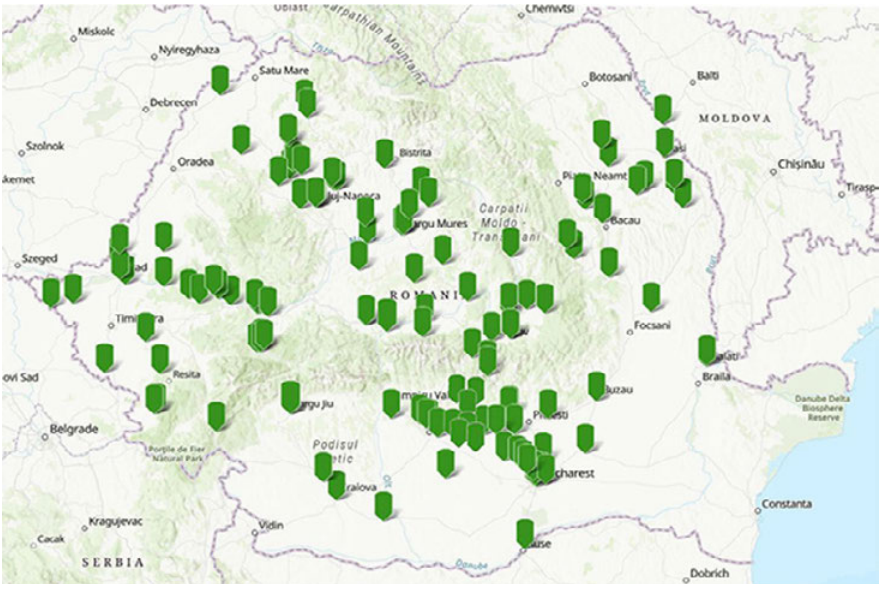


Fig. 2 Map of individually listed historic municipal parks and castle/manor gardens in Romania.

Source: authors

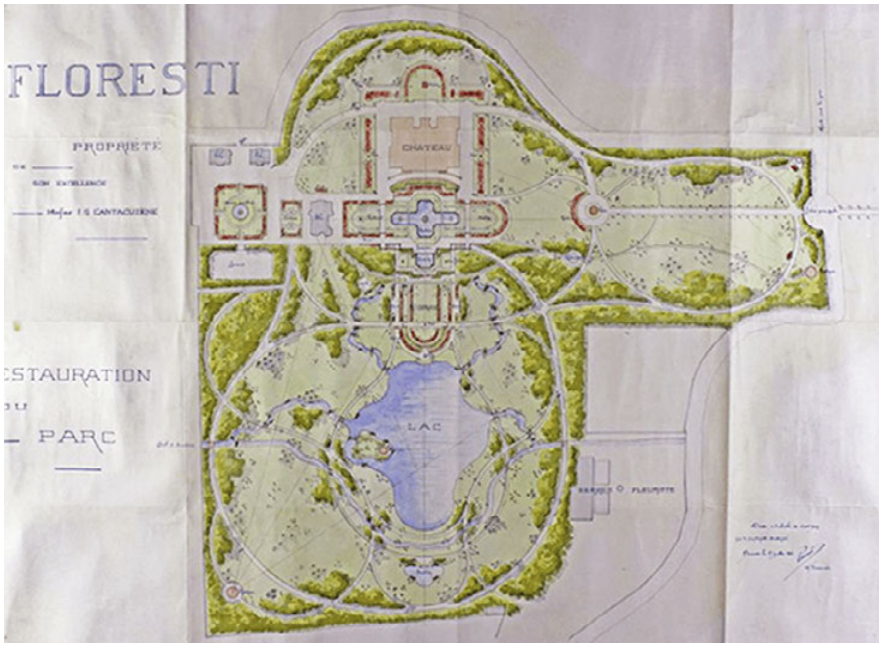


Fig. 3 Map of the "restoration" (in fact, redesign) of the park in Florești, 1912.

Source: Romanian National Archives



Fig. 4 The "Little Trianon" Palace, undated.

Source: Romanian Academy Library



Fig. 5 The “Little Trianon” Palace, 2020.

Photo: Ștefan Stoica

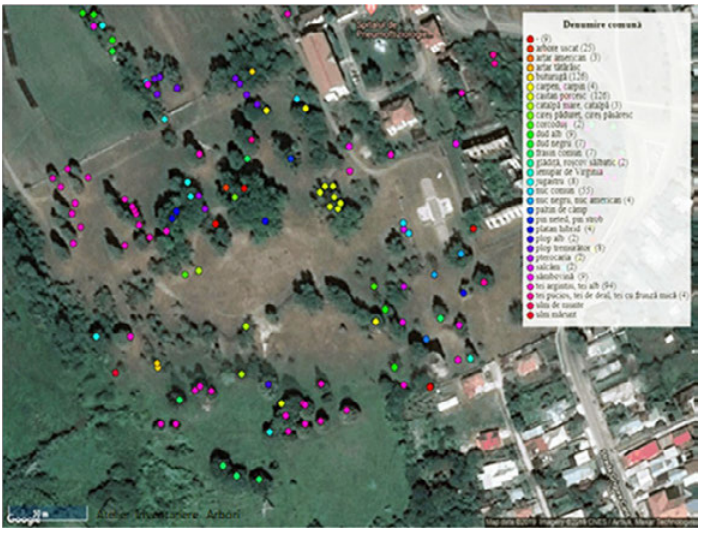


Fig. 6 Tree survey in the park, 2019.

Source: Diana Culescu



Fig. 7 Path discovered in 2019.

Photo: authors



Fig. 8 One of the walking alleys discovered in 2020.

Photo: authors



Fig. 9 Fragments of water installations, 2023.

Photo: authors

Fig. 10 Excavations at the rocaille, 2021-2023.

Photo: authors





Fig. 11 Excavation at the mouth of the grotto, 2021-2023.

Photo: authors



Fig. 8 One of the walking alleys discovered in 2020.

Photo: authors



Fig. 12 Artificially enhanced waterfall, 2022.

Photo: authors

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Integrated advanced techniques for comprehensive digitalisation of historic gardens

Digital geomatics survey methods have become an indispensable tool for recording and studying historic gardens. An accurate and complete 3D model forms an essential reference-base for all other kinds of data and the starting point for different types of analysis and activity, including sustainable conservation management. A range of different instruments and procedures are currently used, each having limitations as well as advantages. The article overviews and introduces new survey technologies capable of delivering results rapidly and with unprecedented quality and accuracy.

Introduction

Historic gardens constitute a distinct yet vulnerable subset within cultural heritage. Primarily, any garden's structure is predicated on fragility. Its principal albeit not exclusive focal plant elements are susceptible to significant damage even from brief periods of neglect and exhibit a dynamic quality that is influenced not only by vegetational growth but also by climatic fluctuations and human intentions. An added complication is the past failure to conserve historic gardens for any length of time. Created as private villa gardens and later transformed into public gardens, they have undergone great transformations that in most instances do not respect the original values and now are often managed as a common, green public space. Conversely, it is currently acknowledged that historic gardens not only form a significant element of the historic landscape but are also a pivotal component in shaping the cultural identity of the local people. Furthermore, a garden serves as a valuable asset that can draw attention to intangible cultural assets, which are uniquely and

distinctly expressed through the garden's structure and design. This article demonstrates how geomatics can contribute to garden study.

According to the Italian Charter of Historic Gardens drawn up in 1981, a historic garden, like any architecture, can be understood as a palimpsest, a text repeatedly written and rewritten that has its own material consistency and stratified signs that cannot be erased.[1] Geomatics survey is an essential and crucial step in supporting archaeological surveys and historical field research. In particular, the survey is indispensable to record any surviving evidence of gardens that no longer exist.

A digital survey facilitates documentation of existing assets and enables the implementation of Digital Twin technologies. These methods enhance management procedures and support virtual digital dissemination for tourists or experts.

Surveying, in its most diverse forms, is an indispensable tool for the study of a garden and for the organization and planning of its conservation and management.

When conducting a survey of an architectural asset, it is important to also survey the surrounding garden and related structures. Additionally, the survey should extend to the area around the studied complex. This is crucial because interactions between the architectural asset and its adjacent territory play a significant role in understanding the site's origin, development, and history. Furthermore, such information serves as a valuable foundation for creating functional projects that make the asset usable and ensure its sustainable management.

In the Italian context, restoration projects of historic gardens financed by the PNRR are governed by specific guidelines which underline the centrality of the survey as a vital stage in building knowledge about the garden for the purpose of its future management.[2]

Finally, the technique of geomatics represents an effective tool for retrieving drawings, plans or other historical representations from archives and making them available to researchers. They enable tracing and studying correspondences between current geometries and historical ones in order to develop the basis for creating geographical information systems that link historical documentation to its geolocation, thereby allowing its intelligent and effective use by scholars.

This article focuses on the relationship between geomatics methods and historical gardens. It provides a comprehensive overview of such instruments and procedures currently used for surveys, including their limitations and advantages. Furthermore, it elaborates on the cutting-edge tools that digital transformation has provided to specialists in the restoration and study of historic gardens. It highlights their potential and the most efficient methods for using them in a comprehensive manner.

Geomatics: innovation in cultural heritage survey

Surveying an historical garden requires the same rigorous approach as would be applied to a World Heritage Site. Today, as in the past, it is crucial to establish an accurate reference network of measured points, or vertices of known coordinates.[3] The individual points should be unambiguously identifiable in the field, typically constructed of metal and positioned in stable areas (fig. 1). The vertices have

1 Dezzi Bardeschi 1990.

2 https://media.beniculturali.it/mibac/files/boards/be78e33bc8ca0c99bff70aa174035096/PDF/2022/LINEE%20GUIDA%2

3 Achille et al. 2005, 43-48; Vassena et al. 2000.

to be measured, which is typically done using Total Station if accuracy of several millimetres is required, or using GNSS in the case of larger areas where accuracy of several centimetres is acceptable.

It is critical to keep in mind that all topographical measurements are relative. Even with the GNSS approach, the creation of permanent "fixed points" at the vertices of known coordinates at the site should be considered mandatory, even if the values of these coordinates are established by connecting the GNSS receiver to real time positioning services.[4] Topographic surveying techniques are rapidly and continuously evolving. With the introduction of EDM technology (electronic distance measurement), the theodolite has been transformed into Total Station; GPS (Global Positioning System) has now evolved into GNSS (Global Navigation Satellite System) and its main usage has been moving from time-consuming static measurements to Real Time Positioning (RTK) services.

The introduction of innovative technologies, instruments and procedures is radically changing site surveying and the deliverables of mapping activity. In the past, the surveying process consisted of measuring single points in the field by a total station or GPS, and producing 2D drawings from the data using CAD software. Today, the data generated by a laser scanner or image elaboration is a 3D point cloud, which is becoming increasingly widespread in surveying historic gardens (fig. 2).[5]

Terrestrial Laser Scanning (TLS) can capture reality with a massive number of points and resolutions selected according to the final goal of the project. The process of capturing 3D reality has become more efficient and fast compared to the labour-intensive task of conducting a comprehensive survey using a total station. However, the post-processing and managing of the vast quantity of data obtained by TLS has significantly increased when compared to what is required by a classical survey. At the same time, as the evolution of topographical instruments, photogrammetry has also seen an important advance in terms of capabilities and products. SfM (Structure from Motion) algorithms have made digital photogrammetry usable by a much larger community, thanks to the possibility of automatically extracting 3D coloured point cloud models from images using low-cost semi-automatic software.[6]

The introduction of low-cost UAV vehicles made the use of Digital Photogrammetric survey (UAVDP) technology very popular.[7] Due to the fact that the final result is a point cloud model, it has become obvious to start combining point clouds from TLS and/or UAVDP surveys.[8] UAV photogrammetry is a well-consolidated technology and the introduction of the SfM pipeline extended the potentiality of this methodology. The level of diffusion of LiDAR devices shows the potentiality of these technologies; however, specifically in the context of mapping historic gardens, the cost and timing of terrestrial laser scanning can be a significant constraint. TLS is considered the most accurate approach to obtain a comprehensive depiction of complex terrain geometries and to retrieve data such as BHD (diameter at breast height), tree height and tree canopy width, which are essential for tree and vegetation inventories.[9] TLS enables the acquisition of important information

4 Wajda et al. 2008.

5 Papa 2022.

6 Aicardi et al. 2018; Adami et al. 2018.

7 Turner et al. 2012.

8 Vassena and Clerici 2018.

9 Liu et al. 2018; Srinivasan et al. 2015.

and data, which are frequently essential for accurate site recording and conducting quality investigation. Additionally, TLS enables the documentation and analysis of existing trees, together with other botanical components and ornamental artefacts such as statues, pathways, and buildings. However, because of its cost, the use of TLS in garden mapping has been limited to leading projects.

As a consequence, the introduction of LiDAR equipment capable of surveying indoor and outdoor environments by moving rather than remaining static has been extremely significant (IMMS: Indoor Mobile Mapping Systems). Several new instruments have entered the market, enhancing the variety of techniques and equipment available to surveyors. The final and most revolutionary tools and procedures have emerged after the broad introduction of technologies that allow 3D surveying with mobile devices, providing the surveyor, who is moving across the site, with an instrument that can be carried by hand or installed in a backpack. Currently, IMMS represent the most opportune technology for ground-based 3D mapping due to their capacity to simplify field survey operations and significantly increase productivity, in addition to delivering a comprehensive 3D point cloud model. IMMS devices are based on the Simultaneous Localization and Mapping, or SLAM algorithm, implemented in computer vision to allow an instrument to determine its position while simultaneously mapping its surroundings.[10] This is particularly useful in situations where the mobile instrument moves through an unknown or unexplored environment without the support of any positioning sensor such as GNSS. The primary objective of the indoor mobile mapping system is to create and continuously update a 3D map of its surroundings while moving, and also to determine the trajectory by tracing the exact position within the 3D model. The complexity of this method arises from the simultaneous estimation of both the surveyor/instrument location and the environmental map, which are both unknown variables.

Indoor mobile mapping systems usually combine the geometric SLAM algorithms based on the data coming from Multibeam Lidar sensors with an Inertial Measurement Unit (IMU) mounted in the device. With this multisensory approach, the instrument is capable of registering along the trajectory, simultaneously building a map and localizing the sensor within it almost in real time. The SLAM technique has been favoured over the use of TLS since coming to the market, largely because of its superior throughput. Lidar-based SLAM systems have consistently shown some limitations in terms of measurement accuracy if applied, for example, to the calculation of accurate tree trunk diameters (fig. 3). Specifically, the surveys have shown local accuracies of two centimetres.[11]

The global accuracy of IMMS for large area surveys has exhibited significant variability, sometimes even exceeding tens of centimetres. For this reason, in several forest and garden mapping projects, a combination of TLS and SLAM IMMS has been applied. Several experiments with the combined use of static and mobile Lidar mapping approaches (fig. 4) to evaluate the performance of MMS and TLS scanners have shown that although it contains more noise, MLS can better define sections in less scanning time.[12] IMMS technologies provide

10 Hess et al. 2016; Ceriani et al. 2015; Sánchez-Belenguer et al. 2020.

11 Del Duca and Machado 2023.

12 Dong et al. 2020; Shao et al. 2020; Pérez-Martín et al. 2021.

an easier strategy for generating point clouds, although with a marginal decrease in accuracy in comparison with the conventional TLS method. Numerous variables affect the accuracy of the final point cloud, including the absence of GNSS positioning data, the survey design, the 3D geometrical characteristics of surroundings, and improper surveyor conduct during the mapping phases. Furthermore, the correct selection of SLAM algorithm parameters during the post-processing phase is equally crucial.

The above variables can influence the method's accuracy and repeatability. In order to mitigate this and minimize drifts of the IMMS trajectory, it is a good practice to include the measurement of an appropriate number of GCPs, or Ground Control Scans, into the SLAM post-processing elaboration procedure, as was tested in the city centre of Meda in North Italy (fig. 5).[13] Experience has also shown how the use of GCPs as constraints in the SLAM process can dramatically improve the accuracy of the IMMS survey (fig. 6).[14]

Several IMMS systems have been introduced into the market, each with different characteristics and performance (fig. 7). According to the specific needs of historical gardens and cultural heritage sites, only IMMS devices with a high-resolution camera should be considered.

In light of rapid technological development in geomatics, it should be stressed that the introduction of new instruments has not made the older ones obsolete; rather, the innovations have resulted in functional enhancements. The introduction of GPS, which developed into GNSS over time, did not replace the total station, but expanded its capabilities by introducing field management issues for equipment that uses fundamentally different reference systems. Likewise, laser scanning has not completely eliminated the need for total station measurement support, even if just for the definition of true vertical or to georeference the 3D scans. Similarly, the UAVDP technique requires GNSS measurements.

While the digital metamorphosis of equipment has made its use in the field easier and more intuitive, it has also necessitated expanding surveyors' competences. One example of the increasing complexity of post-processing procedures refers to data obtained through UAVDP and TLS. Extracting high-quality information from digitally challenging datasets, such as point clouds in space or digital photographic data from a wide variety of sources, requires special skills.

Furthermore, the generation of deliverables that are clear and accessible to the end user is becoming extremely demanding. Consider, for example, HBIM skills for three-dimensional modelling of architectural elements that are difficult to describe with simple vector structures[15] or the management of three-dimensional data such as tree trunk structures with three-dimensional modelling (fig. 8)[16] rather than management of such information in 3D GIS information systems.

An integrated approach to surveying historic gardens and related architectural structures

Surveying an historic garden involves not only mapping the vegetational component but also recording all of its constituent parts, especially architectural elements and features revealed by

13 Marotta et al. 2022.

14 Gexcel Official Website, htttps://heron.gexcel.it/en/gexcel-solutions-for-3d-surveying/heron-portable-3d-mapping-systems/heron-ms-twin-color/ (accessed 10 December 2023).

15 Jouan and Hallot 2019.

16 Kumazakia and Kunii 2016.

archaeological investigation and other research. Modern surveys must be completed at different times and tempos, either during the progress of an archaeological excavation or to support individual conservation projects, which might range from condition reports and routine monitoring to specific restoration works and recording the effects of maintenance. The choice of techniques and instruments depends on what is to be mapped and on expected results.

A comprehensive survey uses multiple techniques to capture different elements. The first strategy almost always includes a measurement campaign to establish a topographical reference network using total stations and, in the case of large properties, the GNSS approach. This network is then used as reference for all surveys and updates, ensuring that everything will be included in the same system. To produce an extensive survey of a site, it is increasingly common to conduct an Unmanned Aerial Vehicle Digital Photogrammetry survey (UAVDP). This involves using a drone equipped with a camera; the captured images are then processed by SfM to generate a coloured 3D point cloud model of the location. The typical deliverable consists of a coloured orthophoto of the site (fig. 9).

Professional methodology for conducting these surveys is well-defined and involves setting up temporary points measured by a topographic network and visible in the images captured by the drone's cameras. These points, called Ground Control Points (GCPs), are essential to accurately georeference the survey and correctly scale the 3D point cloud model obtained as a result of the digital photogrammetric process. At the same time, it is recommended to establish physical markers, known as Control Points (CPs), which should be visible in the images taken by the drone. They serve to verify the accuracy of the model and the orthophoto as well to check the quality of the overall georeferencing process.

The orthophoto derived from this survey is currently very informative and reduces, but does not exclude, the need for graphic 2D reconstruction by CAD. An integrated approach can be used to combine UAVDP surveys with three-dimensional surveying methods such as TLS or Terrestrial Digital Photogrammetry (fig. 10).[17]

With this approach and taking into account the global limitations in accuracy as well as areas normally inaccessible to UAVs, interiors of buildings and underground areas such as tunnels or cavities can be easily mapped using IMMS. Indoor mobile mapping instruments can move rapidly from open air to indoor areas without stopping or calibration, as demonstrated at Villa Burba, where the garden is an open-close space containing different kinds of structures. The survey was undertaken there using the Heron MS Twin Colour[18] mobile mapping system developed by the Italian Company Gexcel in cooperation with researchers from the Joint Research Centre of the European Commission at Ispra, Italy. The capture head of the backpack includes an IMU (inertial measurement unit) and two multibeam Lidar sensors – the one with 32-lines is oriented horizontally and the one with 16-lines is inclined at an angle of 45 degrees; a camera fitted above (Gexcel MG1) has 8K resolution.

At Villa Burba, the three measured trajectories intersect frequently; thus, the point cloud model is rendered with maximum comprehensiveness (fig. 11). Furthermore, this enables the use of an

17 Huilin et al. 2018.

18 Perfetti et al. 2023.

important function in the post-processing of data. This function, which is covered by a registered patent, enables the clouds obtained from individual paths to be relatively aligned, thereby reducing the value of possible drift errors.

In Villa Burba, using a combination of IMMS and UAVDP point clouds, a DTM of the entire garden was extracted and represented by contour lines. The measurements and drawings included individual tree canopies, represented by green circles, trunk sections at a standard height of 1.3 metre from the ground, as well as internal and external plans of all structures, including the Manor House and other buildings situated at the property (fig. 12). One notable attribute of surveys using IMMS equipment is the remarkable efficiency at delivering results, which can be quickly elaborated and visualized almost in real time to support decision-making. A post-processing procedure can produce necessary CAD representations (fig. 13).

Another survey was conducted at Krzyżtopór, a seventeenth-century castle in southern Poland. Like those in Villa Burba and Villa Medolago, it was made using the Heron MS Twin Colour mobile mapping system. At the same time, with the 3D point cloud, Heron can acquire colour, which is mandatory at cultural heritage studies. This is accomplished in two ways: the operator has to determine whether to set the system so that the camera is in video mode or to acquire high-resolution images on demand at the start of the mapping procedure. The video mode is employed to acquire 5K-resolution 360° spherical images, which are used to enrich the point cloud model with colour (fig. 14).

The second setting, or the on-demand mode, is employed to acquire 8K images of high resolution exclusively at the time and site specified by the operator during the mapping procedure. Using RGB panoramic photos, the result in this scenario is a walk-through virtual tour of the captured site. The quality of the images allows the use of machine-learning algorithms to automatically recognise features in the images and to organise web-based virtual tours using the most common 3D data web-sharing portals, such as 3DUsernet[19], Atis Cloud[20], Benaco[21], Cintoo[22], and Prevu3D.[23] These platforms are also the starting point for implementing a cultural heritage site Digital Twin.

The mapping of one level of Krzyżtopór Castle required almost one hour, considering the time necessary to take photos on demand. Several visitors were present during the procedure but were removed from the final point cloud model using the "moving object removal filter." During post-processing, Heron Desktop software can remove all moving objects from the mapped scenes (tourists, workers, cars, etc.). The system is fully controlled by the operator through a PAD device, and the mapping process is executed at ordinary walking pace while traversing the area to be surveyed (fig. 15). The 3D point cloud model is fully calibrated with the spherical picture and the high-resolution images are mapped on a 3D model. The virtual tour navigation using the Reconstructor software platform[24]

19 3DUserNet official website, https://www.3dusernet.com (accessed December 2023).

20 Atis Cloud official website, https://www.atis.cloud/en/ (accessed December 2023).

21 Benaco official website, https://benaco.com (accessed December 2023).

22 Cintoo official website, https://cintoo.com (accessed December 2023).

23 Prevu3D official website, https://www.prevu3d.com (accessed December 2023).

24 Gexcel official website, https://gexcel.it/en/software/reconstructor (accessed December 2023).

can display the spherical images or the 3D point cloud model fully calibrated with the images (fig. 15).

Testing innovative tools: ANT-3D multi-camera system

A comprehensive survey can include establishing a topographic surveying network, drone surveying, measuring with TLS for parts where sub-centimetre accuracy is needed, and surveying with IMMS when it comes to hidden features and buildings, or for mapping areas covered by vegetation. The IMMS approach, although very efficient, still has weaknesses that are intended to be investigated by the test described below and also by proposing innovative solutions that may, in the short term, counteract some of the IMMS limitations. A new technology is now available, consisting of a Mobile Multi-Camera System capable of three-dimensional moving measurements with a photogrammetric approach. The ANT-3D measuring instrument is a functional prototype that was designed to efficiently and reliably survey confined and narrow spaces and, for this reason, has only a very short range of ca five metres.[25] It comprises a backpack and a handheld device with five cameras of five-megapixel resolution. The cameras are installed along the edges of a rectangular metal plate, while the backpack contains batteries and the control unit (fig. 16).

