

Historical vegetation used as camouflage at *Festung Breslau* (Fortress Wrocław)

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Abstract. Areas around fortified cities offer extra historical values, which were introduced into landscape centuries ago. Historical vegetation at former fortresses was a part of 'living defensive systems'. Large areas of land and roads were planted with appropriate plant species according to military instructions. The combination of local species and land configuration (natural defence areas) protected the fortification and deployed troops. Fast growing trees and shrubs were moulded into hedges, clusters and lanes screening and camouflaging the fortress's roads and plots of land. Studies of historical vegetation at fortresses are based on collecting old technical guidelines, maps and aerial photographs, as well as on field research. In this article, the authors present general examples highlighting the role of vegetation used for camouflaging fortifications. The example discussed is *Festung Breslau* (Fortress Wrocław) over 120 years after its construction.

Key words: camouflage, historical vegetation, *Festung Breslau*.

Introduction

In the authors' opinion, *Festung Breslau* possesses camouflage green typical of that of German fortresses, planted in response to the introduction of dedicated technical guidelines in 1905 [17]. The hypothesis put forward in the paper calls not only for the consideration of general issues related to unique fortress structures, but also to a broadly understood fortress landscape, including camouflage and observation. In order to determine whether the fortress has any features distinguishing it from other surviving domestic complexes it is necessary to examine the historical aspects used to establish the main context in which the fortifications were erected. The study was designed to preliminarily examine the types of fortress greenery with a view to establishing whether it is subject to any threats and how the fortress greenery in the former fortress plots can be managed. To this end, the authors present some general remarks based on field observations, as well as results of their examination of archival sources.

Camouflage, deceit and concealment used in fortification can be of interest to a landscape architect. Over its long history, the world has been constantly changing, experiencing innumerable wars, which has affected the cultural landscape. As the nature of war has altered, so the camouflage, which has had to meet the current requirements, has been modified. Consequently, the rules of the deadly 'hide-and-seek' have changed all the time as well. Misleading and incorrect information obtained by direct or indirect observation could determine the results of battles in various theatres of military operations. Vegetation, being part of landscape, could either hide or show off a given area to enemy fire or observation. Because of the country's geopolitical changes, Poland's territory constitutes a unique military park with former Polish, Austrian, French, Soviet, Russian, Prussian and German fortifications [5].

First scientific studies regarding the fortress landscape in Poland focused on investigating the existing situation and determining possible options as regards the development of fortress sites and their greenery were carried out in Cracow under Prof. Janusz Bogdanowski (1923-2003) and a team of scientists from the Technical University of Cracow. The research done in the last 25 years has not only encompassed architecture, but also the exposure of facilities in landscape on the example of Fortress Cracow and Fortress Przemyśl in the Austro-Hungarian Empire. It was preceded by surveys of archival sources, which disclosed a number of connections between landscape and defensive architecture. They covered for instance masking vegetation and activities related to the concealment of facilities and soldiers from the enemy. It is noteworthy that the area taken up by masking green was sometimes bigger than the areas of the villages adjacent to a town or of its individual districts.

Following the sociopolitical turning point of 1989, historical fortifications grew in importance, principally due to ownership changes and increased accessibility of former fortress areas to a broad spectrum of scientists and enthusiasts alike. However, the changes also marked the beginning of a gradual degradation of the facilities, which had lost their owners, and so are no longer subject to maintenance or care. At the same time, the natural and ecological value of the fortifications subject to secondary succession started to rise.

Studies of former fortress sites, focusing on their nature, possible use for recreation or tourism, quickly covered the whole country. The studies were conducted at over a dozen sites throughout Poland, including: Gdańsk (*Festung Danzig*), Giżycko (*Festung Boyen*), Toruń (*Festung Thorn*)

Poznań (*Festung Posen*), Srebrna Góra (*Festung Silberberg*), Szczecin (*Festung Stettin*), the so-called *Międzyrzecki Rejon Umocniony* (*Ostwall* or *Festungsfront im Oder-Warthe Bogen*), Warsaw and Wrocław (*Festung Breslau*). A number of steps have

been taken in association with the Society of Friends of Fortifications, whose many field units are still active today. This led to the establishment in 2002 of Poland's first Fortress Cultural Park – at *Srebrna Góra*.

Camouflage in fortifications

Camouflage is a means of disguising the true nature