Images acquired by ANT-3D are processed by Structure from Motion (SfM) and Multi-View Stereo (MVS) workflows. Previous comparison between the multi-camera system and Heron Twin colour found that the multi-camera system facilitates robust reconstruction of the trajectory and accurate 3D reconstruction at close range.[26] IMMS needs GCPS and cannot provide local accuracy better than two centimetres, but can obtain reliable and dense 3D information in the medium range. The combined use of the two methodologies seems promising. Surveying with IMMS is quite fast, due in part to the instrument's measuring range. ANT-3D, on the other hand, requires more trajectories and more time for surveying due to its short measuring range (fig. 17).

The IMMS Heron point cloud is also capable of measuring the highest points of trees, with a high point density that is much denser than that produced by the drone or multi-camera systems. ANT-3D, on the other hand, can measure the lower levels of trees with remarkable accuracy (fig. 18).

Using the multi-camera technique, the results for the BHD of trees by ANT-3D show greater accuracy than measurements conducted with a single handheld camera.[27] Interestingly, the photogrammetric data processing chain can integrate a mobile multi-camera photogrammetric system, aerial drone images, and any supplementary ground-based photographic acquisitions. In our case study, the data derived by the multi-camera system adequately compensates for the drone's failure at computing the tree base model, and vice versa (fig. 19).

The results obtained in our trial are even more expressive and significant (cf. fig. 20).

It is evident from the introduction of the new, ground-based, mobile photogrammetric approach that technological progress is moving in the direction of providing surveyors with more and more high-performance specialised tools. We will increasingly see the integration of

25 Perfetti 2022; Perfetti and Fassi 2022; Perfetti et al. 2022.

26 Marotta et al. 2022.

27 Liang et al. 2014.

instruments and technologies, which also demand greater specialisation and better training in the processing of data obtained from various instruments with different accuracies, resolutions, and global characteristics. On the other hand, new methods and tools must be developed to handle the outcomes of these new surveying techniques that generate 3D products. Given the huge challenge in modelling cultural heritage, especially the diverse elements that make up a garden, hierarchical approaches to ordering and managing data will become increasingly necessary and there are already some good instances of modelling plant components with promising outcomes.[28]

Conclusions

The introduction of new tools such as IMMS, digital drone photogrammetry, and new mobile tools has revolutionised the surveying technologies available to experts dealing with historic gardens and cultural heritage. Surveying tools are increasingly productive and capable of delivering results with unprecedented quality, accuracy, and content. Mobile surveying systems based on multi-camera photo capturing will soon appear on the market. In addition, new IMMS systems equipped with multibeam LiDAR sensors have recently been made available and have sub-centimetre accuracies, almost at the level of static TLS sensors. It is essential for historians, conservators, architects, managers, planners and others who are concerned with historic gardens to acquire the expertise concerning available surveying tools and the types of information they can provide. Major effort is also required to equip oneself with an adequate computer and procedural tools to fully manage the information that new technologies can record. Digital data can be extremely useful for efficient and sustainable management of historic sites that are to be preserved.

New survey technologies, combined with modern approaches to the management of cultural heritage, offer interesting perspectives that can be of great use if properly addressed and professionally managed.[29] Today, the digitisation process in the field of cultural heritage is a fundamental aspect of preservation and management. An accurate and complete 3D model offers a reference base for all other kinds of data and comprises the starting point for different types of analysis. Surveying is the first important stage in this complex process.

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28 Teruggi et al. 2020.

29 Jones et al. 2020; Jouan and Hallot 2019.

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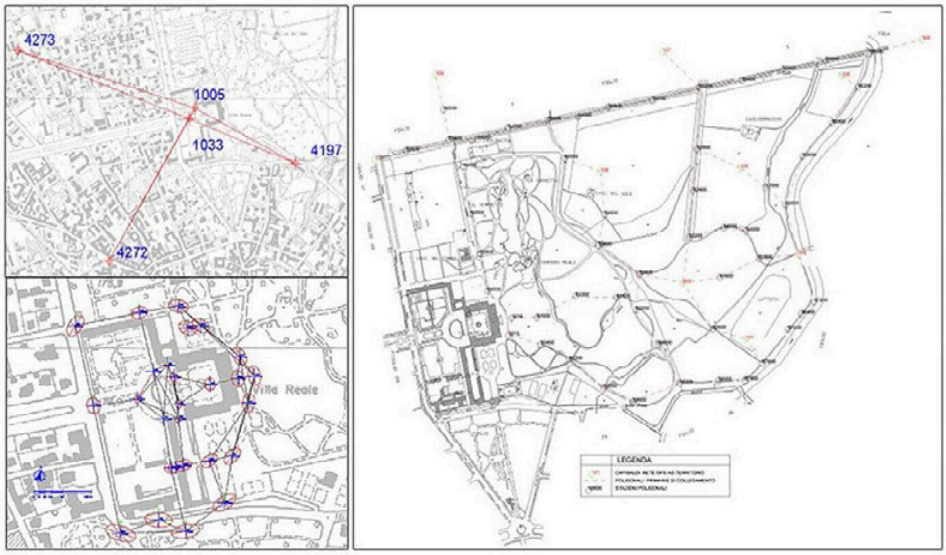


Fig. 1 A topographical reference network extended to cover the complete garden of the Villa Reale di Monza

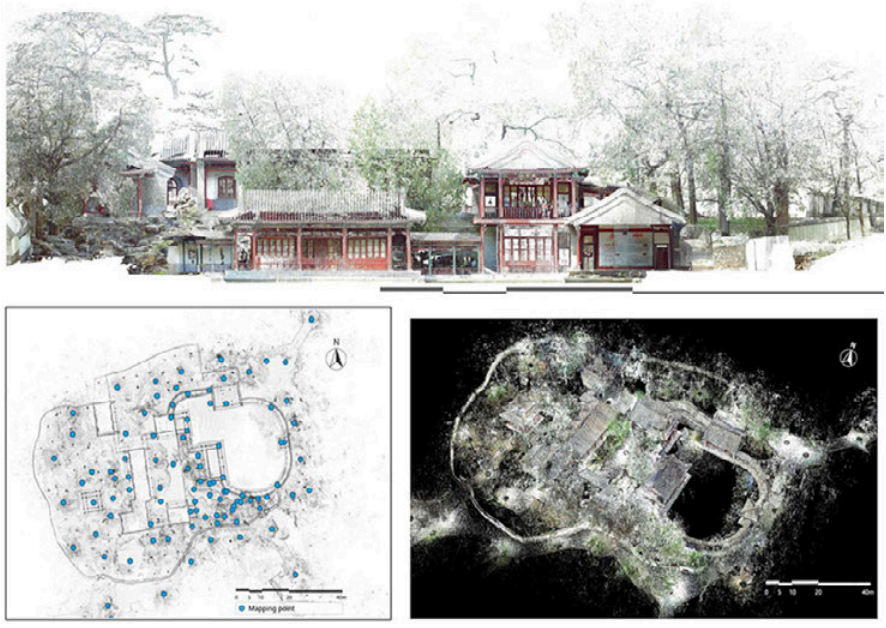


Fig. 2 Jianxin courtyard in the Jingyi garden, China. Top: 3D survey by laser scanner; bottom left: location of static scans; bottom right: garden-wide point cloud model.

Source: Jia et al. 2022

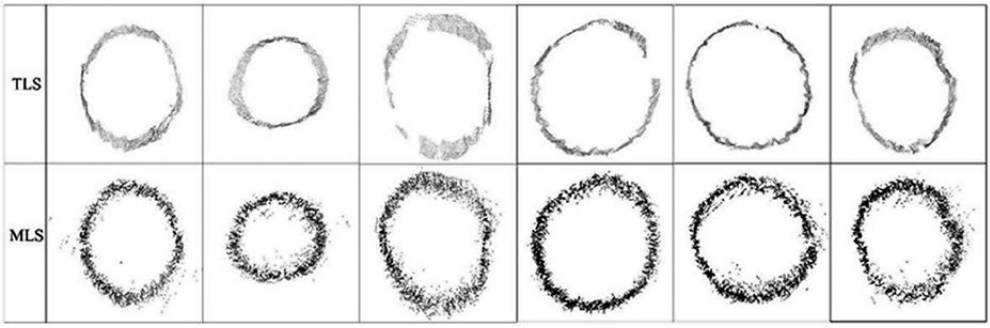


Fig. 3 Comparison between the horizontal sections of tree trunks at a height of two metres above ground using measurements derived from Terrestrial Laser Scanning (top) and Mobile Laser Scanning.

Source: Del Duca and Machado 2023

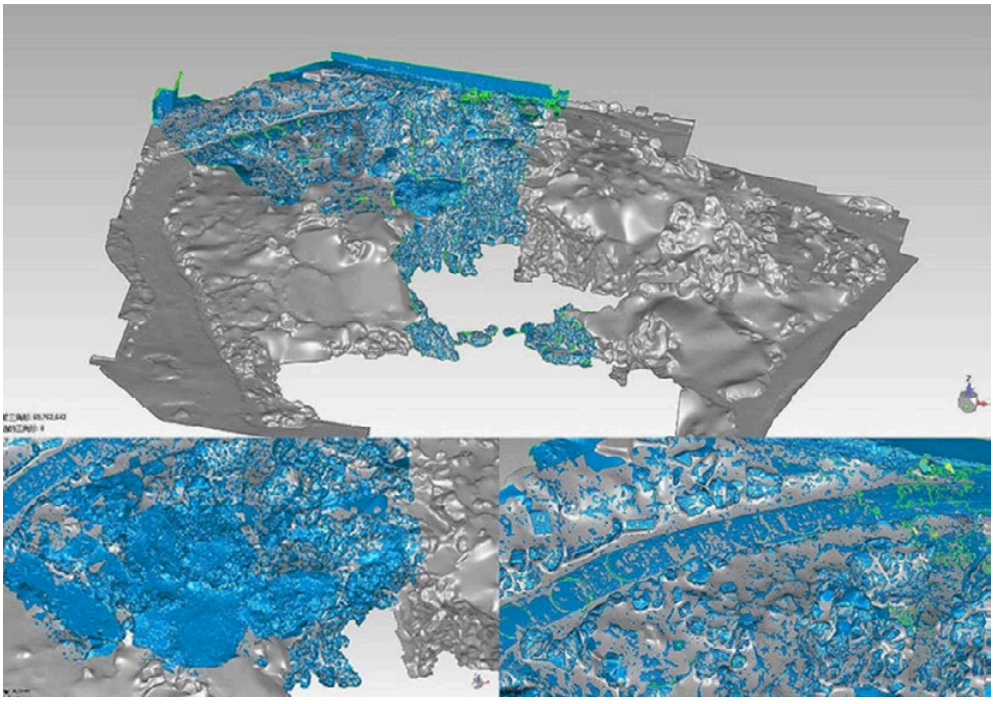


Fig. 4 Combined model of Slam Horizon data (blue) and Trimble TX8 showing Chinese classical garden rockeries at Zhanyuan's South Rockery.

Source: Dong et al. 2020

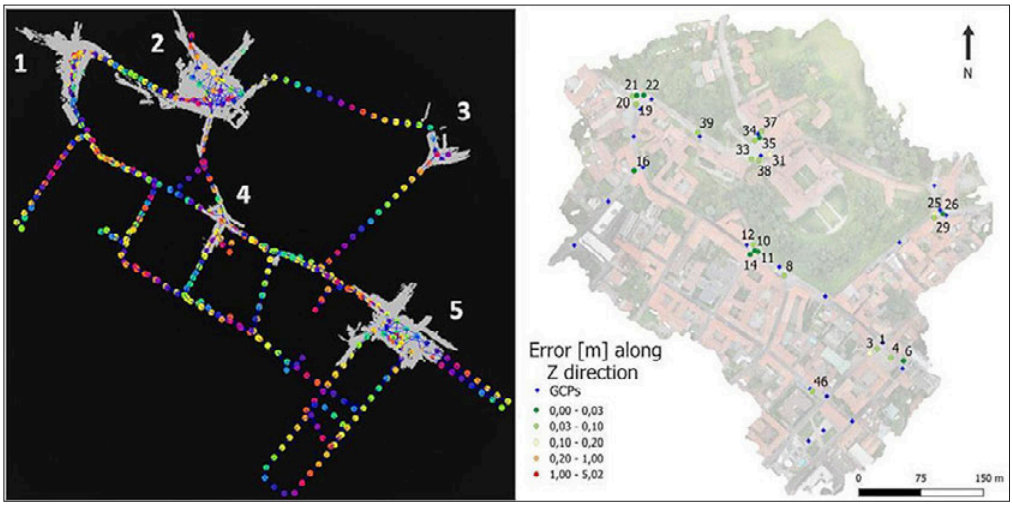


Fig. 5 Meda, Italy. Left: the trajectory of the IMMS instrument (coloured dots) and the TLS scans (grey). Right: the locations of the GCPs used to georeference the static scans.

Source: Marotta et al. 2022



Fig. 6 Measuring GCPs with IMMS HERON Twin Colour device and a GNSS receiver.

Source: Perfetti et al. 2023



Fig. 7 Examples of professional IMMS devices with 3D Lidar sensors and integrated camera: a) Navvis VLX; b) Faro® – ORBISTM; c) Gexcel – HERON MS TWIN Color; d) Leica – BLK2GO



Fig. 8 Examples of tree modelling: polygon model of a black pine trunk, application to deciduous tree model, and a red pine trunk model.

Source: Kumazakia and Kunii 2016



Fig. 9 An orthophoto obtained using digital photogrammetry by UAV at Villa Medolago in Limbiate, Italy

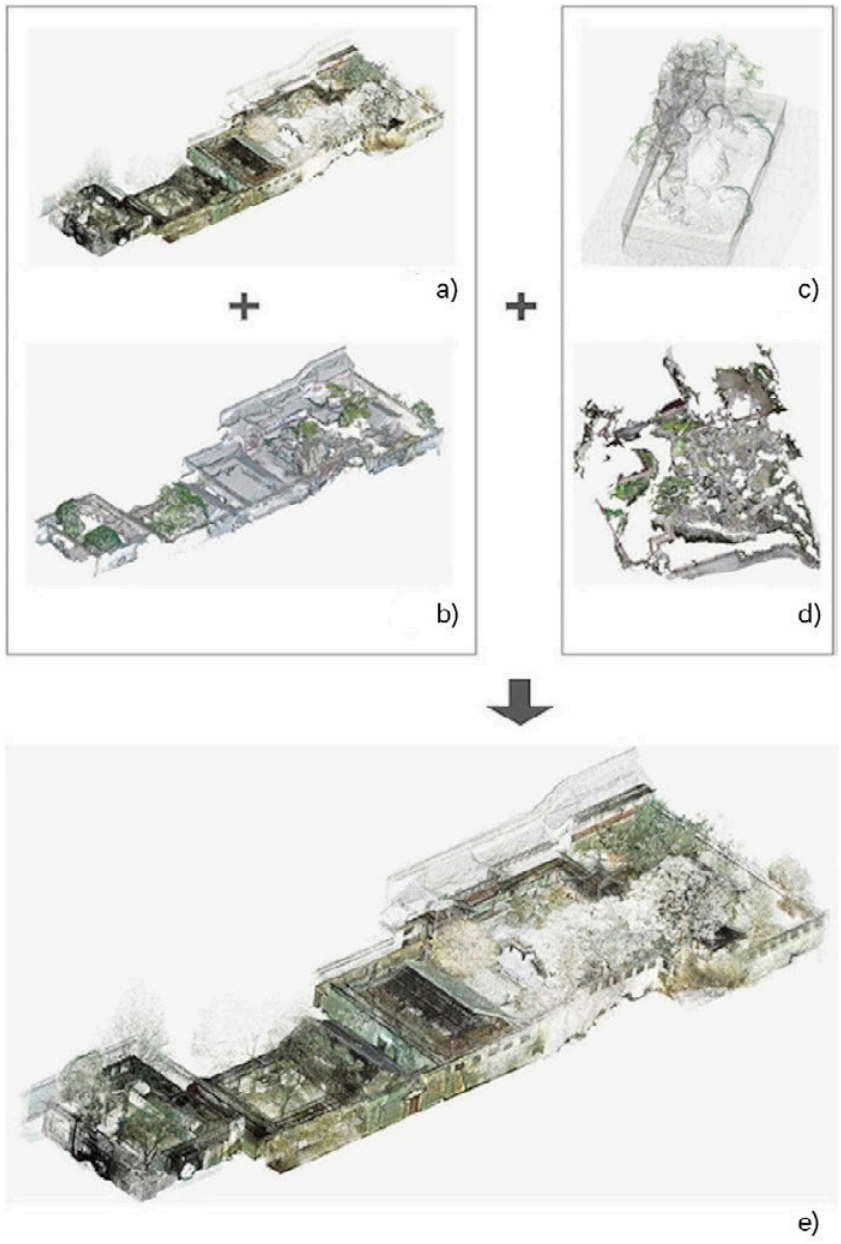


Fig. 10 Mixed survey techniques at the Huanxiu Shanzhuang garden in Suzhou, China: (a) TLS point cloud model; (b) UAVDP point cloud model; (c) and (d) 3D surveys by close-range Terrestrial Digital Photogrammetry of monoliths A and B, respectively; (e) aerial view of the integrated point clouds from TLS, TDP and UAVDP.

Source: Huilin et al. 2018



Fig. 11 Villa Burba garden survey. Fieldwork using the Heron Backpack; trajectories shown in colour

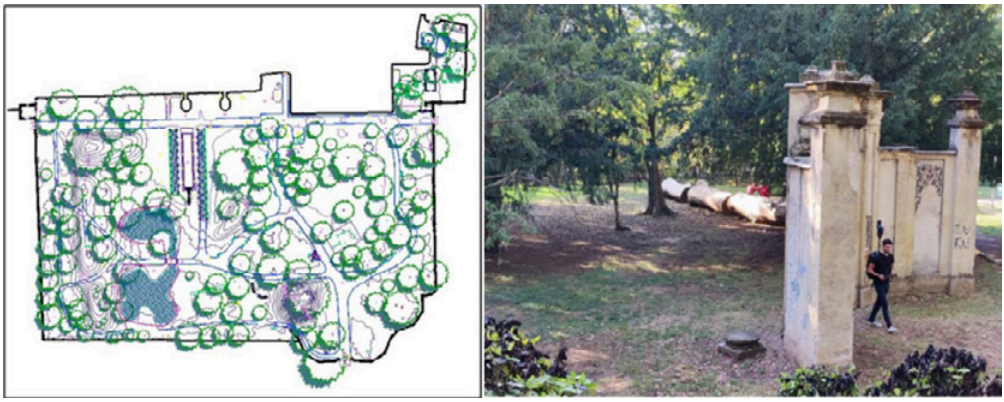


Fig. 12 Villa Burba garden survey, 2D CAD drawing based on 3D digital survey. The mobile mapping survey included the trees and full ground plans of all the structures situated at the property

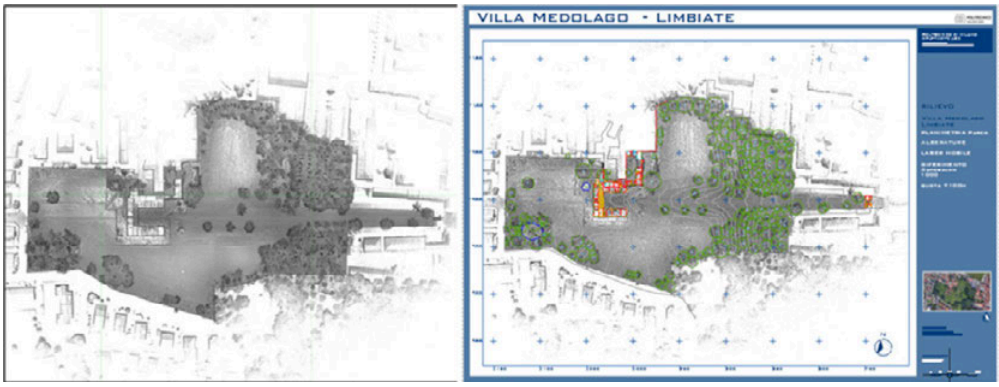


Fig. 13 Left: blueprint of the Villa Medolago area obtained using the point cloud extracted by IMMS Heron mobile mapping survey. Right: the complete 2D CAD representation



Fig. 14 Colour test of part of the University of Brescia. The video mode is used to provide colour to the point cloud model

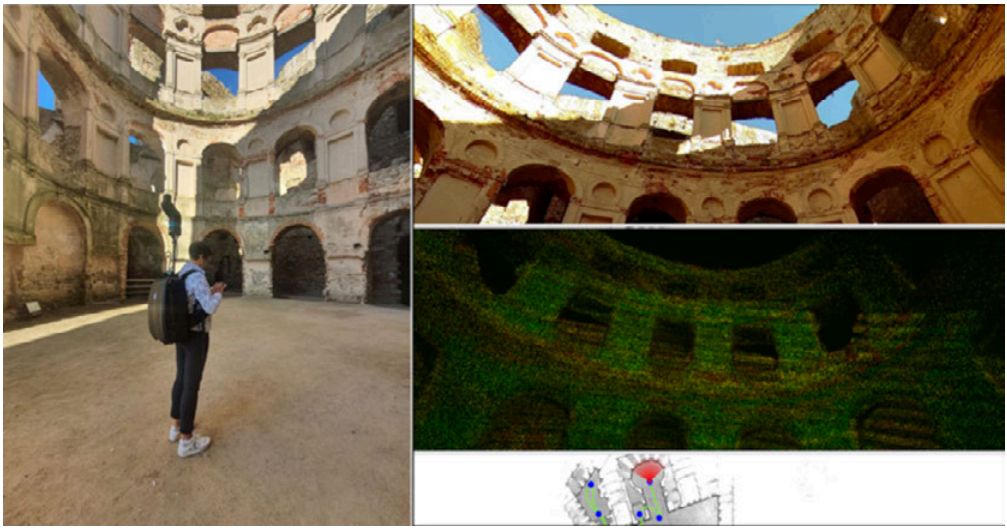


Fig. 15 Mapping Krzyżtopór Castle with a Heron MS Twin Colour mobile mapping device. Right: image tour navigation inside the IMMS survey using the Gexcel software platform Reconstructor. The colour image is automatically superimposed on the 3D point cloud model

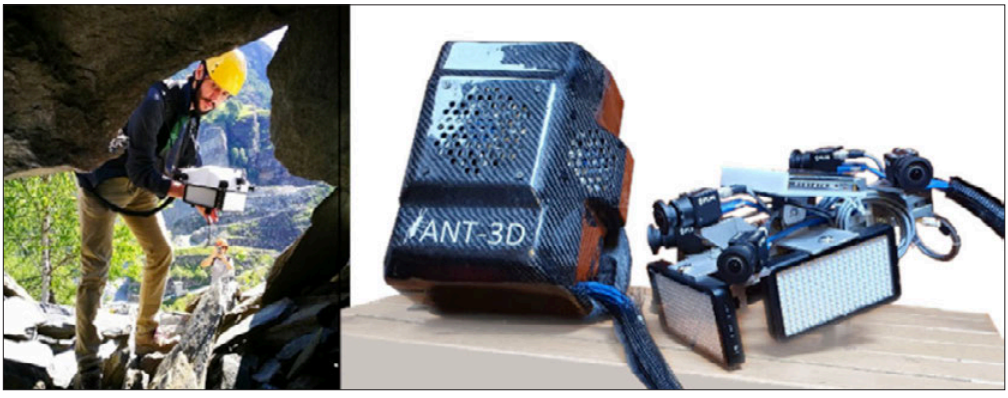


Fig. 16 The portable ANT-3D multicamera device

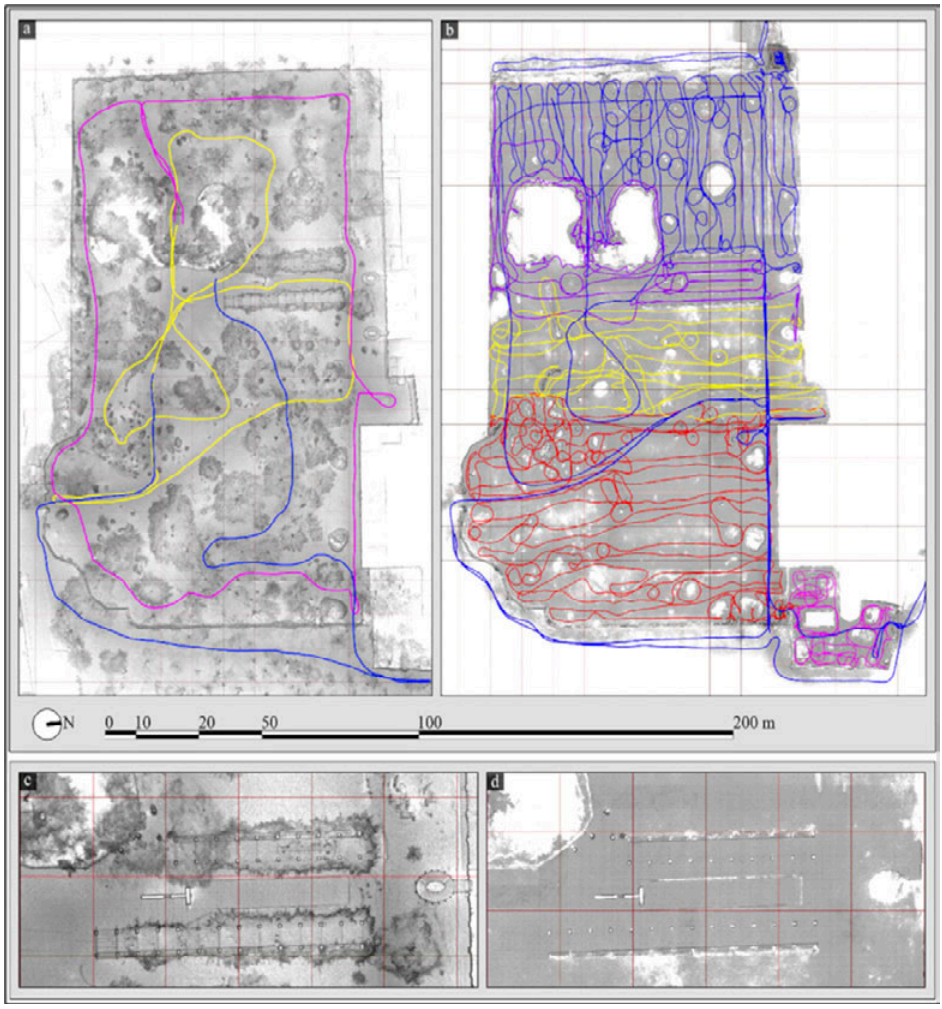


Fig. 17 Blueprints of two separate point clouds obtained at the Villa Burba, along with the trajectories that were followed: (a) Heron Backpack survey and (b) ANT-3D survey, with respective zooms (c) and (d). The red grid has a spacing of ten by ten metres.

Source: Perfetti et al. 2023

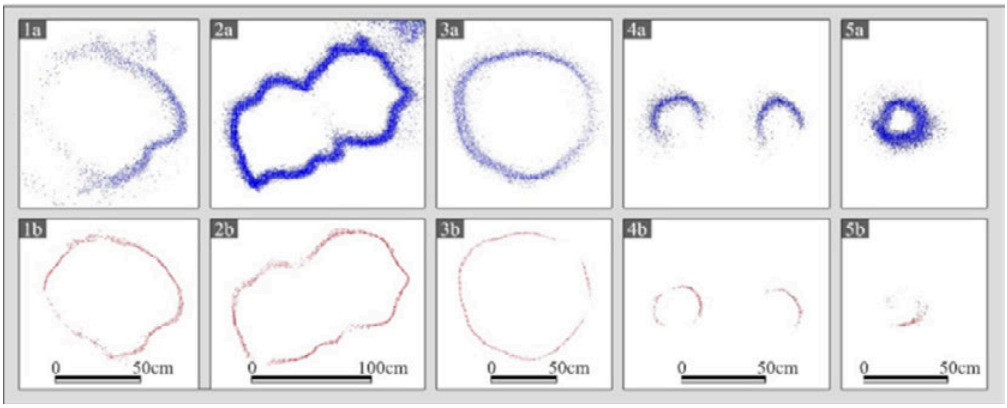


Fig. 18 Tree sections at breast height extracted from the Heron Backpack point cloud (blue) and the ANT-3D point cloud (red).

Source: Perfetti et al. 2023

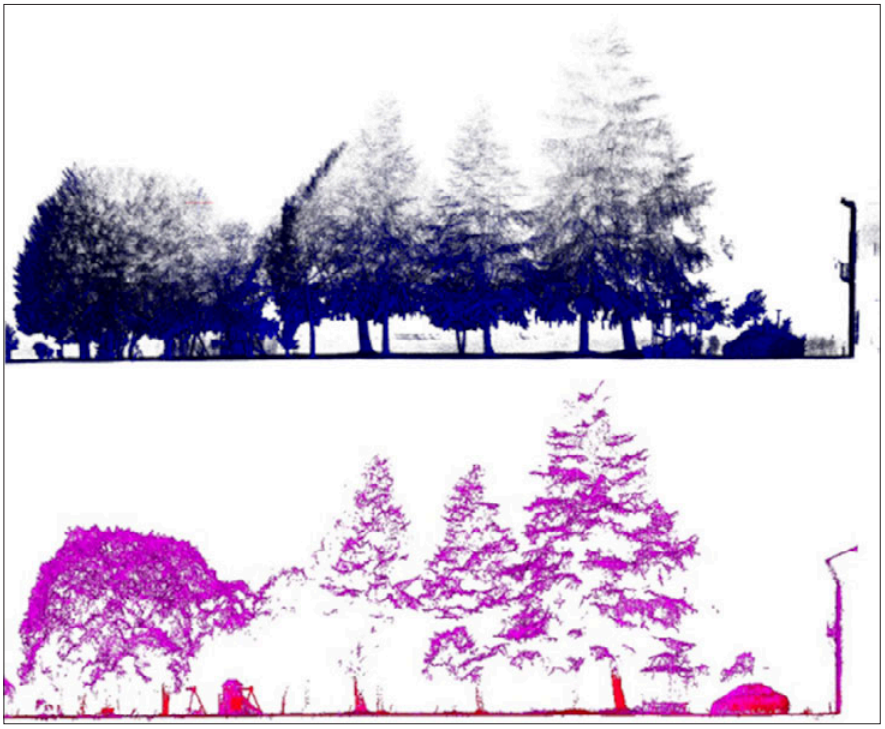


Fig. 19 Cross-sections extracted from HERON Backpack (top) and from ANT-3D + UAV (bottom). ANT-3D in red, UAV in pink.

Source: Perfetti et al. 2023

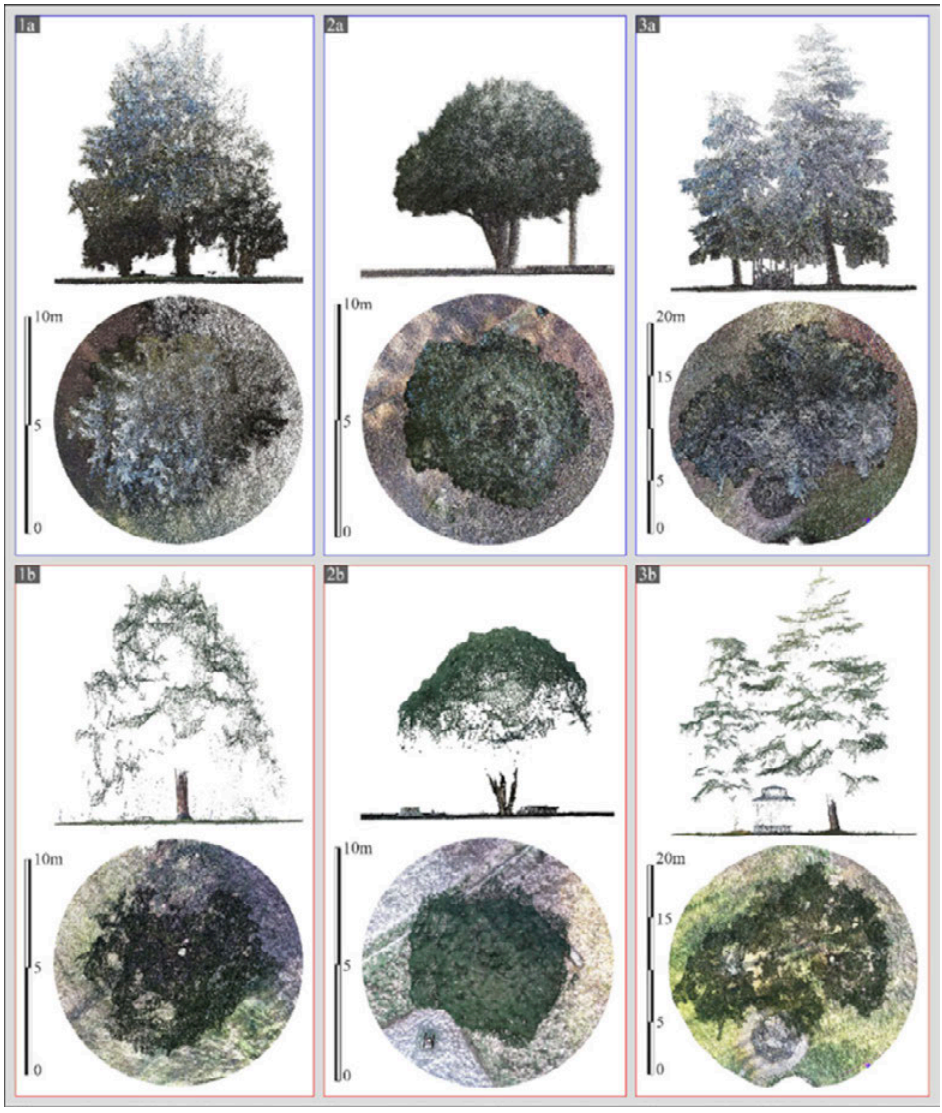


Fig. 20 Tree plans and elevations extracted from the HERON Backpack point cloud (top row) and the Ant-3D + UAV point cloud (bottom row).

Source: Perfetti et al. 2023

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Neil Linford – employed as a senior geophysicist within Historic England's Geophysics team providing advice on the use of geophysical methods within the historic environment, including field survey and the application to standing buildings. His research interests include the use of multichannel ground penetrating radar, environmental magnetism and high-sensitivity caesium magnetometer surveys. He has contributed to a wide range of geophysical survey reports and publications, and currently serves as the book review editor for the journal *Archaeological Prospection*.

Tomasz Herbich, Neil Linford

Geophysical methods in garden research

Geophysical survey has been applied to the investigation and research of historic gardens for a number of years using a range of different techniques and methodologies. This contribution summarises the use of the main geophysical techniques: earth resistance, magnetometry and ground penetrating radar applied to a range of very different historic garden sites. The article is illustrated with representative data sets collected by the authors and their colleagues from England, Poland, Egypt and Spain.

Introduction

Geophysical survey has provided a practical, non-destructive means of investigating garden archaeology using a range of techniques dependent upon the specific features under investigation and access in cases where planting designs are still extant. Three methods are commonly used in such research practice: earth resistance, magnetometry and ground penetrating radar (GPR), with the occasional use of the electromagnetic method. Geophysical methods have been applied to the study of gardens for at least three decades, and in Poland since the first decade of the twenty-first century. The experience gained from these studies allows the effectiveness of these methods to be assessed. However, the chosen method is often determined by current site conditions, ease of access, and nature of the expected garden features. Other considerations may include the need to estimate the depth of a particular feature, for example when further invasive work is planned or to determine the fall of a historic drainage network.

Results presented in this paper are drawn from surveys conducted by the authors across a diverse range of sites

located in England, Poland, Egypt and Spain. While the aim of the majority of these surveys was to identify and locate known garden remains, the unexpected discovery of geophysical anomalies associated with horticulture has also been reported.

Methods

The application of geophysical survey methods to garden archaeology is covered by a number of authors[1,2,3,4] using a range of techniques.

The earth resistance technique is well suited to the detection of a range of planting pits, former paths and hard design features. In this technique, a small electric current is passed through the subsurface to detect variations in soil moisture by determining how easily the current can flow through dissolved ions present in any retained water. In this regard, earth resistance often responds in a complementary manner to the formation of parch marks where the presence of near-surface garden features can reduce local soil moisture, causing the overlying grass to turn brown. In general, parch marks only occur under very specific conditions during long, particularly dry periods of weather, such as when the Victorian parterres appeared at Gawthorpe Hall during the 2018 heatwave.[5] While data acquisition is often slow when using earth resistance, the technique offers the advantage of flexible access in confined areas, although only grass or bare soil surfaces are suitable for the insertion of mobile steel electrodes. The method is dependent on seasonal variations in soil moisture contrasts, precluding use when conditions are either very arid or water-logged. In general, however, it responds to garden features even when parch marks are not apparent.

The magnetic method is useful in registering the layout of a garden design, especially in cases where structures were made of materials with enhanced magnetic properties (e.g. burnt brick or ferrous edging). However, the application of the method is often challenged by the presence of modern ferrous features, including recently buried services, potentially limiting the application to more open areas. In certain instances ferrous features may be associated with the previous design or integral utilities within a garden. Electromagnetic instruments have also proved useful where conditions may prove too challenging for standard magnetometry, for example when used to detect previous cinder paths in the garden at Kenilworth Castle, Warwickshire, which was reconstructed in the 1970s.[6]

More recent surveys have seen the application of GPR. This technique responds to a similar range of garden features as earth resistance with the added advantages of much higher spatial resolution, the capacity to make accurate depth estimates, and the ability to work over a range of different surfaces including metalled paths and roadways. Accurate location of measurements is usually obtained through the use of either global navigation satellite systems (GNSS) over open ground or a tracking robotic total station under more challenging areas of tree cover, although data can be also collected over a regular grid. Vehicle-towed antenna arrays can be used to acquire data over very large areas,

1 Aspinall and Pocock 1995.
2 Bevan 1994.
3 Keevil and Linford 1998.
4 Cole et al. 1997.
5 BBC 2018.
6 Linford, Linford and Martin 2005.

allowing application in a wider range of designed landscapes, often providing additional context about more formal garden layouts.[7]

Examples of geophysics applied to English garden sites

An original earth resistance survey conducted in July 1992 at Kirby Hall, Northamptonshire, revealed a range of features to the south and east of the partially ruined mansion, associated with a wider pattern of drainage and paths surrounding the reconstructed Great Garden.[8],[9] GPR was not available at the time of the original survey but a comparative area of the site was resurveyed in July 2022 during the investigation of a partially collapsed floor within the surviving buildings at the site.[10] Figure 1 shows a comparison between the two data sets and the enhanced level of detail revealed in the GPR data collected at a 0.075 m x 0.075 m sample interval with a 3d-radar (Kontur) MkIV GeoScope using a DXG1820 ground coupled twenty-channel antenna array. The near-surface data imaged small individual tunnels created by burrowing moles immediately under the current lawn, revealing the faint remains of original gravel paths lined by planting pits at increasing depth. The remains of a demolished building together with drains and modern services are evident from the depth of half a metre onwards with retaining wall foundations and possible statue plinths extending beyond one metre from the surface.

Traditional techniques such as magnetic survey can often be applied to investigate specific garden features. For example, at Down House, London Borough of Bromley, the family home of Charles Darwin, there are historical records of both a cistern for waste water and experimental liquid manure. Water at Down was obtained with considerable effort from a deep chalk aquifer well and would most likely have been reused to supply the walled kitchen garden. This would have been particularly true in Darwin's later life when he was advised to take daily cold water showers for his rheumatism using an outside facility. While no traces of these structures survives at the site, a magnetic survey of the garden (fig. 2) revealed a ferrous pipe unrelated to modern services that would appear to suggest a possible water supply from the site of the well and cistern to the walled garden.[11]

However, it is perhaps the wider availability of high sample density GPR that has proved most useful when applied to garden archaeology. This has allowed application in large areas while also retaining considerable detail when revealing ephemeral garden design or planting features. Subtle garden paths imaged by GPR in the "Mithraic glade," forming part of the expansive garden design at Wrest Park, Bedfordshire, were compared to contemporary water colour sketches, which allowed the location of a romantic "root house" dwelling to be suggested (fig. 3). Clay drainage pipes were also found at Wrest surrounding the buried base of a removed statue in the Duke and Duchesses' square (fig. 3) together with a wide range of other garden features, partially known from parch marks and contemporary records.[12]

Given the frequent redesign and change of use in gardens, geophysical

7 Linford, Linford and Payne 2017b.

8 Dix 1991.

9 Linford 1992.

10 Linford 2022.

11 Linford, Linford and Payne 2018.

12 Linford and Payne 2019.

survey can help provide evidence for surviving features or confirm the actual elements of a planned design that were finally constructed. For example, at Belsay Hall in Northumberland, the historic Ordnance Survey mapping shows a fishpond feature adjacent to a surviving "hot wall," although no remains of water features exist at the site today. Figure 4a shows the results from a GPR survey that confirms the survival of buried walls associated with the fishponds and additional features not represented on the mapping.[13] Details of the garden features surrounding the bowl of the Perseus and Andromeda fountain at Witley Court in Worcestershire were also lost following the abandonment of the property after a catastrophic fire in the mansion house (fig. 4b).[14] A water colour painting was prepared by the garden architect William Andrews Nesfield, showing an arrangement of eight planters surrounding the fountain. While the GPR survey had clearly identified the location of the planters, there was only evidence of four in the implemented design.

Figure 5 shows an extract from GPR data collected from the remains of a Tudor water garden at Belhus Park in the borough of Thurrock, east of London.[15] A manor house was first tenanted there from the fourteenth century and was rebuilt as Belhus House towards the end of the sixteenth century, obtaining in 1618 a licence to create an extensive park and elaborate parterre garden, shown on an estate map of 1619 and on a bird's-eye view of the property from the early eighteenth century (fig. 5). Following a period of neglect, the house and its grounds were remodelled by "Capability" Brown between 1753 and 1763 before eventually being abandoned after the Second World War. The site has been used as a municipal golf course since 2000, with no evidence of formal gardens beyond a subtle, circular depression on one of the fairways. Access to the golf course was therefore restricted, although a window of opportunity arose during the COVID-19 lockdown for two days prior to the reopening of outdoor public amenities.

The central circular GPR anomalies correlate with the slight depression and corroborate details shown on the contemporary, false perspective painting of the gardens. The GPR survey also suggests that the location of the gardens to the north are slightly offset compared to the painting and the survival of structural remains to the east is more fragmented, perhaps due to the later remodelling of the gardens owing to the Second World War activity at the site. The GPR survey has also revealed a substantial network of buried conduits and services across the site that may well, in part, be associated with the water supply or drainage from the original house and water gardens. Surviving architectural elements in the wider landscape, including a brick built Tudor "stench pipe" may also be associated with the drainage conduits.

Examples of geophysics applied at sites in Poland, Spain and Egypt

Geophysical research of gardens in Poland does not have a long history. A limited number of cases of such research are known, and none of them have been reported in literature. There are several reasons for this but the most important is the lack of demand for this type of research, which is related to the low number

13 Linford, Linford and Payne 2017a.

14 Linford and Payne 2017.

15 Bristow et al. 2021. An animated version of GPR data can be viewed at https://www.youtube.com/shorts/WGKI1VXRggk.

of archaeological research projects studying gardens in Poland. This, in turn, results from the fact that investigating and exploring the history of subsequent garden layouts is usually the last in a long line of activities aimed at restoring, or retaining the splendour of palace and park complexes. One example is the research carried out in the gardens of Wilanów, where geophysics accompanied a large-scale programme of archaeological works, forming a still unique project.[16] Nevertheless, the Polish co-author of this article managed to conduct research in several locations in Poland, two of which are presented below: Łazienki Park and Korczew. The same co-author also managed to reveal elements of garden layouts during geophysical research outside of Poland: in Medīnat az-Zahrā in Spain and Dahshur in Egypt.

The research in the Royal Łazienki Park in Warsaw was done in the lower part of the park surrounding the royal residence, built in the second half of the eighteenth century for the last king of Poland, Stanisław August Poniatowski. It aimed to settle a very specific issue concerning the dimensions of the orangery built in the park around 1822 (when it was already the residence of the representative of the Tsar of Russia) and demolished in the second half of the nineteenth century. The location of the orangery is marked in nineteenth-century plans of Warsaw.[17] The appearance of the building is known from one engraving, made by Paweł Charzyński in 1828. The building was rectangular, erected on a podium, part of which, on the southern side, was a terrace. Fragments of the central part of the terrace – a decorative niche on the southern side, and the entrance to the dome-vaulted basement on the northern side – have survived to this day (fig. 6).

The tests were carried out using the earth resistance area survey and the earth resistance tomography (ERT) methods. The area survey was carried out applying a twin-probe array with three traversing electrode spacings (0.5, 1 and 1.5 m), providing an image of changes in resistance in layers to the depth of approximately 0.7, 1.5 and slightly above two metres, respectively.[18] The measurements perfectly reproduced the outline of the building's foundation, showing that the basement was only below the building and did not reach under the terrace (fig. 7, top). The resistivity map showed an area with a significant increase in resistance corresponding to the basement. The presence of a structure with identically changing resistivities (values rise with the increase in the prospection depth) indicates the existence of a similar room (basement) also on the western side of the building. This observation is supported by the ERT results – the image and depth of the structure of high resistivity in the western part is identical to the image and depth of the anomaly corresponding to the known basement (fig. 7, bottom).[19] High resistivity in the eastern part of the building – observed from the surface layer to the deepest layer covered by the prospection – indicates that rubble is accumulated there, limited from the north and south by the building's

16 GPR and electroresistance research were carried out by Łukasz Porzuczek. However, the publication does not include the results of these studies. See: Gołembnik and Jankowski 2005.

17 For example, the locations of the Gothic Orangery in Łazienki Park can be found on nineteenth-century maps, for example "Plan miasta stołecznego Warszawy wymierzony przez oficerów Korpusu Inżenierów" by Józef Koriot, 1828.

18 Schmidt 2013.

19 ERT measurements were carried out by Radosław Mieszkowski from the Faculty of Geology, University of Warsaw. See: Jaskóła, 2018 (unpublished report).

foundation walls. The hypothesis about the presence of rubble was confirmed by excavations carried out in the central part of the orangery and terrace.

The palace in Korczew in eastern Mazovia – a settlement first mentioned in sources in 1401 and changing owners many times – was built in 1734–1736. There is no information about any other residences before the palace was built or the use of the area. The oldest maps of the palace surroundings date back to the nineteenth century and are too imprecise to reconstruct the park plan or identify elements of garden architecture. The sources only contain information about the park's establishment according to a plan by Franciszek Jaszczołd, an architect working in this area in the first half of the nineteenth century.[20]

Geophysical research, followed by excavations aiming to verify the findings from non-invasive research, was carried out as part of a broader project to revitalize the surroundings of the palace, which was restored in recent decades to its former glory thanks to the efforts of the heirs of Krystyn Ostrowski, who owned the palace until the communist agrarian reform in 1945.[21] The park is located on a slope descending towards the Bug valley. The research covered a part of the park with sparse trees, located on the northern side of the palace, and the adjacent annexes. The only preserved element of the park's architecture is the former orangery (connected with Jaszczołd's activities) transformed into a chapel in the inter-war period, standing perpendicular to the northern façade of the palace, on the axis of the eastern outbuilding. Resistivity and GPR research revealed the presence of a number of structures invisible on the surface. According to the results, the park, whose width equals that of the palace and outbuildings, was entirely surrounded by a wall. The building of the former orangery was erected in the north-western corner of the area surrounded by the wall. Symmetrical to it was a building with identical dimensions in the north-eastern corner (fig. 8). There was a wall running across the slope, dividing it into terraces. The shape of this wall reflected the outline of the northern façade of the palace. A source query revealed a document that allowed the orangery and the symmetrical building to be dated back by almost one hundred years.[22] The discovered structures are therefore a relic of an unknown French Baroque garden, characterized by symmetry of composition. These structures ceased to exist because Jaszczołd transformed the garden in the English style. Excavations confirmed that the building symmetrical to the orangery was demolished in a planned manner.

The palace and garden complex in Medīnat az-Zahrā was built in mid-tenth century as a private retreat for caliph Abd ar-Rahman III, in the vicinity of Cordoba, which was the capital city of the Umayyad caliphate. Over the course of two decades, the complex, measuring 620 x 645 metres (of which the garden covered an area of 520 x 620 metres), grew to 750 x 1,510 metres after taking over the function of the capital of the caliphate, but the area of the garden did not change significantly.[23] Lidar and satellite images showed that the garden, located on a slope, below the section with the palace buildings, is divided into rectangular

20 Murawska 1980; Kotyńska-Stetkiewicz 2006.

21 Główka et al. (in preparation).

22 The author of the query is Grzegorz Śnieżko from the Institute of Archaeology and Ethnology of the Polish Academy of Sciences. See: Główka et al. (in preparation).

23 Vallejo Triano 2010.

sectors.[24] A much more accurate picture of the garden plan was provided by a magnetic survey (fig. 9). It showed that the garden was surrounded by pathways eight to ten metres wide, and two paths intersecting in the centre at a right angle divided the garden into four parts. At the southern end of the path constituting the axis of the complex, research revealed the presence of a gate mentioned in written sources.[25]

Research also provided information enabling the reconstruction of the garden's irrigation system. Magnetic maps show the main water channels running down the slope, from north to south. The channels are connected to water reservoirs visible on the surface. The map also shows linear anomalies with reduced magnetic field values running across the garden along the east-west line. The average distance between the lines is approximately 7.5 m. It can be safely assumed that the anomalies correspond to earth channels that distributed water in the garden. There is no information about the type of trees that grew there. However, it can be assumed that seven-metre strips are suitable for growing fruit trees. Moreover, the obtained magnetic image shows that the irrigation system was identical for the entire garden area, which proves that it was built at the same time.[26] Neither satellite nor lidar image analysis provided information about the irrigation system.

The design of the garden, reconstructed on the basis of magnetic studies, may have its roots in Middle Eastern Abbasid garden architecture. Thus, the tradition may reach back to the Achaemenid Empire of Persia, where, in the context of the Zoroastrian religion, gardens with such a plan might have been seen as a representation of order in the face of chaos.[27]

The existence of gardens in ancient Egypt is confirmed in iconographic sources, primarily decorations of tombs.[28] Another source are models of houses placed as grave goods, with gardens within a rectangular wall surrounding the house.[29] Excavations confirm the existence of small gardens in front of tombs.[30] There are also documented groups of trees and shrubs decorating the area in front of temples. The latter are known from Western Thebes, before the temples were built on desert plateaus on the edge of the Nile Valley. Trees were planted in pits dug in a sand and gravel substrate, filled with fertile Nile mud, creating favourable environment for vegetation.[31]

During magnetic research in Dahshur, a necropolis from the Old and Middle Kingdom, located approximately twenty kilometres south of the Giza pyramids, a complex preceding the construction of the temple was discovered in the vicinity of the Valley Temple associated with the Bent Pyramid. The complex consisted of an enclosure wall measuring 81 x 56 metres and a small building within it (fig. 10). The function of such enclosures, known from the early dynastic period, was associated with rituals accompanying the ruler's funeral.[32] Inside the enclosure, along the walls, a number of oval anomalies were recorded, symmetrically arranged in rows. The nature of the anomalies (identified through increased values of magnetic susceptibility) allowed them

24 Arnold 2019, 309-310.
25 Ruggles 2000, 64.
26 Arnold 2019, 311-313.
27 Arnold 2019, 315.
28 Wilkinson 1990.
29 Wilkinson 1990.
30 Galán 2019.
31 Tietze et al., 2011; Wilkinson 1994, 12.
32 Bestock 2008.

to be considered as reflections of pits filled with mud (Nile mud has magnetic properties due to the content of iron oxides).[33] Excavations confirmed the existence of pits; analysis of plant remains made it possible to identify that palms, sycamores and cypresses were planted there.[34] The small size of the pits (usually 60 centimetres in diameter) indicates that these were young trees which did not grow to large sizes. Taking into account the funerary function of the complex, a purely agricultural function of the garden should be ruled out. It was rather symbolic in nature. Taking into account the function of the enclosure and the fact that the garden was located deep in the desert, the vegetation would have served to establish a setting suggestive of nature' fertility.[35]

Continuation of research deep into the desert led to the discovery of a completely unknown settlement.[36] On its edges there are anomalies of identical shape and dimensions to those verified as pits for trees and shrubs. The pattern of anomalies shows that trees were planted there at regular intervals. Excavations made it possible to hypothesize that it was a settlement related to the builders of one Snefru's pyramids (in Dahshur, two pyramids are associated with this pharaoh – Bent and Red).[37] The high status of the estate's inhabitants is evidenced by the decoration of the houses. The presence of gardens would provide further confirmation of this. It is worth noting that there are no traces of greenery in the barracks located approximately 700 metres away, which housed workers employed in the construction of the pyramid.[38] Gardens were too expensive to maintain in desert conditions for people from lower social classes.

Conclusions

Geophysical survey provides a range of techniques for non-invasive investigation of historic garden remains, responding to a number of different features. While traditional geophysical techniques such as magnetic and earth resistance surveys continue to prove successful, the wider application of ground penetrating radar has made it possible to enhance the resolution of often subtle garden design features. Distinguishable geophysical responses from cut features, retaining walls and ferrous pipes or edging can be detected by a combination of traditional techniques, but the added spatial and depth resolution provided by GPR can help image more ephemeral features such as gravel paths or planting beds. Where possible, vehicle-towed GPR arrays can provide large area coverage while maintaining suitably high sample density.

Perhaps what has been equally important to the methodological advances is the much wider recognition of garden features identified in geophysical survey data. This may be achieved through the discovery of unknown or earlier garden designs within existing designed landscapes or by identifying possible planting features within a previously unrecognised context.

33 Hesse 1967.

34 Arnold 2015.

35 Arnold 2018, 124.

36 Herbich 2022, 399.

37 Rosenow 2022.

38 Alexanian and Herbich, 2014/2015.

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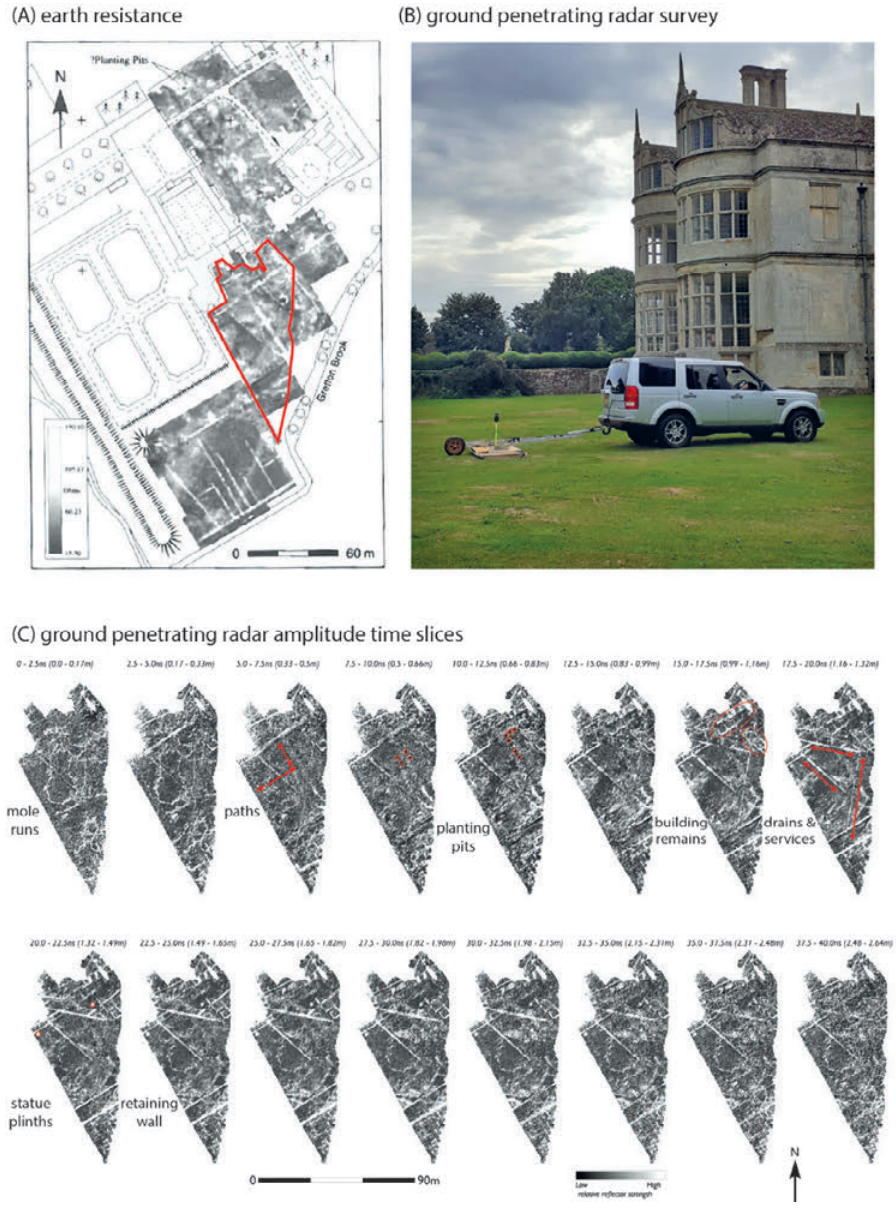


Fig. 1 Kirby Hall, Northamptonshire, UK. (a) results from the 1992 earth resistance survey conducted with a 0.5 m mobile electrode spacing using 1.0 x 1.0 m sampling interval; (b) 2022 GPR survey in progress using a 3d-radar (Kontur) GeoScope Mk IV with a twenty-channel ground-coupled vehicle-towed antenna array collecting data at a 0.075 x 0.075 m sample interval; (c) GPR amplitude time slices – each greyscale image represents the variation of reflection strength through successive ~0.17 m intervals from the ground surface.

Processing and photo: Neil Linford

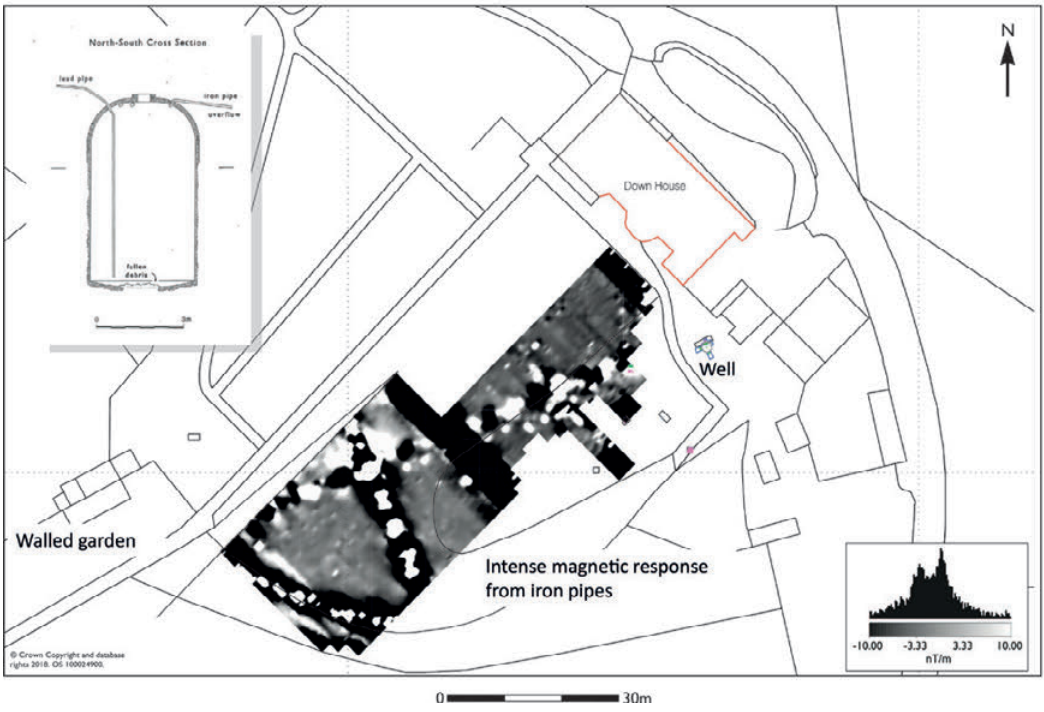


Fig. 2 Magnetic survey results from Down House, Bromley, London Borough of Bromley, UK, showing the distinctive response to ferrous pipes leading from the vicinity of the well and waste water system for reuse in the walled kitchen garden. A cross section through the waste water cistern is shown inset. Bartington 601 dual fluxgate gradiometer, sampling grid 0.25 x 1.0 m.

Processing: Andrew Payne.

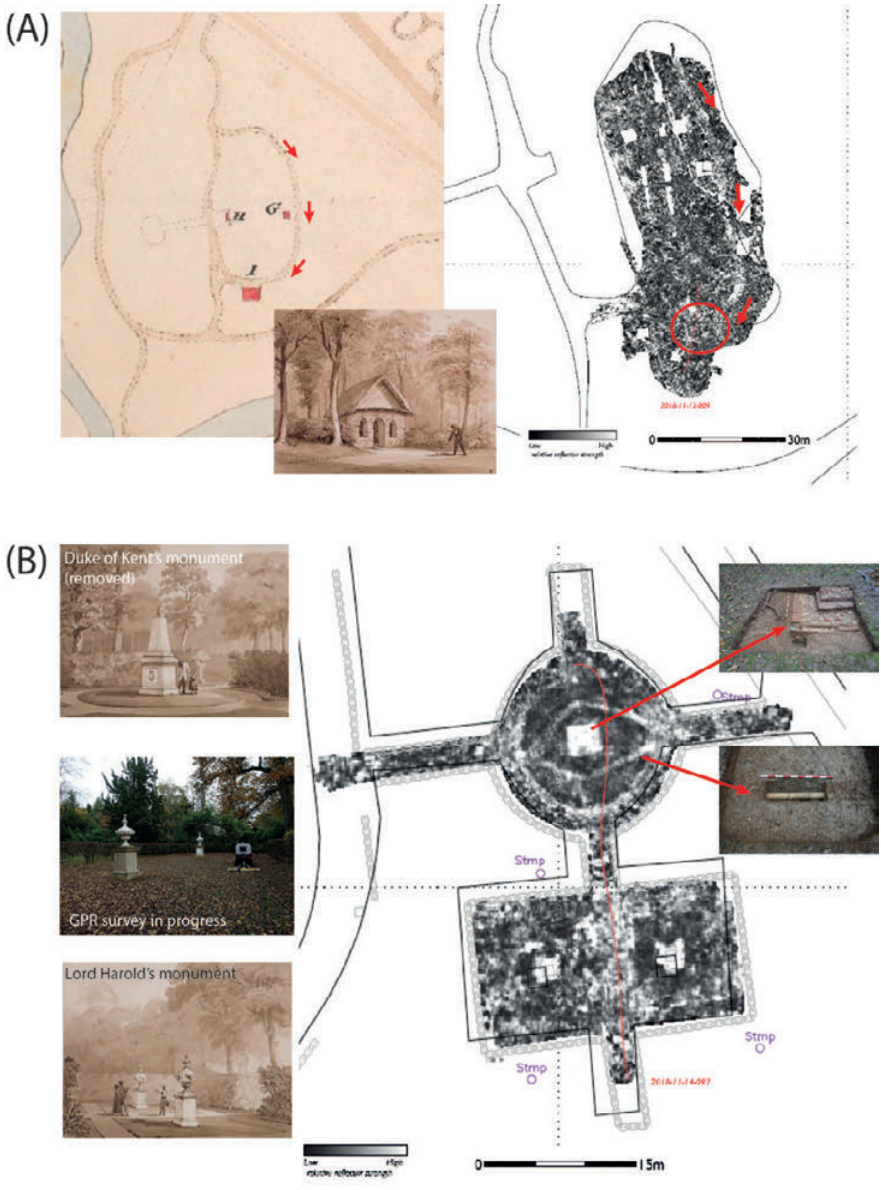


Fig. 3 GPR survey data from Wrest Park, Bedfordshire, UK. (a) contemporary plan of the Mithraic Glade with an inset water colour of the "Root House" by Earl de Grey to the south of the circular path at "I." The location of the "Root House" (red circle) could be discerned from the faint response to the surviving remains of the path (red arrows) shown in an amplitude time slice from between 2.5 and 5.0 ns (0.15 to 0.3 m); (b) GPR results revealed the plinth for the removed Duke of Kent's monument and clay drainage pipes confirmed through subsequent excavation (inset photographs) and lost paths to the south surrounding Lord Harold's monument at a depth of approximately 0.45 to 0.61 m. Details of the GPR equipment and sampling interval are identical as in Figure 1.

Processing and photo: Neil Linford

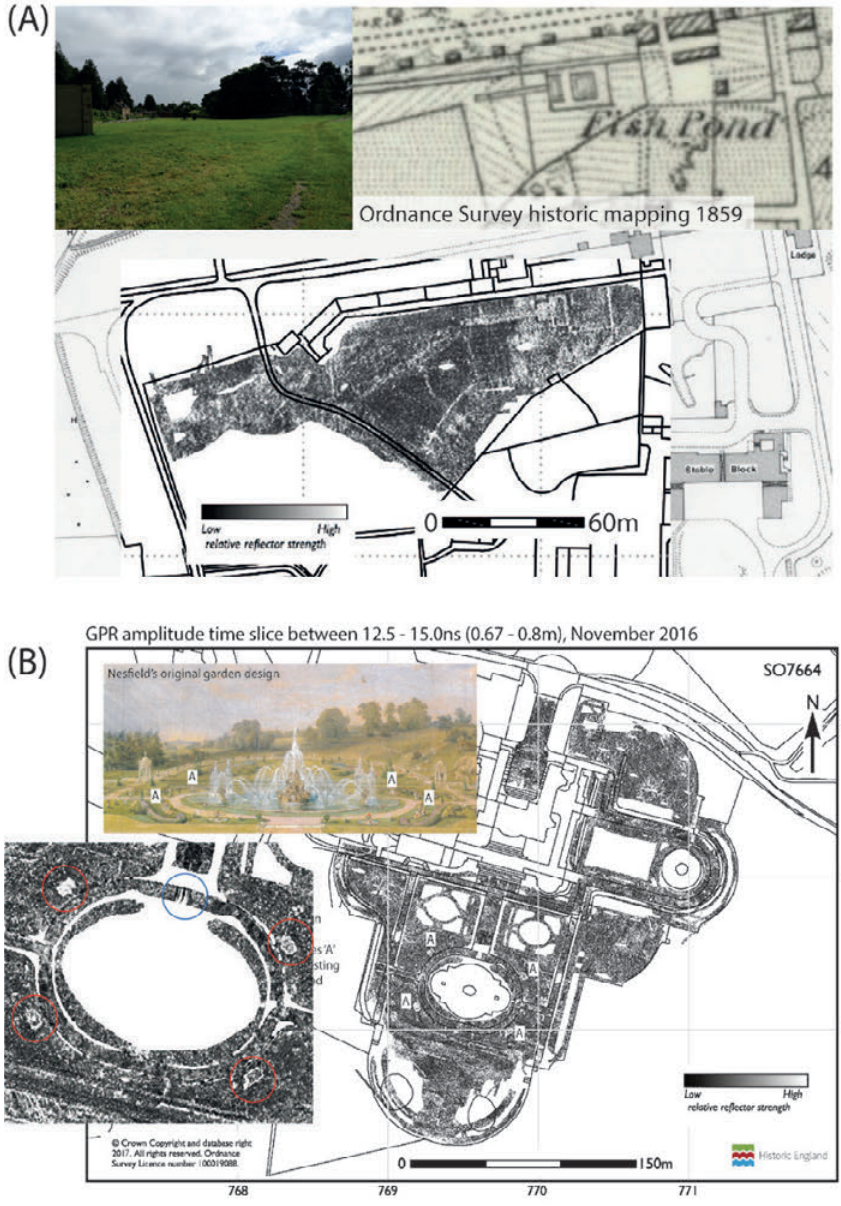


Fig. 4 (a) GPR data from the former "fishponds" marked on historic mapping at Belsay Hall, Northumberland, UK, recorded as geophysical anomalies from 0.7 m onwards, together with an inset view of the level site today; (b) GPR survey at a depth between 0.67 and 0.8 m of the partially reconstructed gardens at Witley Court, Worcestershire, UK, showing inset detail of the former planters, marked "A" surrounding the fountain, suggesting the original garden design plan was not fully established. Details of the GPR equipment and sampling interval are identical as in Figure 1.

Processing and photo: Neil Linford

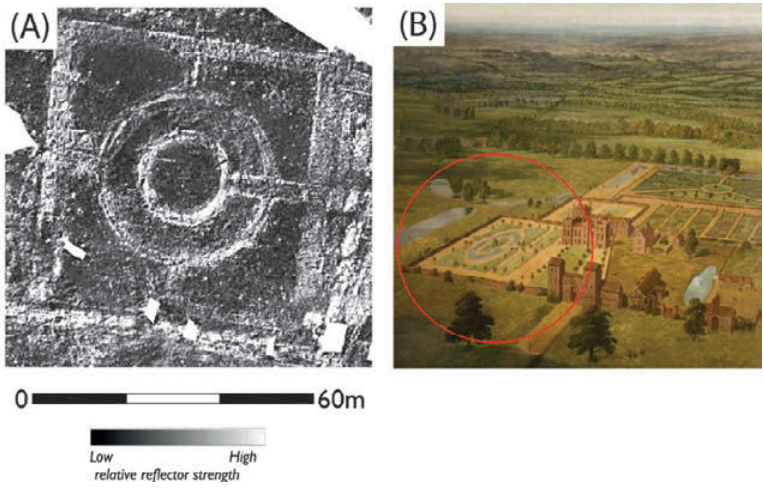


Fig. 5 (a) Extract from a GPR survey of the remains of a former Tudor water garden at Belhus Park, England, showing surviving garden features at a depth of approximately 0.53 to 0.66 m beneath the fairway of a modern-day golf course. Detail of the garden is shown in (b) a contemporary oil painting of the site (by permission of the Thurrock Museum). Details of the GPR equipment and sampling interval are identical as in Figure 1.

Processing: Neil Linford



Fig. 6 Royal Łazienki Park in Warsaw, Poland. View of the Gothic Orangery by Paweł Czarzyński, 1828 (Collections of the National Museum in Warsaw). Below: the current appearance of the remains of the orangery. The view is consistent with Charzyński's engraving.

Photograph by Tomasz Herbich

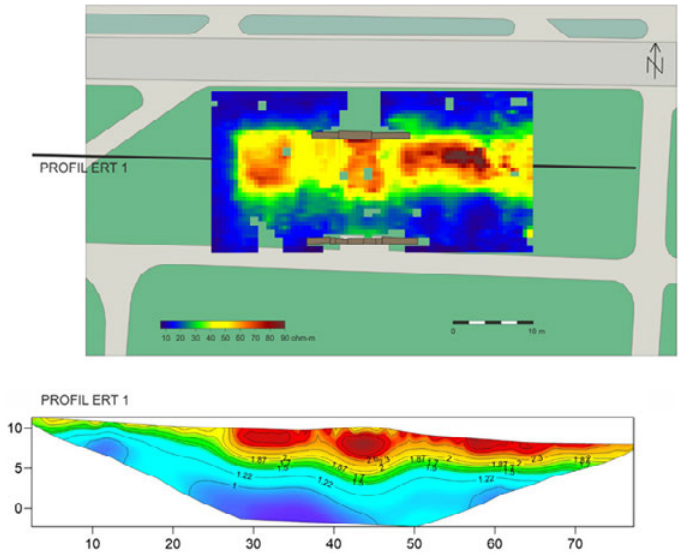


Fig. 7 Results of earth resistance survey at the Gothic Orangery in the Royal Łazienki Park. Top: resistivity map. Twin-probe array, distance between traversing probes AM = 1.5 m, sampling grid 1 x 0.5 m. Processing: Tomasz Herbich. Bottom: resisitivity cross-section, ERT measurements, Wenner arrays.

Processing: Radosław Mieszkowski

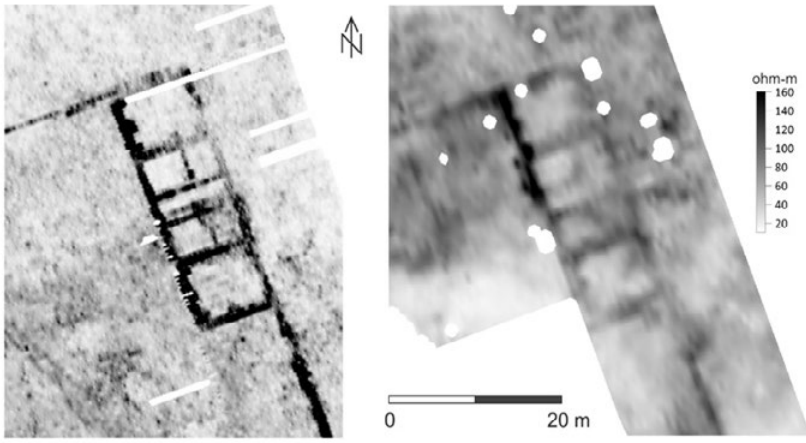


Fig. 8 Results of the survey in Korczew, Mazovia, Poland. Left: results of the GPR survey. Fragment of amplitude time slice showing the building standing in the north-eastern corner of the baroque garden. Image of changes at a depth of approximately 0.8 m. Georadar Malå GX HDR, antenna GX 450 MHz HDR, traverses 0.5 m apart. Right: the same building imaged on the resistivity map (twin-probe array, spacing between traversing probes AM = 0.75 m, sampling grid 1 x 0.5 m).

Processing: Tomasz Herbich and Robert Ryndziewicz

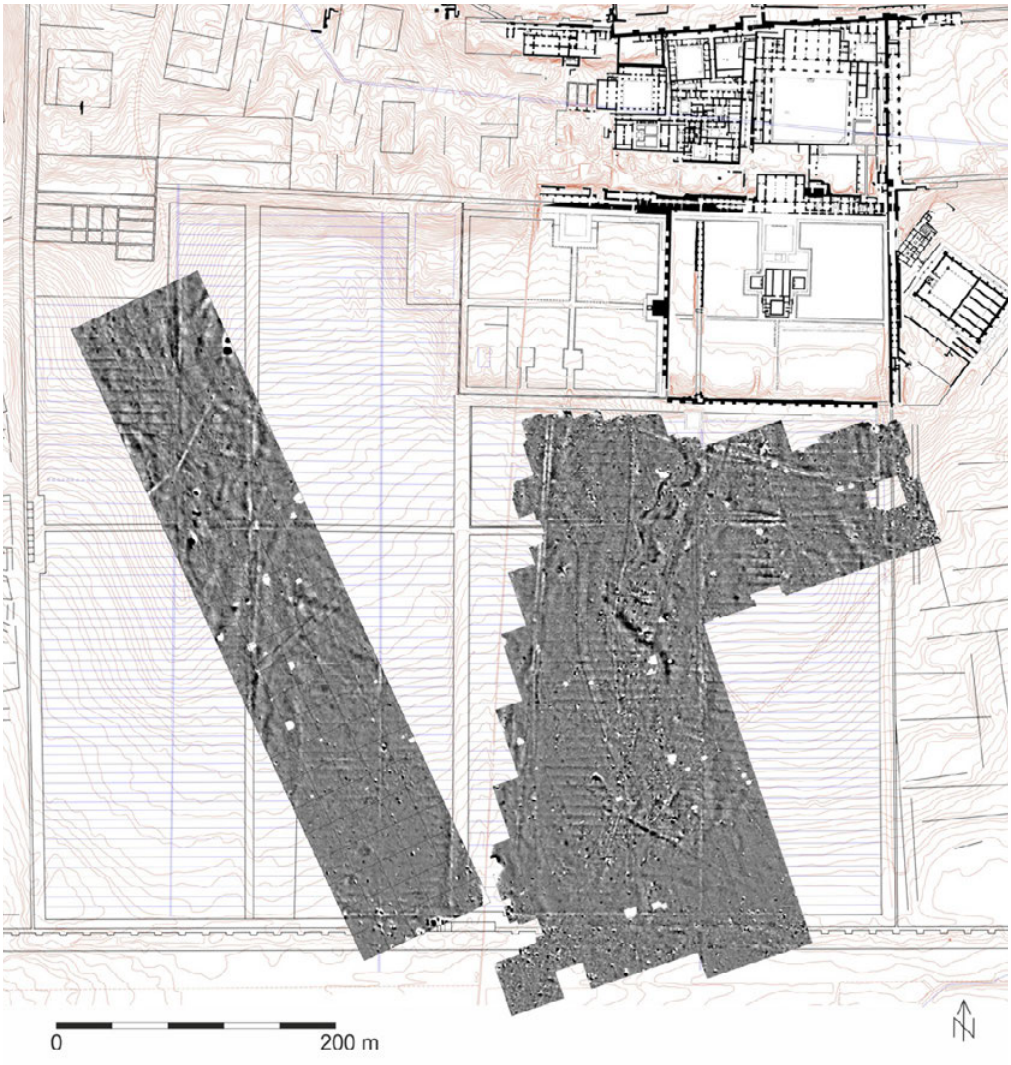


Fig. 9 Medīnat az- Zahrā, Andalusia, Spain. Results of the magnetic survey. Geoscan Research FM256 Fluxgate gradiometer, sampling grid 0.25 x 0.50 m. Dynamics -4/+4 nT. Site map after: Arnold 2019, 312 (fig. 3).

Processing: Tomasz Herbich. Plan: F. Arnold / DAI and Conjunto de Madinat al-Zahra

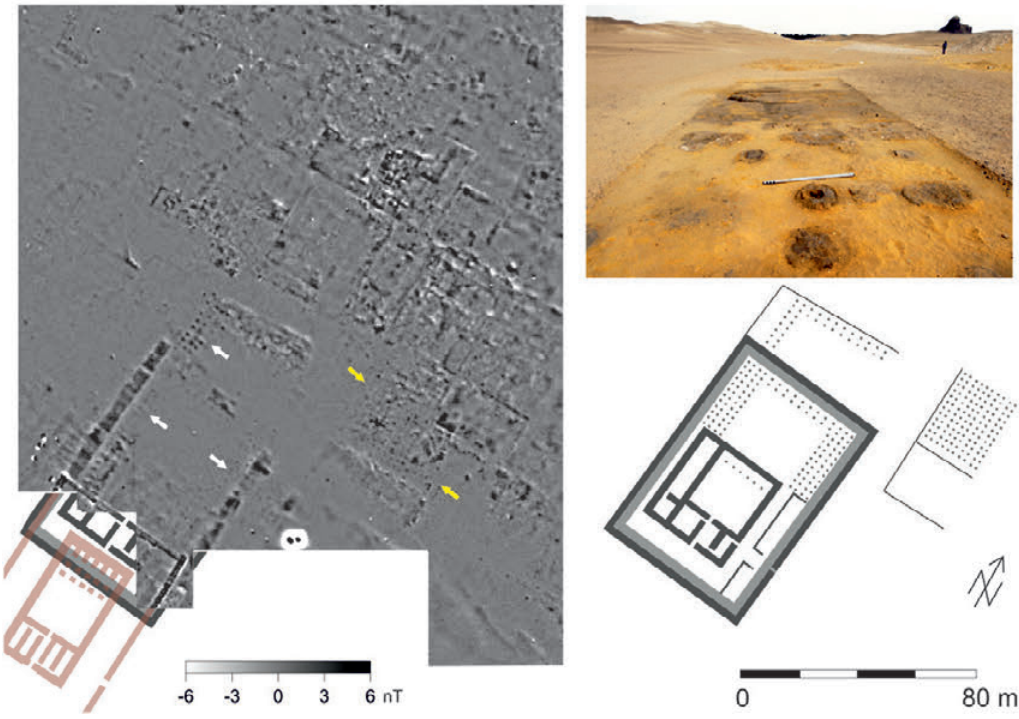


Fig. 10 Dahshur, Bent Pyramid complex. Left: magnetic map of the area on the north side of the Valley Temple. Geoscan Research FM256 Fluxgate gradiometer, sampling grid 0.25 x 0.50 m. White arrows point to anomalies corresponding to tree-pits inside the early Old Kingdom funeral enclosure. Yellow arrows indicate tree-pits in the garden associated with the settlement. Top right: tree-pits exposed by excavations. Bottom right: reconstruction of the funeral enclosure and the places where trees were planted (inside and outside the enclosure).

Processing: Tomasz Herbich. Reconstruction according to:
Arnold 2016, 7 (fig. 2). Photo: Felix Arnold

Roman Marcinek – historian and chief specialist at the Regional Office of the National Institute of Cultural Heritage in Kraków, who has authored numerous publications on heritage, cultural landscape, and intangible values.

Roman Marcinek

Krzyżtopór Castle and the surrounding area

Krzyżtopór Castle, located in the village of Ujazd, was erected in the years 1627–1644. Designed in the Italian style, it was the seat of Krzysztof Ossoliński, voivode of Sandomierz. The site was surrounded not only by bastions and walls, but also by a natural landscape that was transformed into a decorative and picturesque garden. The castle functioned as a stately residence for a relatively short time and quickly fell into disrepair, as did its surroundings, despite having been meticulously landscaped at considerable expense. This article presents the phases of the historical development in the area around Krzyżtopór, as well as its changing forms of use and function. It is based on research conducted by the author for the purposes of the conservation and architectural restoration of the castle gardens. Work on their final design is still underway and will take many years to complete.

KRZYŻTOPÓR CASTLE is located within the boundaries of Ujazd, an ancient settlement situated three kilometres south-east of Iwaniska and approximately ten kilometres north-west of Klimontów. The castle – one of the most renowned Mannerist-Baroque magnate residences in Poland[1] – was situated in the lower part of a hill sloping north-westwards, on the edge of a wide promontory, which was separated from the surrounding area by the marshy valley of the Koprzywianka River.

The location was somewhat isolated. Even at the end of the nineteenth century, Stanisław Tomkowicz complained that "access to the site is challenging for tourists and researchers attempting to take measurements and photographs on site face significant obstacles due to political circumstances."[2]

A drawbridge over a dry moat, hewn into the rock, provided access to the castle. Behind the gatehouse, located on both sides of the guard room, was a large trapezoidal courtyard. Further along, on the axis of the castle complex,

1 Szewczyk-Wojtasiewicz and Szmukier 1980, 34-40.

2 Tomkowicz 1894, 1.

a small road led to an elliptical courtyard surrounded by a multi-storey cloister (with the longer plane of the ellipse being perpendicular to the main axis of the castle). On the left side of the courtyard was the entrance to the chapel and on the right, a grand staircase led to the first floor, the so-called *piano nobile*. The main axis of the building featured an entrance that led through the cellars to the gates and on to the gardens, where there was a pond, fed by a spring located in the castle cellars.[3] On the terrace above the pond, there was a pavilion – an arbour.[4] Adjacent to the garden wall, on the north side, was a reservoir which had been created by damming the Koprzywianka River. Water from the spring in the castle cellars flowed into the reservoir through the pond. Analysis of the existing topography shows that, in order to create the reservoir, it was sufficient to dam up the water by less than two metres in relation to the level that can still be seen today in the ponds located below the gardens. Probably, an island was situated in the centre of the reservoir, aligned with the axis of the complex. Today, the site is merely an irregular hillock. It is hoped that future archaeological research will confirm whether this is a natural feature of the landscape or man-made. The castle's bastions offer a view of the gardens below and a vast panorama with the Świętokrzyskie Mountains in the distance.

Janowski wrote: "The castle terrace rises high, like a peninsula, above the emerald green meadows. On the right, a large pond spreads its waters. Behind it, the village of Ujazd shines white. Small woods are scattered on the slopes, and further on, there are magnificent avenues of linden trees planted by Pac, one of the castle's later owners."[5] However, at the time of the residence's construction, the area had trees. A document concerning the endowment of the parish in Ujazd states: "I hereby give and donate the following property and funds to the church in Krzysztopór […] for the garden near the Krzysztopór fortress, from the fortress's rampart to the road leading from the manor house to the former church in Ujazd, I hereby bequeath the entire forest on the right to the church and the forest on the left to Krzysztopór Castle. This [deed] was drawn up […] in my castle in Krzysztopór on 7 March 1627, [signed] Krzysztof Ossoliński of Tenczyn."[6]

Sobieszczański, among others, drew attention to the close connection between the fortifications and the gardens: "This castle was once surrounded

3 Kuls 2016, 51-52: wrote: "Krzyżtoporska grota była elementem łączącym rezydencję z ogrodami. Jak już wspomniałem, wyjścia umieszczono po dwóch jej stronach, poprzecznie do osi głównej założenia. Prowadziły one na położone u podnóża wałów obronnych tarasy, wyniesione blisko 5 metrów ponad poziom ogrodów. Te, powtarzając wspomniany już kilkukrotnie schemat, rozciągały się na osi poprzecznej, symetrycznie do głównej osi założenia. Przed widzem rozciągał się oszałamiający widok na ogrody i oblewający je zalew." [The Krzyżtopór cave connected the residence with the gardens. As previously stated, the exits were located on either side, transversely to the complex's main axis. They led to terraces located at the foot of the defensive ramparts, raised nearly five metres above the level of the gardens. These, repeating the pattern which I have mentioned several times already, stretched along the transverse axis, symmetrically to the main axis of the complex. The viewer was greeted by a stunning view of the gardens and the floodplain surrounding them.]

4 The discovery of the remains of elliptical walls, visible on Dahlberg's plan between the pavilion and the castle bastion, as well as the original stone elements, suggest that the water feature, fed by the castle spring, consisted of a cascade, a four-leaf-shaped pool, a pond, where there may have been a fountain, and a canal under the pavilion, draining water towards the Koprzywianka River valley.

5 Janowski 1900, 37-46.

6 AP Kielce, Rząd Gubernialny Radomski no. 88; quoted after: Dąbska-Śmiałowicz et al. 1987, 231-237.

by delightful Italian gardens; the same trees still remain there. Scattered here and there are variously shaped brick arbours, which time is stripping of their bricks and covering with moss."[7] After a hundred and fifty years, the site has changed significantly. Only a pond is visible at the foot of the slope, a flattened area of land cut by a stream and a pool in front of a conch-shaped recess in the bastion wall. These are the only remains of the former Italian-style garden with a pond and an orangery, enclosed by a wall, that have survived, apart from archaeological ones.[8] Geometric, extensive and artfully composed gardens have accompanied the residence from the very outset.[9] Bogdanowski[10] thus described the Krzyżtopór gardens: "At the foot of the fortified complex, there was an Italian garden with a pond and an orangery. The short axis and large width form typical wide interiors, with all the splendour of the magnificently developed garden elevations and shallow terraces, enclosed with Baroque opulence in the form of balustrades, ramps, grottoes and sculptures. In Krzyżtopór, a cave-like recess with a spring was given special protection thanks to the presence of embrasures.[11] This recess, along with the embrasures protecting it, can also be seen in a general view of the castle from the north-west, published in the Urban Planning and Architecture Commission's file (Teka Komisji Urbanistyki i Architektury).[12] The reasons for this are not entirely clear. Tomkowicz wrote that "from the north-western side, that is, from the rear of the castle, the garden once extended into the adjacent damp valley, as marked on our plan. A covered, single-flight staircase, located on the northern flank of bartizan, with an extension attached to it that is indistinguishable from the rest of the walls, facilitated communication between the castle and the gardens. This staircase still exists today, but it is not visible on the plan. I have marked the location of this staircase with the letter (f)[13]".

Andrzej Gruszecki argues that there may be an exit in the axis of the bastion, at the location of the present conch. He writes: "Instead of the two gates currently present in the flanks of the High Barbican bastion, there could have been a single exit in the axis of the Korona bastion, in the place of the current conch. Removing the corner of the bastion would have been a significant deviation from the fundamental principles of bastion fortification, and this would not have been done solely for the sake of introducing a conch, which was, moreover, equipped with a series of embrasures. However, the fact that there was an exit to the garden on the axis of Bastion IV, which was accessed from the elliptical

7 Sobieszczański 1847, 218-19.

8 *Słownik Geograficzny Królestwa Polskiego i innych krajów słowiańskich*, 762-763.

9 The term "geometric garden" refers to a layout based on a grid of perpendicular straight lines or circles, forming so-called quartier outlines. Geometrization, introduced in the sixteenth century, continued as the main compositional motif after the turn of the eighteenth and nineteenth. During this period, architectural design evolved significantly, with various forms emerging. These included simple quartiers and the Italian gardens associated with the Renaissance, as well as Baroque and classical designs that organized the quartiers in various ways, with a strong emphasis on the axes. See: Kajzer, Kołodziejski and Salm 2007, 510-15.

10 Janusz Bogdanowski (1929-2003) was an architect and professor at the Kraków University of Technology. During the Second World War he was a soldier of the Home Army. Creator of a landscape valuation system (the JARK-WAK method); spokesperson for the protection of monuments and cultural landscapes; involved in fortification art and the forms and history of garden design.

11 Bogdanowski 2000, 59-61.

12 Dąbska-Śmiałowicz et al. 1987, 235.

13 Tomkowicz 1894, 16.

courtyard via a slightly sloping passage with a barrel vault, could have been the cause. Judging by the level of the corridor, this exit would have been located quite high above ground level, necessitating the use of stairs or an embankment. The following elements also support the existence of the original exit on the axis of the bastion: the stone wall on the chamfer (angled edge) of the bastion, up to the rectangular recess (the plaque above the entrance), is rebuilt with brick from both the outside and the inside." Stanisław Mossakowski agreed with this, stating that "military considerations led, among other things, to the bricking up of the central exit to the garden in the northern bastion and the cutting of additional embrasures."[14] Gruszecki further clarified it: "This brickwork is not entirely related to the stone wall. The side exits in the bastion's flanks have rough, architecturally unfinished ledges. Given the palace and garden's elaborate architecture, it is difficult to imagine that there were no portals at the representative exits to the garden. On Pufendorf's etching there are no bridges over the moat, which would have been necessary had there been gates in the flanks of Bastion IV, located approximately three metres above the bottom of the moat.[15] It is possible that this bastion had a gate along the axis of the chamfer, but the reconstruction would have been carried out at a time when the castle's defences were still of significance."[16] The construction of a gate within the dead zone of a bastion was not in accordance with the established principles of bastion fortification. However, this deviation may have been mitigated by the fact that the gate was protected by flooding and shielded by the ramparts of the Italian garden, which could serve as external defence if necessary. The garden, which was situated transversely to the axis of the fortress and surrounded by a wall resembling the layout of bastions, contained a pond and an orangery pavilion. Two exits situated in the bastion on the axis of the complex led to the garden. Franciszek Xawery Bartkowski wrote:

> Cała strona zachodnia na znacznej przestrzeni
> Ogrodzona wokoło nasypem z kamieni,
> To jest wałem z bramami na wszystkie trzy boki;
> A wał taki, mniej więcej, sześć łokci wysoki
> Zakreślał wielki ogród, gdzie bogini Flora
> Roztaczała swój warkocz z rana do wieczora.[17]

The stone rampart in question is clearly visible on Dahlberg's plan.[18] However, the precise function of the semi-circular annexes, which may have served to protect the gates, can only be confirmed by archaeological research. At the centre of the castle, below the garden and on the low floodplain, a triangular structure has been preserved. This is believed to be a remnant of a ravelin. It is possible there was a pond behind the garden at that time because it exists today.[19] Archaeologists have also confirmed the usable

14 See: Mossakowski 2002, 41.

15 Gruszecki 1962, 173-174.

16 Gruszecki 1962, 180.

17 Bartkowski 1927, 46: "The entire western side, covers a considerable area fenced in by a stone embankment, that is, a rampart with gates on all three sides, This rampart, about six cubits high, enclosed a large garden where the goddess Flora spread out her tresses from morning till evening".

18 Plan of the castle according to a drawing by Erik Dahlberg, engraving from Samuel Pufendorf's *De Rebus A Carolo Gustavo Gestis*, 1656.

19 Gruszecki, 1962, 182.

levels on which the garden was once laid out. The layout of the stairs and retaining walls depicted in the visualization is the author's interpretation, based on an analysis of the aforementioned materials. Further archaeological research may also confirm the layout of the garden's parterres, in which six-pointed stars are clearly visible. Next to these elements are motifs that are closely associated with the Cross of Jerusalem. We have come to accept these elements without question, believing that they were implemented as faithfully as the other aspects of the layout that have already been confirmed.

On Pufendorf's plan, the castle gardens are drawn accurately and described as "hortus amoenissimus" (in handwritten German: "ein angenehmer Garten"). They were created in keeping with the prevailing spirit of the times. Bogdanowski, an eminent expert on Polish garden art, wrote that "[t]he seventeenth century stands out as a period of remarkable diversity in Polish garden art. Both Renaissance forms and new forms typical of the century were influential at that time, intermingling with each other to create unique and inimitable variations. When we add to this the still living traditions of the Middle Ages and new French ideas, we obtain a complex mix of styles, manners and variations, which we can only partially unravel and recreate today."[20]

War with Sweden divides the prosperous period into two main parts. The one before the conflict was closer to Renaissance and Italian influences, while the one after – to Dutch and French influences, thus marking the commencement of the next chapter in garden art: the neo-classical eighteenth-century period. From the beginning of the seventeenth century, Dutch influences intensified in garden art as evidenced by the clipping of trees and shrubs into decorative figures as well as the construction of canals and moats. French influences began to appear around the middle of the seventeenth century; in accordance with this school of thought, the planes of the parterres and mirrors of water were contrasted with the tall greenery of bosquets.

Dahlberg's drawing, later transformed into a copperplate engraving that illustrates Pufendorf's work, shows the outline of the gardens at Krzyżtopór. The garden, complete with a brick arbour, was situated to the north and surrounded by embankments and retaining walls. In Tomkowicz's account, "castle gardens, situated on land conducive to lush vegetation, had a regular and symmetrical layout."[21] Pufendorf's design does indeed feature rectangular gardens. However, this is one of the deviations from reality that we encounter when analysing the plan. During archaeological works carried out between 1973 and 1976, survey research enabled correcting the course of the garden walls, which were laid out transversely to the main axis of the castle. In contrast to Dahlberg's plan, the layout of the gardens is not rectangular but trapezoidal, with the longer side oriented northwards.[22] Paths were laid out along

20 Bogdanowski 1999.

21 He also adds: "Akwarella, z której reprodukcyę dajemy na czele tego opisu, ma punkt widzenia wzięty właśnie od strony tych ogrodów; w ich skład wchodzić musiała sadzawka pierwszego planu i nieco pozostałych drzew, które świadczą o dawnem przeznaczeniu miejscowości zamienionej dziś na pola i łąki." [The watercolour, a reproduction of which is given at the beginning of this description, shows the view from the side of these gardens; they must have included a pond in the foreground and a few remaining trees, which testify to the former purpose of the place, now converted into fields and meadows.]

22 Szewczyk-Wojtasiewicz and Szmukier 1980, 34-40.

the outer stone wall.[23] The parterres and garden architecture were arranged symmetrically in relation to the main axis of the complex. The main arbour was located directly on the axis (probably identical to the one depicted in ruins in nineteenth-century iconography). The plan indicates that this was a garden gate, referred to in sources as the Ossoliński Gate, through which visitors entered the gardens surrounded by a stone rampart. The structure consisted of three pillars and two openings, all of which were most likely covered by a roof with an additional level on top, forming a combination of a terrace and an open orangery. This form was later described in accounts as the "hanging gardens." The gate is flanked by eight narrow quartiers arranged in a symmetrical pattern. Some researchers consider them to be light defensive structures, akin to ramparts. It is possible that they were trellises used to support climbing roses, which are referred to in local place names.

The geometrically composed gardens were surrounded by regularly planted trees, separated from the low walls with entrances on each side, leading to the garden by a path. The corners of the walls were accentuated, perhaps with small forms such as spheres or pinnacles. In the corners of the composition, on square platforms formed by the outer paths, circular bases are visible, suggesting the regular arrangement of sculptures or perhaps vases. However, we have no information about them. Zymunt Vogel's watercolour shows a sculpture of Mars accompanied by an eagle taking flight, reminiscent of the Wilanów gate. However, it remains doubtful whether trust can be placed in an artist who was known for his imagination and the tendency to embellish.

The focal point of the layout was a circular fountain basin, positioned in front of the truncated top of the Wysoki Rondel bastion. According to Gruszecki, this suggests that the conch-shaped recess visible from the outside in the wall of this bastion, now rebuilt, originally contained exits to the garden.[24] The basin was surrounded by a low wall similar in shape to the bowl of the fountain, with an entrance from the bastion side. This entrance was divided by a channel connecting the basin with the fountain spout; the shape of this spout is shown on the plan in the form of a cross with arms with rounded ends. The plan indicates that the alleyway surrounding the wall that separated the parterres was lined with a row of trees on the outside. The short distance between them, approximately three and a half metres, suggests that these were rows of trees clipped in accordance with the period's rules. The corners were further accentuated with four additional sculptures. Their number suggests that they may have been personifications of the seasons. Single trees accentuated the corners of the wall, the shape of which is reminiscent of bastions. Dahlberg's plan shows rectangular, elongated parterre quartiers on both sides of the arbour. This was probably the functional part of the garden, comprising a vegetable and herb garden. The clipped hedges, inside the parterres, created a pattern reminiscent of embroidery (*parterres en broderie*). The relics of the garden pavilion, which were preserved until the 1920s and are depicted in Kielisiński's drawing, provide sufficient information for its unambiguous reconstruction. The structure

23 Record card of architectural and building monuments: compiled by L. Polanowski, VII, 1993, KOBiDZ archive in Warsaw, Świętokrzyskie Voivodeship, no. 575.

24 Mossakowski 2002, 39.

resembled a triumphal arch whose architecture was based on Serlian motifs that had already been used in the elevations (facades) of the courtyard and great hall.

The castle gardens in Ujazd were an integral part of the residence. Unfortunately, we know nothing about the ideological programme of the gardens. It can only be speculated that, in accordance with garden art of the time, sculptures were placed in specific locations. These may have depicted nature and represented personifications of the seasons. It is also possible that they could have symbolized Parnassus. If this were the case, the alleyways would have been adorned with depictions of Apollo and the other deities. There is also a possibility, albeit remote, that they may have been a continuation of a political programme glorifying antiquity and the merits of the owners' family.

To the east and west of the main axis were parterres consisting of two quartiers filled with flowers, separated by north-south running paths. Those closer to the axis were irregular in shape; on the inner side, they take into account the outline of the wall surrounding the basin of the fountain, and are intersected axially by oval squares, accentuating the centre of the decorative *parterres en broderie*. The quartiers furthest away from the axis are decorated with arrangements of double hexagonal stars, with vertical elements most likely placed at their centres. Five pointed stars and hexagrams, which we now clearly associate with the State of Israel, had a different meaning in the seventeenth century. Since ancient times, they have been present in sacred buildings, symbolizing the unity of Heaven and Earth.[25] We do not know either how long the gardens survived, or if they were maintained in their original form after Krzysztof Ossoliński's death. Only archaeological research can answer these questions. However, it is known that 1733 was a turning point as the castle surroundings were devastated by flooding from the Koprzywnianka River.

Tomasz Kuls wrote, "I used two iconographic sources to reconstruct the appearance of the gardens: the Dahlberg plan, which has been mentioned many times, and an engraving by Kajetan Kielisiński from 1831, showing the ruins of the garden pavilion. These two representations provide a reliable basis for reconstructing the gardens, even though Dahlberg's plan is not an inventory drawing. During the course of research and conservation work carried out at Krzyżtopór, Andrzej Gołembnik's archaeological team made a discovery which confirmed that the gardens had been built in accordance with the drawing shown on Dahlberg's plan. Excavations revealed the remains of the walls enclosing the garden parterres. At the foot of the bastion, the almost complete stonework of a four-leafed pool was unearthed. Remains of walls built on an elliptical plan, as well as the foundations of a pavilion – which was the main element of the gardens – were also discovered."[26]

According to nineteenth-century accounts, the Italian parterre garden was full of exotic flowers and trees as well as contained arbours and an orangery (known as a winter garden). The latter was most likely identical to the one at the Ossoliński Gate. In the nineteenth

25 With one exception: in the seventeenth century, the Jewish community in Prague adopted the hexagram as its symbol. Prague's imperial period also saw the city's Jewish community flourish. It may be because of these associations that Krzysztof Ossoliński was linked to magical practices, of which there are references in the margins of professional literature on Krzyżtopór.

26 Kuls 2016.

century, the image of their shape incorporated factual elements alongside legendary features. Wiślicki offers the following description of the surroundings of the residence: "The whole was complemented by hanging gardens, in which arbours of various shapes still exist, spread out over a vast area."[27] Local rural lore also speaks of exquisite hanging gardens on palace grounds and a magnificent "rosarium." Until the twentieth century, the space in front of the walls was referred to as the rosary by locals. Bartkowski provides another account:

> W ogrodzie znów altany, latem dla ochłody;
> Resztę uzupełniały wiszące ogrody.
> Widocznie róż najwięcej było w tym ogrodzie;
> Najbardziej się podobał ów kwiat Wojewodzie;
> Taki z mroków przeszłości wniosek się dobywa,
> Gdyż lud dziś jeszcze ogród «różańcem» nazywa.[28]

Information about the "hanging gardens" may be related to the aforementioned garden structure, the shape of which is known from nineteenth-century iconography (including Kielisiński's drawing). It is reasonable to assume that the structure enabled plants to be placed on the roof of the building, which is the likely basis of this memory. At the close of the nineteenth century, Tomkowicz argues, "[g]eometric figures were created from flowerbeds, flowers, lawns, shrubs, and rows of trees, varied with arbours and kiosks built in the style of the era. The side wall of one of the latter has survived to the present day." The appearance of garden structures is depicted in a drawing by Kielisiński from 1831, which shows a fragment of an arbour in the castle gardens. Adjacent to this are rural buildings. The gardens feature a watercourse visible under an arcade, with an arbour erected on the arcade, and a pool surrounded by shrubs. Tall greenery and numerous stones, possibly from the former wall surrounding the gardens, are also visible.[29]

It is likely that the gardens began to deteriorate in the eighteenth century, alongside the decline of the castle. At that time, people were well aware of the high cost of such residences. Jędrzej Kitowicz regarded them as a particular manifestation of luxury: "Many a nobleman has lost his fortune building and furnishing a magnificent palace with an Italian garden, orangeries, and other splendours. And when he decided to recruit young people from his native villages, that did not suit the palace, to be footmen, huntsmen, floor scrubbers and polishers, gardeners and other such parasites, when the head gardener took most of the workforce every summer to weed the parterres and prune the trees and hedges, and when all the best fertilizers were wasted in the cold frames for melons, cucumbers and lettuces, it was only natural that the farmland would decline. As a result, income shrank, expenses increased, and debts accumulated […]. Thus, the palace and the Italian garden with its exquisite features began to deteriorate and wither, and ultimately everything fell into ruin when the owner, legally entitled to the estate, preferred to grow wheat rather than

27 Wiślicki 1854, 131-132.

28 "And arbours in the garden, a shady retreat in the summer; The rest complemented by hanging gardens. This garden visibly had the most roses; As the Voivode liked this flower the most. Such a conclusion can be drawn from the mists of the past, As the local populace still refer to the garden as a "rosary."

29 K. Kielisiński, *Rozwaliny zamku ujazdzkiego*; etching, 1831; reproduced in *Przyjaciel Ludu*, 1847, fasc. 46, p. 361.

tulips or lounge around landscape paintings in the rooms."[30]

However, not everyone shared this harsh opinion. Michał Jan Pac, who was briefly responsible for the castle, also oversaw its surroundings. This was not limited only to the immediate surroundings. An avenue of linden trees (so-called Planty) runs from the pond area to the site where the manor house of the last owners of Krzyżtopór, the Orsetti family, once stood. This is part of the former system of alleyways described by Hofmanowa: "In the vicinity of Ujazd, there are beautiful avenues of linden trees, and it is evident there used to be more of them in the area. They were planted by Pac. He used an effective method to protect the trees from attacks by members of peasantry. He employed a brave *hajduk* whose sole duty was to patrol these roads with a whip and guard the trees. Should he find any individual causing damage, he had the right to administer ten lashes. Thanks to this strictly enforced measure, the trees were preserved."[31] In addition to planting avenues of linden trees, Michał Jan Pac was also responsible for tidying and cleaning the gardens. The view of the park and the garden pavilion from this period is depicted in miniatures on porcelain from Baranówka, produced around 1820.[32]

We are unaware of the scale of the work ordered by Pac. However, it is unlikely that this would have altered the fate of the garden, particularly since it was abandoned after Pac fled the castle. At the turn of the eighteenth and nineteenth century, Bishop Ignacy Krasicki, a leading expert on garden art, expressed regret that "[t]he largest of the gardens adjacent to the castle in Iwaniska or Krzysztopór, built by Krzysztof Ossoliński, the voivode of Sandomierz, [had declined] leaving only a shadow of its former glory."[33] This is an excerpt from Letter VIII, referring to native Polish gardens. At the beginning, the bishop makes a light-hearted reference to Kruszwica; then, in a display of patriotism, he presents the traditions of Polish gardens, starting with Bolesław Chrobry, highlighting the Łobzów garden of Kazimierz the Great[34] as well as appreciatively presenting a whole array of later designs, including Krzyżtopór, which are based on the work of Samuel Pufendorf.[35] He also praises the gardens of Warsaw, the accomplishments of Queen Bona and the "king gardener": Jan III Sobieski. However, his descriptions are limited to general statements, such as "a garden divided into quartiers, with trees forming roads" in the case of Wiśnicz.[36]

The gardens had lost their former glory and by the nineteenth century effectively ceased to exist. Today, we can only decipher mere traces of them. As depicted in the watercolour accompanying Stronczyński's inventory (ca 1844), the garden area appears to have been in use, with tall greenery in the foreground near the bastions and palace ruins, and one of the gates also visible in the curtain wall.[37]

30 Kitowicz 2003, 555-556.

31 *Przejażdżka w Sandomierskie w 1828*. In: Hofmanowa 1876, 283-8.

32 MN w Warszawie / National Museum in Warsaw, inv. no. 19882. Dąbska-Śmiałowicz et al. 1987, 231-237.

33 Krasicki 1803, 384ff.

34 Krasicki 1803, 384.

35 This motif is highlighted in Goliński, introduction to Krasicki 1803, 680.

36 Marcinek 2021, 47.

37 Ruins of the Castle known as Krzysztopór from the South; watercolour, ca 1844; engraving in: *Opis zabytków starożytności do guberni radomskiej przez delegację wysłaną w latach 1844-1846 zebrane i rysunkami w dwóch osobnych atlasach zawartymi objaśnione*, MS, Gabinet Rycin Biblioteki Uniwersytetu Warszawskiego [Atlas II, tabl. 58].

One print (etching), based on a drawing by Andriolli from the second half of the nineteenth century, shows the ruins of the central arbour. The artist also included trees growing in the former gardens, in the immediate vicinity of the bastions and on their crowns, but he did not mark any traces of landscaped gardens.[38] An engraving of unknown authorship depicting the castle from the garden side dates from the same period. In the centre it is possible to discern the remains of a small stone building (perhaps one of the kiosks mentioned in literature). The garden area was subsequently divided by woven fences, probably made of wicker; the whole area seems to have been used for agriculture, with crops, and geese grazing on stubble. The vegetation in the foreground is tall, and climbing plants connect the garden area with the bastions and the ruins of the palace.[39] A slightly later engraving by Kuhlwein shows a newly laid road, wicker fences, and newly planted trees, most likely fruit trees, close to the walls.[40] The draughtsman also depicted the remains of the old tree stand. On the right, the first buildings of the emerging village as well as shelters attached to the bastions can be seen.

At the end of the 1860s, the local population built thatched huts in the former moat. This was the result of land reforms when landless peasants were granted small plots of state-owned land. The Russian government considered this land to be the bastions and moats of Krzyżtopór, as they were considered to be military structures.[41] As Tomkowicz notes, "[o]n granting enfranchisement, the Russian government donated the escarpments and ramparts to the peasants, who attached their houses to them."[42] Janowski adds: "At the foot of the castle, the inhabitants of Sandomierz built their huts, which now bear witness to their hard work and the greater durability of living, thatched roofs made of straw than dead, marble castles. In their huts, they welcome visitors with milk and black bread, and in the summer heat, crystal clear water from cisterns cools travellers down."[43] The development of the buildings progressed slowly.[44] The woodcut after a drawing by Gerson and sketch drawings depicting the castle from the gardens all date from 1866.

38 M.E. Andriolli, *Ruins of Krzyżtopór Castle from the Rear*; woodcut; second half of the nineteenth century. Ossolineum, I.g. 1202; MNK III-ew. 35 014: B. X. After: Andriolli, zinc plate; 11 x 15.4 cm.

39 Author unknown, *Zamek Krzyżtoporski from the north-west*; woodcut, second half of the nineteenth century; Ossolineum; I.g. 1204.

40 N. Kuhlwein, *Ruins of Ujazd Castle in Sandomierz*; woodcut, second half of the nineteenth century; Ossolineum; I.g. 1468.

41 On 2 March 1864, Tsar Alexander II issued four decrees prescribing the emancipation of peasants and local government in the Kingdom of Poland. The aim of the emancipation reform was to dissuade peasants from rebelling and win them over to the partitioning powers. All peasants were granted ownership of the land they used. Landowners were to receive compensation for lost labour service (corvée) entitlements. The compensation was to be paid from funds that the state intended to obtain from a perpetual land tax imposed on peasants (it could not exceed 2/3 of the rent or charge paid so far). Farm servants living in the countryside and landless peasants were allocated land from state property. Rights to use common land were also maintained. The decree on rural self-government created single-village communities headed by village leaders (sołtys), and collective municipalities consisting of several villages with farms, which were managed by mayors (wójt). The decrees also established a Committee for the Affairs of the Kingdom of Poland in St Petersburg and an Organizing Committee in Warsaw. The Organizing Committee included Nikolai Milutin, Vladimir Cherkassky and Yakov Solovyov. Its task was to prepare and carry out the enfranchisement reform and to unify the Kingdom with the Empire.

42 Tomkowicz 1894, 2.

43 Janowski 1900, 37-46.

44 The full extent of the castle buildings can be seen in the photograph from the early twentieth century reproduced below.

In the foreground, viewed from a considerable distance, one can see the ruins of the central arbour with five supporting pillars and three arcades. Gerson also included the trees growing in the former gardens, which were then being used for agriculture (as fields for growing grain and grazing cattle), and within the castle grounds. The village buildings on the left, which were not yet directly contiguous with the bastions and castle moat, were divided by wicker fences.[45] In the twentieth century, the visible remains of the arbours were demolished and only small relics survived. A postcard from 1935, which depicts the bastion and its immediate foreground, clearly shows a depression and a landslip on the left, which is sometimes associated with the Second World War and the Red Army's use of the castle. In 1972, the Wawel Royal Castle Restoration Project management team acquired the adjacent land and partially demolished the farmsteads. According to a report from 1986, "[f]urther steps in this direction are underway. It is, therefore, to be expected that the immediate surroundings of the castle will soon be cleared. […] The garden, which was once located transversely to the main axis of the complex and contiguous with the walls and bastions on the north-western side, has disappeared. In its place, a cultivated field has been created where works disclosed small fragments of the garden wall as well as the remains of a brick garden pavilion that was once part of the garden design."[46]

A modest cross at the site of former gardens commemorates the prisoners from Ostrowiec who were shot there by the German military police in 1944.

45 W. Gerson, *View of Krzysztopór Castle*; woodcut 1866 ; Ossolineum I.g. 19970; MNK 134 126.

46 Dąbska-Śmiałowicz et al. 1986, 56.

After the war, the idea of rebuilding the castle emerged, prompting studies on the restoration of the gardens. Professor Ciołek undertook this task[47] and drafted plans to document the gardens basing on Dahlberg's sketch and measurements taken in 1927 at the Department of Polish Architecture. As outlined in the preserved restoration plans, the layout and division of the parterre quartiers are to be reinstated, with the addition of tall greenery and privet hedges replacing the historic garden walls. Other researchers and inventory specialists focused on the castle ruins themselves and their protection.

In 2007, the municipal authorities submitted an application for funding from the Regional Operational Programme for a project to develop the area around Krzyżtopór Castle. Both the ruins and the adjacent area required restoration and protection. According to the project's documentation, the development of the area was to consist of marking out and signposting tourist trails in the castle and around the ruins, as well as installing information boards. Next to the ruins, it was planned to build an information point with ticket sales and souvenir shops, along with sanitary facilities adapted for people with impairments. The rose garden was to be restored and the water reservoirs rebuilt on the north-western side. The area

47 Gerard Ciołek (1909-66) was an architect, garden art historian; during the Second World War, he was a soldier in the Home Army and fought in the Warsaw Uprising; professor at the Kraków Polytechnic (now the Kraków University of Technology) (from 1948); he dealt with the history and theory of gardens, rural construction, monument conservation, landscape planning and design, as well as nature conservation; he conducted research on the conservation and reconstruction of historic gardens, including in Wilanów, Nieborów, Rogalin and Krasiczyn; among other works, he wrote: *Regionalizm w budownictwie wiejskim w Polsce* (1944), *Ogrody polskie* (1954), *Zarys historii kompozycji ogrodowej w Polsce* (1955), *Zasady ochrony i kształtowania krajobrazu* (1963).

around the castle was equipped with electricity, water supply and sewage systems. A road was also built around the castle.

Another programme to revitalize tourism at Krzyżtopór Castle included the reconstruction of the entrance bridge, the gate and adjacent rooms, the Italian garden, as well as the creation of a museum and gallery within castle walls. However, no investments could be made without the consent of the conservator of monuments, who gave a negative opinion on the ambitious plans. The conservator had reservations regarding the plans to restore the Italian garden. According to Jerzy Zub, head of the Voivodeship Conservator's Office in Sandomierz, this would have to be preceded by in-depth archaeological research in order to ascertain the appearance of the garden centuries ago.

In 2010, the mayor of Iwaniska, Marek Staniek, and a representative of the Academy of Fine Arts in Warsaw, Professor Andrzej Koss, signed an agreement to begin work on Krzyżtopór Castle. This was preceded by archaeological excavations and archival research. The garden, designed by Myczkowski and Wowczak, was restored in minimalist form. In 2012, at the request of the municipality of Iwaniska, a project was developed to restore the castle's gardens. The restoration was part of a broader investment programme aimed at safeguarding the ruins of the castle.

In 2023, the municipality of Iwaniska received additional funds for the revitalization of Krzyżtopór Castle. Seven million zlotys were allocated for the revitalization of the castle's interiors[48] and the reinforcement of its walls.[49] The work focused on stabilizing the walls, protecting their crowns from the elements, and reinforcing the structure. It was equally important to adapt the castle to accommodate tourists, which involved the construction of paths, viewing platforms and lighting.

However, this funding is still insufficient and but a drop in the ocean. The planned complete reconstruction of the castle gardens, including tidying the surrounding area and restoring the historic ponds, will cost several dozen million zlotys. Revitalizing the surrounding area will undoubtedly increase the attractiveness of the castle in Ujazd. The gardens and ponds, located behind the fortifications on the north side of the palace, are an integral part of the complex.

The successful implementation of this investment plan is contingent on the authors of the project having comprehensive knowledge from written and archaeological sources, in addition to funding. Conservation work is a complex process that aims to preserve the historic substance and artistic value of this unique complex. Work in the gardens must adhere to the principle of the monument's authenticity. This means that as much of the original substance as possible must be preserved.

In 2023, the European Conference on Historical Garden Archaeology was held, with a discussion of the gardens at Krzyżtopór Castle being one of the topics. During the course of the conference, debates continued about the future of the castle gardens, raising awareness of their historic value, and the need for restoration. The key concern has been the extent to which reconstruction is permitted, or the degree to which the castle's forecourt can be restored to match its original appearance.

48 Reconstruction of the vault in the clock tower, adaptation of the guard rooms in the clock tower.

49 Protection, insulation, dewatering and drainage of the Smok bastion, protection of the roof in the octagonal tower and the crown of the walls.

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Fig. 1 Zbyszko Siemaszko (1967), aerial view of the castle.
NID archives

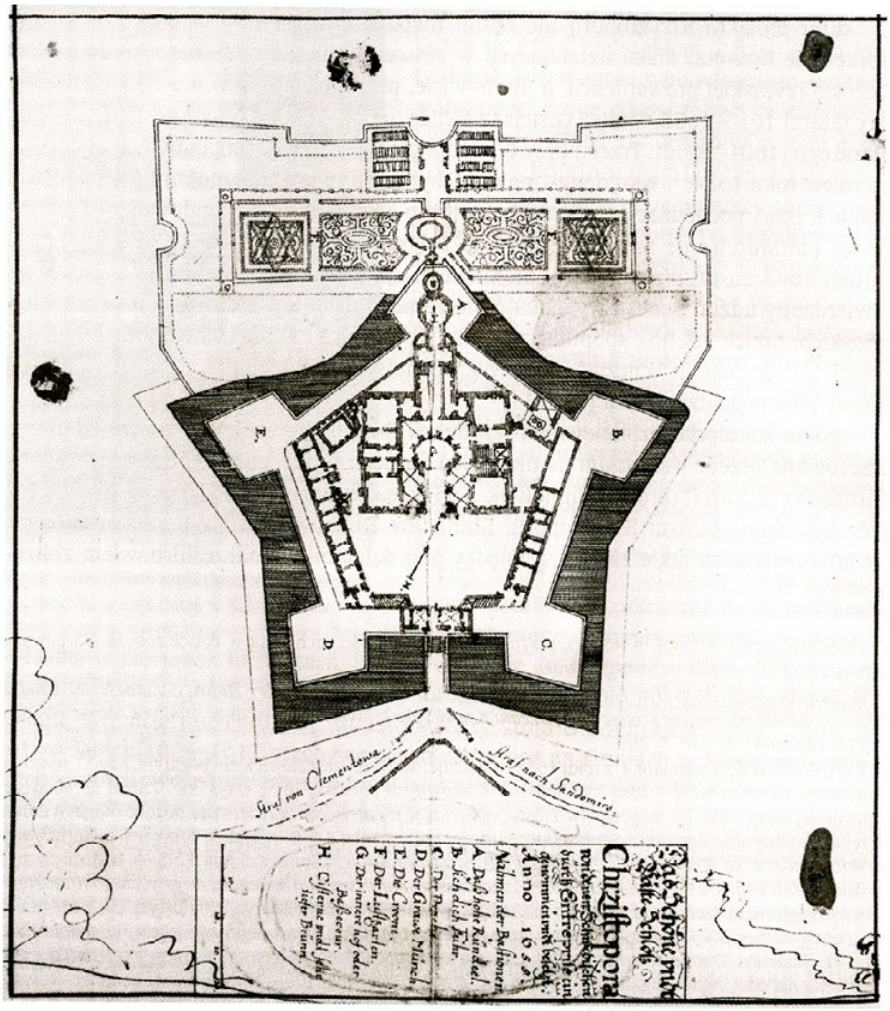


Fig. 2 Ground floor plan of the residence, drawing by E. Dahlberg, 1657.
Royal Library, Stockholm collection



Fig. 3 Gerson Wojciech, *View of Krzysztopór Castle*, 1866; MNK 134 126.

View from the gardens: the ruins of the central arbour with five supporting pillars and three arcades are visible. The artist also included trees that grew in the former gardens, which were then used for agriculture (fields for growing grain and grazing cattle), as well as buildings in the village on the left. These buildings were not yet in direct contact with the bastions and the castle moat, and the land was divided by wicker fences.



Fig. 4 N. Kuhlwein, *Ruins of Ujazd Castle in the area of Sandomierz*, second half of the nineteenth century; Ossolineum; l.g. 1468.

View from the gardens showing a newly laid road, wicker fences and newly planted trees, most likely fruit trees, close to the walls. Relics of old trees can be seen, and on the right are the first buildings of the emerging village with shelters attached to the bastions.



Fig. 5 Stronczyński, K., *Ruins of the Castle Known as Krzysztopor from the South*, watercolour, ca 1844.

Engraving from: *Opis zabytków starożytności do guberni radomskiej przez delegację wysłaną w latach 1844-1846 zebrane i rysunkami w dwóch osobnych atlasach zawartymi objaśnione* (Description of Ancient Monuments in the Radom province by a delegation sent in 1844-1846, collected and explained with drawings in two separate atlases), MS, Print Room of the University of Warsaw Library [Atlas II, Table 57].

Schematic view of the castle ruins.

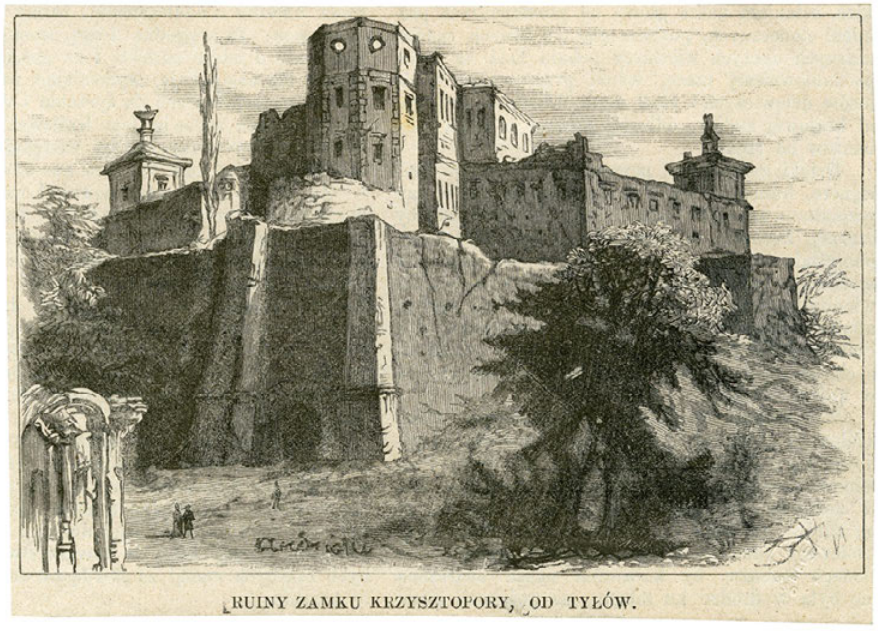


Fig. 6 Michał Elwiro Andriolli, *Ruins of Krzyżtopór Castle, rear view*, second half of the nineteenth century; MNK III, no. 35 014: B. X. After: Andriolli, zinc plate.

View from the gardens, with the ruins of the central arbour visible. The artist included trees growing in the former gardens in direct vicinity of the bastions and on the bastion crowns, but did not depict any traces of the landscaped gardens.



Fig. 7 Napoleon Orda, *Ujazd – known as Krzyżtopór*. Lithograph by A. Misierowicz, 1880.

View of the castle ruins from the main gate with tall greenery and shrubs on the bastions and in the buildings, as well as visible elements of the bridge and fortifications in front of the gate, and rural buildings in the moat.



Fig. 8 The castle foreground from the side of the former gardens. Photo by J. Witkiewicz (1952).

NID archive (no. 10306)



Fig. 9 The castle foreground from the village near the castle. Photo by J. Witkiewicz, 1952.

NID archive, (no. 10304)

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Tomasz Kuls

Formal and spatial analysis in the virtual reconstruction of the gardens at Krzyżtopór Castle

The project to create a virtual reconstruction of the Krzyżtopór Castle necessitated consideration of what its garden may have looked like. Combining information from a seventeenth century plan with the results of archaeological excavation, and basing on analogy to potentially similar gardens elsewhere, it is possible to suggest not only its likely appearance but also the perception of its relationship with the main structure.

THE KRZYŻTOPÓR CASTLE was built in the years 1620–1644 as the family residence of Krzysztof Ossoliński. It is unique that the building was created from scratch and survived to this day in its original form.

Research and conservation work carried out under the supervision of Professor Andrzej Koss in 2010–2012 by the Intercollegiate Institute for the Conservation and Restoration of Works of Art at the Academy of Fine Arts in Warsaw provided an opportunity to analyse the architecture of the castle, its structure and connections with the surrounding area. The scale and scope of the project included a virtual reconstruction of the castle and its surrounding gardens, which was developed in 2012.

The only iconographic source from the past that shows the castle and its garden is the so-called Dahlbergh plan (fig. 1). It was of particular importance to combine the study of this document with analysis of the results of archaeological research. However, the plan requires commentary. The copperplate engraving was made, in accordance with Dahlbergh's drawing, by François de La Pointe, and comes from a work published in 1696 in Nuremberg by Samuel von Pufendorf, praising the achievements of the Swedish king Charles Gustaf. It is titled *De rebus a Carolo Gustavo Sueciae*

rege gestis and contains many drawings from Poland, including the plan of Krzyżtopór.

Dahlbergh visited Krzyżtopór in 1657, accompanying the Swedish king, recording in his memoirs that "His Majesty [...] casually viewed the beautiful and strong castle of Chrzistopora." Charles Gustaf was informed on this occasion about the arrival of his ally, the Prince of Transylvania, and the company proceeded without delay to the meeting place. Dahlbergh therefore did not have time to make any measurements. Additionally, already at first glance the plan appears inaccurate in relation to the real situation. In the drawing, the castle is surrounded by a moat filled with water. In fact, the building is located on a slope, with almost nine metres of difference in ground level between the north and south sides. This is a serious error in representing the topography of the place, and at the same time proof that Dahlbergh's drawing was not based on measurements made on site. Most likely, it was a copy of a plan stolen from the castle library after the war. As for the original, I share the view of Professor Miłobędzki, who argues that Krzysztof Ossoliński commissioned the castle's design from an unknown Italian designer. During implementation, the plans were adapted to the site conditions.

Comparison of the drawing with the surviving walls, 90% of which are intact, confirms that the castle faithfully reflects the illustrated design. It can be therefore assumed that the gardens were completed with the same precision.

The drawing with the garden plan of Krzyżtopór Castle is actually quite clear (fig. 2). It shows a wall surrounding the gardens with a path beside it and trees or shrubs planted to provide additional features in various corners. An elliptical area or room containing a sunken oval pond is located along the principal axis projected from the castle and running at a right angle to the breadth of the garden, which is divided into a symmetrical arrangement of ornamental parterres at either side. Each pair of panels is enclosed within a separate wall, apparently with a hedge forming an arcade or outer boundary at two sides. The drawing delineates a regular system of planting and labels the enclosed area *F – Hortus Amoenissimus*. Another element further along the main axis is a rectangular brick structure with two openings or doorways in the side walls; the central piers contain niches. The gable walls are uniaxial. Flower beds shown on both sides of the building were probably intended for growing vegetables and herbs.

The shape of the gardens is related to the plan of the adjacent building. The corners are framed in forms resembling bastions and the elliptical pond, which is the central point of the gardens, repeats the shape of the arcade courtyard at the centre of the palazzo.

Archaeological research conducted under the supervision of Andrzej Gołembnik determined the functional levels of individual parts of the gardens. During the work, almost the entire lining of the quatrefoil-shaped swimming pool was found, along with foundations corresponding to the shape of the central room shown on the historic plan. The way they connect with the walls and other remains around the parterres coincide with details from Dahlbergh's drawing.

Water from the castle spring continues to flow through the garden pools and into the Koprzywianka river via a formerly vaulted channel below the rectangular brick structure, which we can identify as a garden pavilion. An engraving by Kajetan Kielisiński from 1831 and a photograph taken in 1926 by Józef Kościesza

Jaworski show a brick gazebo resembling a triumphal arch, whose architecture echoes the characteristic decoration of the façade at the central palazzo courtyard (figs 3-4).

In attempting to reconstruct the spatial composition presented in the form of a two-dimensional drawing, it is necessary to conduct comparative analysis with other examples of historical iconography, descriptions in old treatises, paintings showing views of specific images, and finally objects that have survived to this day. Thanks to such hints, the reconstruction becomes more probable.

The concept of "palazzo in fortezza" was developed in the early seventeenth century in Italy. Following confirmation from archaeology that the arrangement of the gardens complied with the one shown on the historic plan, it remained to decide about the architectural form of individual elements, together with planting and sculptures that complement the composition. It was obvious that inspirations should be sought in Renaissance Italian gardens.

In my reconstruction, the function of plants emphasizing the corners of the path beside the garden wall is played by trees cut into geometric forms. Rows of trees around the outside of the parterres form an arcade based on a frame or espalier, as is typical for Italian gardens (cf. fig. 5). Statues in the corners depict figures from classical Roman mythology, but could just as easily be, as is the case with the Wilanów gardens, personifications of the four seasons. Such representations are typically related to the owner's interests and ideological programme, but in this instance we unfortunately have no knowledge of them.

The moat shown in Dahlbergh's plan could not be reconstructed for obvious reasons. This does not mean, however, that water did not play an important role at Krzyżtopór. A spring still exists inside the walls. Just like in the past, it flows towards the Koprzywianka River. Analysing the topography of the area, I came to the conclusion that originally there must have been a reservoir adjacent to the garden, created as a result of damming the river. The reservoir was connected to channels that carried rainwater and sewage away from the castle area. These channels were cleared during conservation and once again fulfil their function of draining rainwater from the building.

When reconstructing the reservoir, I placed an island with an obelisk on the principal axis. A hill with a slightly blurred but regular octagonal outline still stands there today. Lidar images made in later years seem to confirm this, showing clearly visible regular slopes that indicate the shape was man-made. I hope that future archaeological fieldwork will provide final confirmation.

The gardens are an integral part of the residential complex, formally connected to the castle through architectural form and physically through the high "sala terrena," which constitutes a link between the palace and the gardens. It is located within the octagonal tower, directly above the cistern that collected water from the spring, marked H on the historic plan.

The room had an octagonal plan inscribed in a circle with a diameter of nine metres and was also nine metres high. Today, in a building bereft of its former vaults and ceilings, the scale of the room is almost illegible. I am convinced that it was of particular importance to the owner. A corridor covered with a high vault and containing a ramp, or perhaps more likely a gentle stairway, led to the room from the palace square along narrower passages at each side, connecting at the ends. Adjacent to the hall, a room

was built around the opening from which the spring flowed. The hall, together with smaller rooms adjacent to it, was probably intended to have the form of an artificial cave or grotto, which was very popular at that time. We find many examples of this in Renaissance and Baroque palaces throughout Europe.

Krzysztof Ossoliński was widely educated; he acquired comprehensive knowledge of the world in his youth. He represented King Sigismund III at the court of the Archduke (and later Emperor) Ferdinand II of Habsburg. In 1608, he visited Florence, representing the king at the wedding of his sister-in-law, Maria Magdalena Habsburg, and Cosimo II de' Medici.

Since 1894, when Stanisław Tomkowicz first described the Krzyżtopór Castle, researchers have shared his view that the inspiration for its creation was the Villa Farnese in Caprarola. The architect was considered to be Laurentius de Sente from Graubünden, known in Poland as Wawrzyniec Senes. However, although he is documented to have worked on the project, he was only in charge of construction.

The formal similarity to Caprarola is self-evident. However, I share Professor Fabiański's hypothesis that Krzysztof Ossoliński drew inspiration for Krzyżtopór from the residences of the princes of Florence, in particular the Palazzo Pitti and the Boboli Gardens. Although they are not referenced literally, all compositionally important elements of Krzyżtopór can be found there: the monotonous but dignified façade of the courtyard; Forte Belvedere, or the palazzo in fortezza raised above the garden; a grotto separating the palace from the gardens; and finally, the huge Grotta Grande, decorated in the spirit of Mannerism. The last one is a unique structure built between 1583 and 1593 according to the design by Bernardo Buontalenti. It is located in the Boboli Gardens and shaped like a cave, where a unique visual effect was allegedly achieved by covering an opening in the vault with a tank of water in which goldfish swam. Our knowledge about it comes from writings by Filippo Baldinucci (1625-1696) but the device no longer existed during his lifetime and scientists still argue whether it was ever made.

It was probably this mysterious element that became the inspiration for the most magnificent decoration in the Krzyżtopór Castle, the memory of which has been preserved in folk legend. The story tells of a crystal ceiling in an octagonal tower, flooded with water in which goldfish swam. From an engineer's perspective, even given today's technology, it is nearly impossible to make a glass bottom in a sixty-square-metre tank. However, there could actually have been an aquarium in the castle, although the legend may have misrepresented it.

A room intended to resemble an underwater cave should be located closer to water. In my opinion, it could be a small hidden chamber enclosed between the octagonal tower and the walls of the bastion, called the barbican (fig. 6). Its upper walls form a low tower above the embankments and provide an observation platform next to the office on the first floor of the octagonal tower, adjacent to the High Hall. At the base, beneath the terrace, there is a natural water source that remains active. The walls surrounding this spring form a reservoir. There are drainage holes in the bastion wall with an outlet into the garden through an outside niche; further, there are three more holes at the top of the niche. After closing the drain at the base of the wall, the water level would rise, filling the entire chamber (or cistern) and

allowing excess water to cascade outside. The level of rising water would be slightly below that of the floor in the cave above the cistern. Perhaps, with such water pressure, it was planned to create a fountain in the garden pond, although there is no evidence to support this.

A recess in the bastion wall above the niche features openings through which one could look out into the gardens. Access to this room was only possible through the tank at the spring. It can be assumed that there was a gallery leading from a large cave above the cistern to a room – a pool filled with water. The windowless room was illuminated by a magical glow from above. I would argue that just above the spring in the room adjacent to the octagonal tower (close to the legendary location of the aquarium) there was a partly glazed ceiling with small containers filled with water and fish. There are windows in the upper part of the walls, under the terrace. The light entering through them and penetrating the shallow tanks would create a fantastic scene, intensified by the sound of cascading water (figs 7-8).

The water from the cistern descended by a waterfall into the garden, where it flowed through a quatrefoil-shaped pool into the elliptical pond before continuing beneath the pavilion into the reservoir beyond (fig. 9).

No finishing works were ever carried out in the grotto-caves or in many rooms of the palace. Special decorations were probably made on the occasion of celebrations in 1644 such as the wedding of Krzysztof Baldwin Ossoliński and Teresa Tarło, during the Carnival, or for the visit of King Władysław IV at the turn of August and September.

With the premature death of the heir, Krzysztof Baldwin Ossoliński, in 1649, his family line expired and the castle was inherited by Krzysztof's brother, the Grand Chancellor of the Crown, Jerzy Ossoliński. He also died soon after and the furnishing of the castle was never completed. My own task has been to read, interpret, and visualize the ideas of the creators of this unique yet unfinished building. My visualizations are inspired by the achievements of artists working in the sixteenth and seventeenth century.

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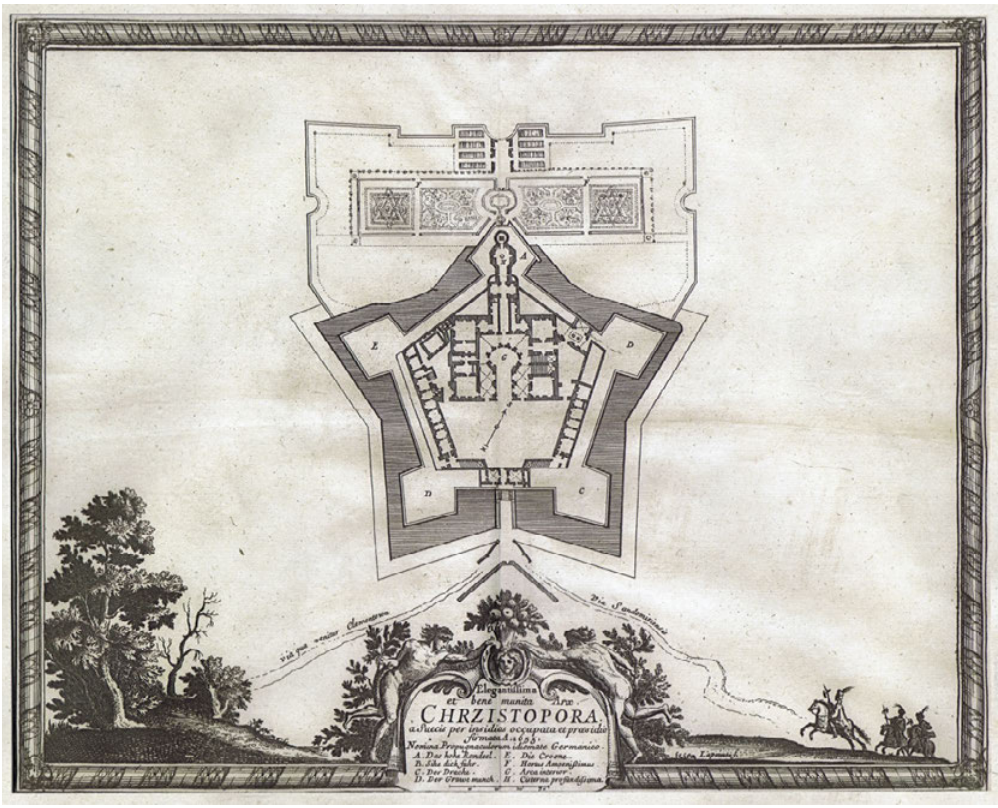


Fig. 1 Dahlbergh Plan

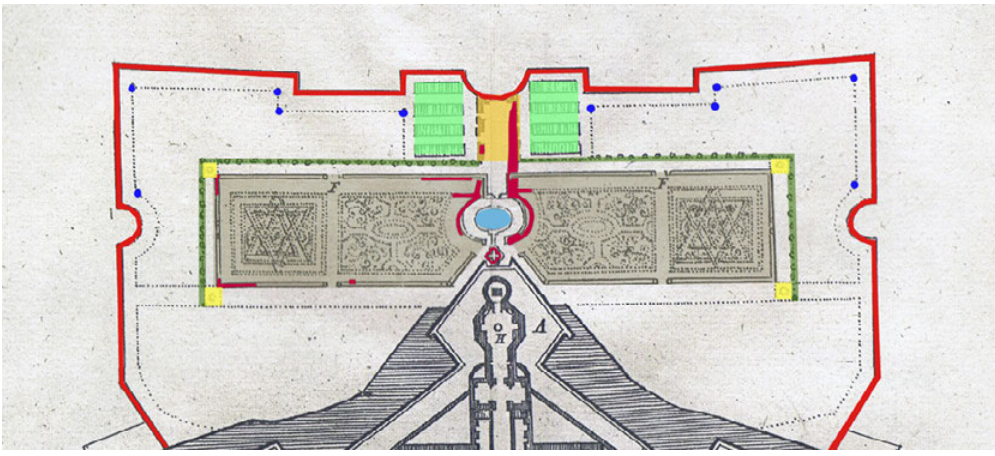


Fig. 2 Plan of the gardens with the main elements of the composition marked and elements whose presence was confirmed during archaeological excavations



Fig. 3 Photo Józef Kościeszy-Jaworski, 1926

Source: ISPAN archive



Fig. 4 Combination of the decorations of the palace facade from the main courtyard side with a drawing of a gazebo.

Drawing by the author based on a copy of a woodcut by Kajetan Kielisiński from 1831

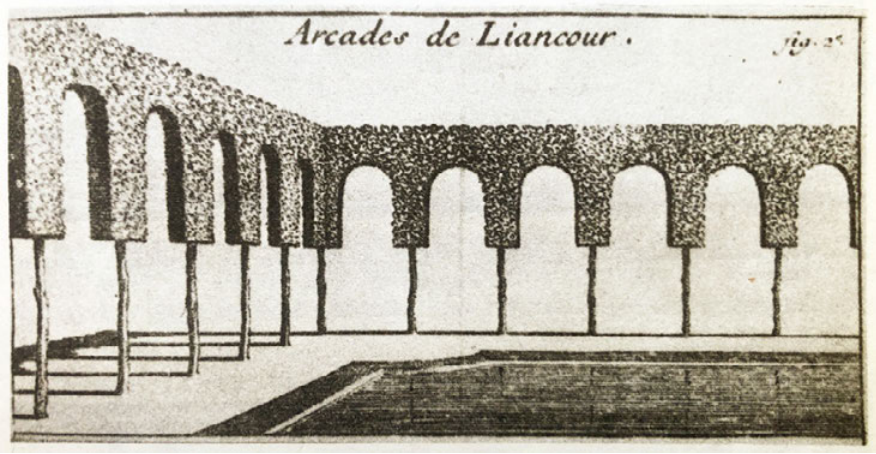


Fig. 5 Palisade a i'Italienne

Dezallier d'Argenville, *Le Theorie et la Pratique du Jardeinage*, Paris 1760



Fig. 6 Cross-section along the axis of the Krzyżtopór castle

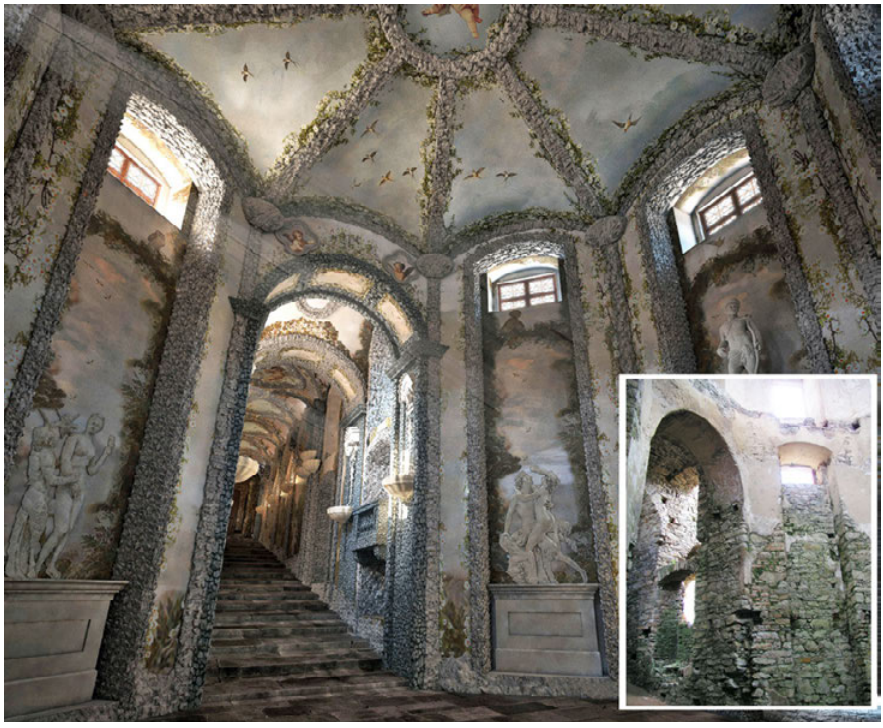


Fig. 7 The great cave of Krzyżtopór castle – reconstruction and existing condition

Fig. 8 Aquarium – location, existing condition and reconstruction





Fig. 9 View from the central part of the garden towards the gazebo – reconstruction



Fig. 10 General view of the complex from the gardens – reconstruction

Andrzej Koss – PhD habilitated, full professor; sculptor and conservator. Long-time head of the Department of Sculpture and Architectural Conservation at the Academy of Fine Arts in Warsaw (1974–2020), where he also served as dean and vice-dean. Founder and director of the Inter-Academy Institute of Conservation and Restoration of Works of Art (1999–2022) and initiator of the world's first Conservation Emergency Unit – a Mobile Laboratory for protecting artworks and monuments. A pioneer of laser technology in conservation, he led numerous major restoration projects, including the chapels of Wawel Cathedral, the Wit Stwosz altar in Kraków's St. Mary's Basilica, Wilanów Palace, and Jasna Góra. Author of many publications, expert for the Ministry of Culture, and member of numerous conservation committees.

Andrzej Gołembnik – archaeologist, graduate of the Institute of Archaeology at the University of Warsaw, former Chief Specialist of the Monument Conservation Workshop for Archaeology, researcher at the Institute of Archaeology at the University of Warsaw and Riksantikvaren – Utgravningskontoret for Bergen (Norway). Co-founder of the Interdisciplinary Research Laboratory at the National Centre for Research and Documentation of Monuments (currently the National Institute of Cultural Heritage). Former expert advisor to the Minister of Culture and National Heritage in the field of medieval urban archaeology and archaeological documentation. He has led long-term research projects in Pułtusk, Bergen, Płock, Gdańsk and Wilanów, and subsequently in Sandomierz and Wiślica. He is a proponent of modern research methodologies and the use of innovative documentation techniques in research and inventory processes in historic spaces.

Piotr Zambrzycki – PhD, specialist in the conservation of sculpture and architectural elements. He serves as Scientific Secretary of the Inter-Academy Institute of Conservation and Restoration of Works of Art and has been a long-standing lecturer at the Faculty of Conservation and Restoration of Works of Art at the Academy of Fine Arts in Warsaw. He is the author of numerous conservation projects and has participated in research initiatives in Poland and abroad. His expertise includes documentation and non-destructive examination of historic objects.

Ruins of the Krzyżtopór Castle have sparked the imagination of architectural historians for years, partly because this gem of late Renaissance Polish architecture and fine example of a palazzo in fortezza has never been fully explored. Research shows that the founder's bold vision was never fully realized. The premature deaths of the owner and then his successor meant that the palace came into possession of less wealthy families. Castle walls were negatively affected by dramatic historical events and abandoned in the nineteenth century. They were saved from degradation by Majewski's team in the second half of the twentieth century. Further conservation work was carried out at the end of the first decade of the twenty-first century. An idea was developed to partially reconstruct the historic gardens, whose image was preserved in the 1655 Dahlbergh plan. Design work was preceded by archaeological research and focused on the main axis of the complex. Small surveys at the outskirts of the garden composition were to confirm the accuracy of the historical map. The results exceeded expectations: after adjusting to

Andrzej Koss, Andrzej Gołembnik, Piotr Zambrzycki

Evaluation of the results of ongoing archaeological research in the gardens of the Krzyżtopór Castle in Ujazd, with discussion of conservation measures and conclusions regarding the programme of future activities

geodetic coordinates, the map agreed with discoveries, which initiated discussion about the future of this historic space, culminating with the First International Conference on Garden Archaeology held at the castle in September 2023. Although no research directives were drafted during the conference, plenary discussions resulted in the creation of a programme for future research, basing on interdisciplinarity and cooperation among conservators. The scope and range of excavation research will be determined by the results of non-invasive research in the geodetically defined space of the gardens and their structural context. The spatial inventory will base on laser scanning and photogrammetry, while the excavation research – on principles developed during research conducted at the royal residence in Wilanów, including use of a spatial GIS database and an archive of geodetically positioned documentation collected in a CAD system.

THE FACT that today we can admire the Krzyżtopór Castle, the Mannerist residence of Krzysztof Ossoliński, built in Ujazd in the style of Palazzo in Fortezza, is due to the work of Professor Alfred Majewski. In the 1970s, the building underwent extensive restoration and conservation work, thanks to which the progressive deterioration of its historic walls was halted. In fact, it was an attempt to carry out works on a larger scale, with the aim of rebuilding the entire complex.

However, following the imposition of martial law in Poland and the resulting standstill, the idea was abandoned. This was probably advantageous because the designs that have survived to the present day deviate from the historical truth, which was only revealed through detailed archaeological and architectural research carried out during subsequent construction and conservation works under the supervision of Professor Andrzej Koss in the years 2009–2011.

Certainly, the reason for the site's charm and its long-standing admiration lies in the architectural assumptions about the building's creators and the owner's indubitable penchant for splendour and fascination with the mystical. All these elements are encoded in the palace walls, their dimensions, elaborate decoration, fanciful arrangements, and omnipresent symbolism. The last element is also found in the ornamental pattern of the garden parterres. They extended at the foot of the northern curtain of the palace wall. In the centre of the defensive wall was a high tower with a water intake. Water was collected in a stone fountain built in the shape of a four-leaf clover. The stone canal then fed the oval pool and led the water under the arcades of the monumental pavilion to an artificial pond that formed the mirror-like foreground of the complex. This terraced arrangement was crowned by a vast counter-slope extending toward the horizon. On either side of the water axis of the composition there were two rectangular ground floors surrounded by a stone wall. We owe the decorative motif of the garden composition to a drawing by Erik Dahlberg, an officer in the army of King Karl X Gustaf, who was stationed at the residence during the Swedish War of Independence. The dominant element of the decoration is the figure of pentagram – probably a repetition of the magical sign on the basis of which the outline of the palace walls was planned. This theme is complemented on the inside by floral embroidery divided by garden paths.

Dahlberg's plan amazes with the detail of the drawing, but its credibility has been questioned in the past. However, research made in 2010, when the first archaeological surveys were carried out at the foot of the northern curtain of the castle, has confirmed the incredible accuracy of the basic divisions. These studies were part of the extensive research, conservation and adaptation work carried out between 2009 and 2013. Their aim was to create an orderly space that would frame the restored monument from the north. For this reason, these studies were only of a survey nature. Only the central axis of the complex was subjected to a more detailed investigation, which revealed the fountain, the full extent of the flowing garden pool, the foundations of the pavilion and the walls of the stone drainage trough. At the same time, the ceiling of the service levels on the west side was exposed. Research at this level was discontinued due to lack of funds necessary to support specialist research.

The advantages of CAD were used to calibrate the Dahlberg plan and to indicate the positions of the corners of the garden walls in the field. The results of the surveying work confirmed that the dimensions shown on the historic plan correspond to reality. If the basic metric parameters agree, why deny the details contained in the plan? Therefore, when it came to investigating the area of the future gardens, the location of the excavations could be guided by the Swedish cartographer's indications.

The archaeological research carried out in 2010 and 2011 had a short history. In addition to confirming the basic

principles of the original layout of the gardens, its purpose was to determine the historical level of use. This knowledge was needed by the designers working on the concept of a sketch marking the basic spatial divisions in the area. At the same time, it was necessary for the team of garden engineers, who had to work at a slightly higher level than the original in order to preserve the historical content expected below. These works were carried out under archaeological supervision by the company Dwa pejzaże Paweł Stękała and Katarzyna Gołembnik. Thus, after removing the modern layers accumulated during the intensive settlement in the nineteenth and twentieth century, the investment level was reached, set at 262 metres above sea level.

In the first phase, surveys were carried out to determine the extent of the gardens. Due to lack of funds, only the western part of the gardens was surveyed. It was assumed that since the Dahlberg plan showed a symmetrical layout, the eastern quarter did not require additional investigation. Furthermore, there was too much modern overburden in the eastern part. Practical considerations also played an important role.

Knowing the initial design assumptions, which centred on the idea of making the water axis the dominant element of the reconstruction, the archaeologists concentrated on this part of the gardens. The crown of the foundations of the garden pavilion on either side of the canal was uncovered. At the same time, the excavation was deepened at the site of the expected well. It was fully exposed at the depth of sixty centimetres. Inside there were elements of stone lining. After being cleaned, it was filled with water that leaked from under the foundations of the towers through a narrow channel. It was not a natural flow of water from the spring inside the tower. It was probably created secondarily during the conservation work carried out by Professor Alfred Majewski in the 1970s. Originally, the water cascaded outside and was collected in a flowing fountain.

The participation of the team of conservators from the Intercollegiate Institute of Conservation at the Academy of Fine Arts in Warsaw was an integral part of the archaeological research. During the excavation phase, their contribution was limited to advice on the treatment of stone elements of the discovered garden architecture and valuable comments on techniques of joining stone elements and their treatment. It should be noted, therefore, that the collaboration with the restorers played a very important role in these studies. It can even be said that it has led to many important discoveries. They are undoubtedly an extremely important element in any research of historical character focused on discovered works of art, architectural elements or entire structures. In the case of the area around the Krzyżtopór Castle, the cooperation of conservators was particularly important in the study of the castle gardens. Apart from the system of regular avenues and quarters, there were interesting examples of historical architecture. Unfortunately, the archival information that has been preserved to date is very fragmentary, and the Dahlberg plan only provides us with information about the spatial layout. For this reason, the excavations planned and carried out locally were a particularly important scientific and intellectual activity.

During the works, a number of small architectural remains were discovered, as well as important buildings from the past that overlook the gardens. At present, most of the walls are buried in the ground, usually only several dozen centimetres

above the surface. They are all located in close proximity to the garden's water system. The location and technological make-up of such structures have caused their effective protection to be particularly difficult. They are under constant pressure from destructive external factors such as rainwater, moisture from the ground as well as seasonal, dynamic thermal changes.

During the research carried out by a team of archaeologists and conservators, and during the levelling work that preceded the partial reconstruction of the layout of the site's central, four sets of historic walls were uncovered. These are fragments of a four-sided well, preserved in the original part of the foundation, which also forms the base of the well. It was made of four stone slabs (sandstone). They were originally grouted with lime and sand mortar. Frames made of semi-circular stone slabs were placed directly on the slabs. These frames have essentially been preserved in two layers. The slabs were joined at the corners by vertical posts.

Another interesting element of the water system that adorned the gardens was a cascading watercourse comprised of three low steps set on cement and lime mortar. The stone steps of the cascade were flanked by two longitudinal stone slabs and led the water to the central oval basin located on the axis of the garden and set in a circular frame with remains of walls. The base of the pool was made of clay and mud. The bottom of the pool is paved with granite slabs surrounded by sandstone slabs of crushed stone.

The most impressive structure in the gardens was undoubtedly a free-standing pavilion with an arcade or triumphal arch. A fragment of its column is currently the highest surviving historical element of garden architecture. During the works, its complete foundations were also uncovered. They are in the form of walls on the north-south axis, leading to the northern canal on both sides of the watercourse. The walls were built using a mixed construction of broken sandstone. In some places, brick reinforcements have been preserved. In the foundation part, clay and lime-sand joints were used.

In the course of planned activities, the primary objective was to display the relics discovered during the archaeological works, while protecting them as much as possible from the destructive effects of the environment. Since they play a key role in the composition of the entire garden, it was necessary to partially reconstruct their shape by means of anastylosis. One important requirement in this activity was to preserve the unchanged expression of the ruins. The aim was also to create the impression of general homogeneity of the stone reconstructions, with additions that could be read from a distance. The garden's water system was partially reconstructed and its original decorative and protective function restored.

Conservation work began with the preparation of detailed documentation. All objects were inventoried and then mechanically cleaned to remove any remaining dirt and loosely adhering layers. Roots of small plants were also removed. The surfaces of the objects were disinfected by spraying them with Sto-Prim Fungal from Sto. After twenty-four hours, the elements were washed with water under appropriate pressure. The deteriorated joints were removed and the weakened parts of the wall were removed in places according to the principles of the inventory. After exposing the stable layers, the dismantled stones were rebuilt. To protect the walls, crowns were made of material similar to the original. In

some cases, stone from excavations was used. In the upper part, the surface of the joints was smoothed to improve the flow of rainwater. The sandstone surround of the pool was conserved, with partial reconstruction of the upper edge. The oval pool underwent thorough conservation and reconstruction. Due to its key function along the watercourse, it was necessary to restore the insulation layers and surface finishes of both the pool itself and its immediate surroundings. The result was an architecturally organised space that emphasised the axial layout of the garden. Finally, the conservation documentation was drawn up in accordance with the regulations in force. The conservation work lasted from November 2011 to June 2013, with a winter break.

Design work began during the excavations. Taking into account the budget and the scope of research, it was assumed that a sparse form of expression would be maintained, reflecting only a schematic representation of the former arrangement. Complete reconstruction of small garden architecture (except for the reconstruction of the fountain) and redesign of the central swimming pool have been completely postponed. A line of new avenues has been marked out. In place of the old embroidery, a schematic colour scheme has been introduced, expressed by the sowing of three types of vegetation with intensive, undisturbed growth and low maintenance requirements. Plans also include placing stone benches around the pool. The whole composition has been conceived as a transitional form.

When works began in the gardens, it was known that cleaning of the area was about to begin. The research was fragmentary, more exploratory in nature, and the expression of the project was, by definition, sparse. It should be emphasised that the research itself was not exhaustive. Today, we can openly say that it lacked interdisciplinary support. It is only now, when it has become possible to carry out complete research on the basis of carefully prepared guidelines, that a future programme can be presented, basing on the information gathered during the conference, which may constitute a guide for field actions in historical gardens. Such a programme is being prepared for research planned in the gardens of the Krzyżtopór Castle.

The research programme, or the planned research strategy should be prepared in three stages:

I. Preparatory
II. Field research strategy
III. Principles of development

I.A An investigation of archival sources, consisting of a detailed analysis of archival resources in terms of written, cartographic and iconographic sources. This part of the preparation should be completed with a survey of available literature.

I.B Area of non-invasive prospecting activities, based on:

I.B.1 Analysis of geodetically positioned LIDAR measurements

I.B.2 Analysis of photographic images using basic techniques

I.B.3 Necessary geophysical surveys, preferably combining the two techniques

I.B.4 Hydrogeological assessment

I.B.5 Series of verification archaeological boreholes

I.C Preparation of results from the preparatory phase

II.A Preparation of the site for excavation

II.A.1 Preparation of the site

II.A.2 Preparation of a numerical model of the area to be excavated

II.A.3 Preparation of a geodetically positioned survey of the site, local

architecture (spatial context), along with research of the excavation area.

II.B Developing the basis for a field research strategy

II.B.1 Defining the framework for basic interdisciplinary cooperation

II.B.2 Establishing the rules of cooperation with the curator

II.B.3 Developing the basics of a spatial GIS database

II.B.4 Development of a thesaurus of defined concepts used in description and analysis of the layers and earth structures

II.B.5 Formulation of principles for exploration (preferred stratigraphic method)

II.B.6 Formulation of principles for carrying out field analyses, mainly description of characteristics of the stratigraphic units

II.B.7 Developing rules for collecting and inventorying finds and samples

II.B.8 Indication of the place where the historical material was collected

II.B.9 Presentation of the rules for the documentation of test results (optional laser scanning and obligatory geodetic positioning). Spatial digital photogrammetry, which can be related to spatial context (point cloud)

II.B.10 Formulation of principles for the collection of spatial documentation (CAD/GIS)

III.A Development of the spatial structure of the database

III.A.1 Horizontal divisions

III.A.2 Vertical divisions

III.B Graphical development of the stratigraphic relationships within the excavations (separately) and for the whole station (together). Optional: Harris matrix or depositional stratification model

III.C Spatial reconstruction in spatial context (if possible)

III.D Reports from cooperating specialists (results of specialist analyses)

III.E Final report with conservation and research conclusions



Fig. 1 Aerial view of Krzyżtopór from a balloon, spring 2009

Photo: MD Studio



Fig. 2 Krzyżtopór, spring 2009. Dahlberg's plan is superimposed on a photograph of the castle.

Photo: MD Studio



Fig. 3 Contemporary contour map with Erik Dahlberg's correlated plan

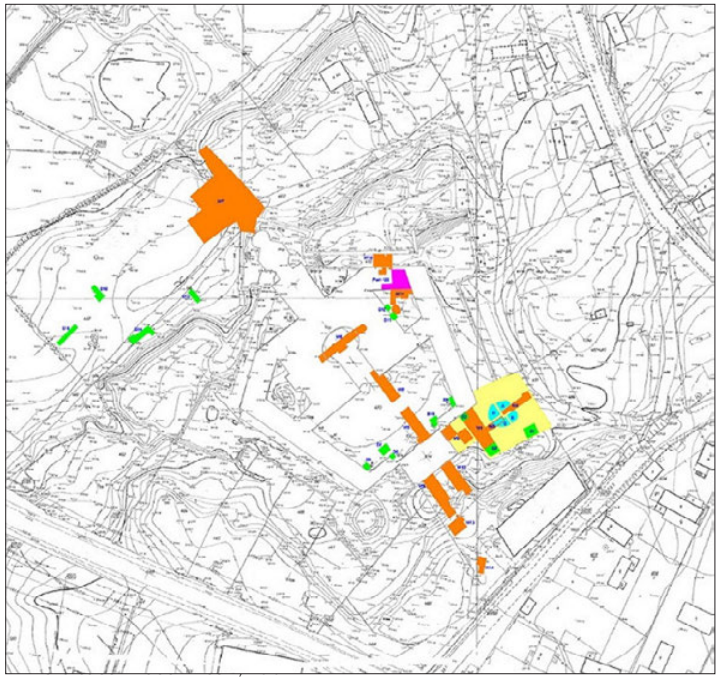


Fig. 4 Scope of archaeological research in the 2009–2011 seasons. In the garden area, the test pits are marked in green; the areas of exploratory research are marked in orange



Fig. 5 Krzyżtopór Castle in Ujazd. The garden area to the east of the main axis, April 2010



Fig. 6 Krzyżtopór Castle in Ujazd. The garden area, April 2010



Fig. 7 Cleaning the excavation profile of a well



Fig. 8 The central part of the archaeological site, showing the outline of the central flow pool and the line of the drainage channel



Fig. 9 Krzyżtopór Castle in Ujazd. View from the National Park and the garden, April 2010.

Photo: P. Zambrzycki



Fig. 10 The four-leafed well uncovered at the High Barbican bastion, August 2011



Fig. 11 Krzyżtopór Castle in Ujazd. Garden area, pillar – remnant of an arcaded pavilion. Stage of works in 2011



Fig. 12 Work on the four-leafed well, June 2013



Fig. 13 The garden after conservation and restoration work, June 2013

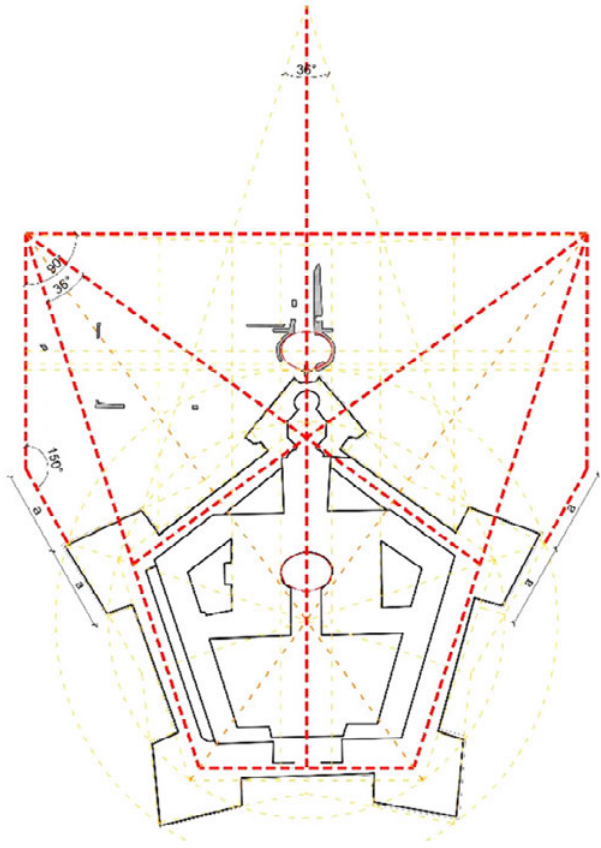


Fig. 14 Recomposition of the garden layout according to Z. Myczkowski and J. Wowczak

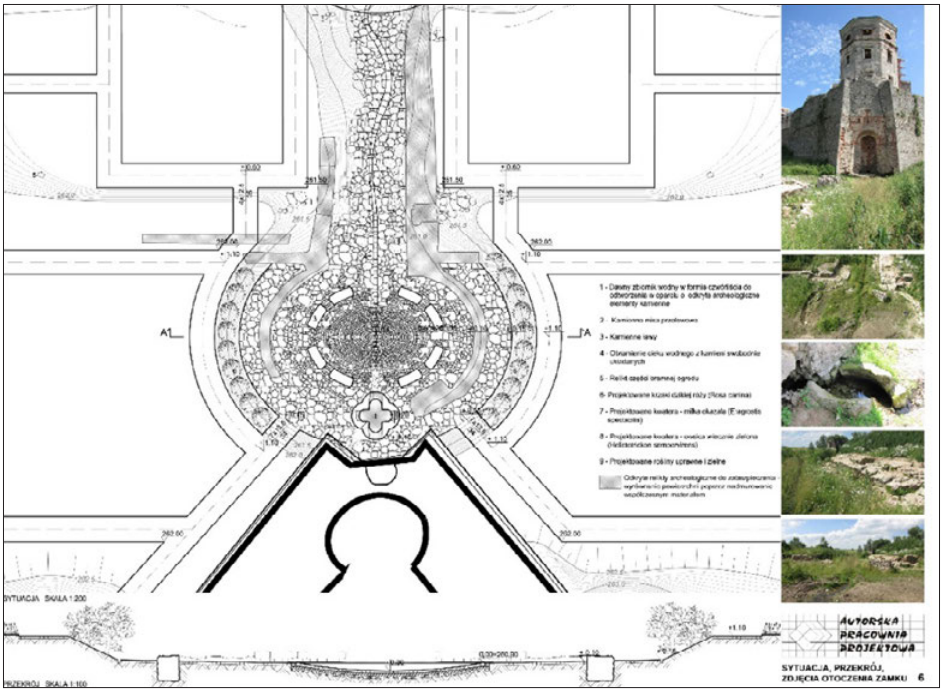


Fig. 15 Technical drawing of the layout of the central pool and its surroundings according to Z. Myczkowski and J. Wowczak

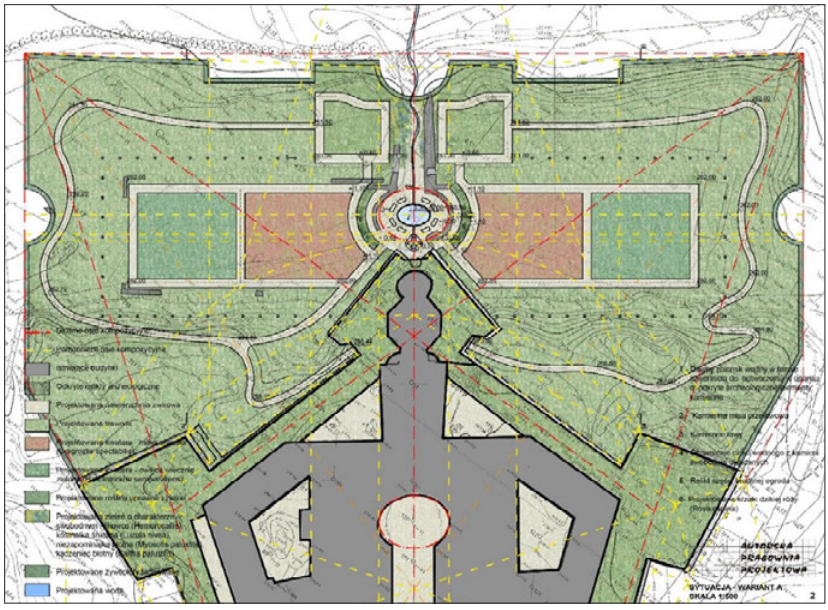


Fig. 16 Detailed design of the gardens, according to Z. Myczkowski and J. Wowczak



Fig. 17 Final restoration work on the garden (2013)



Fig. 18 The garden during conservation and restoration work, June 2013

Brian Dix

Afterword

THE CONFERENCE demonstrated the value of using archaeology in the study of historic gardens, showing how careful investigation can recover details concerning former layouts and planting. Such information is vital for accurate reconstruction but is also an important resource.

The remains are often fragile but continuing advances in scientific techniques enable increasingly sophisticated analysis to aid our understanding of historic gardens. Examination of soil micromorphology linked with detailed studies of molluscs and archaeobotanical identifications add greatly to our knowledge of past horticultural practices as well as provide specific information regarding what may have been grown and where.

All these indicators are vulnerable to damage and loss, especially where soil conditions change. While fluctuating water levels can affect the survival of some types of evidence, the greatest threat is from soil disturbance. This may arise through ground shrinkage and heave but is most commonly caused by cultivation or other digging, including archaeological excavation.

One outcome of the conference was the need for a clear vision of the aims of any future work at Krzyżtopór. In addition to an initial metrical and digital survey, meant to form the basis for subsequent actions, this should include further archaeological exploration of the gardens.

Investigation might range from a non-intrusive survey through trial excavation to complete clearance and eventual reconstruction. Alternatively, it may be desirable to preserve important deposits and other buried remains *in situ*, thereby protecting them for the future. The historical appearance of the garden could be shown in other ways, for instance through different patterns of shallow-rooted vegetation or using computer graphics to create a virtual reality experience.

A minimum level of archaeological work, involving geophysical survey and targeted sample excavation, will be necessary to evaluate the nature and extent of surviving buried remains and to assess their significance and vulnerability.

Similar considerations should apply to the castle buildings, where recreating the possible appearance of rooms raises inevitable compromises and tensions. A crucially important element of the building and its sense of place is its authenticity. The varying fortunes of the castle are particularly evident. Its current appearance and the nature of its fabric are intimately linked with events in wider history. Its story line resonates with visitors.

The overall feeling at the conference was that a scientific board of suitably qualified experts should be appointed to consider these matters more fully.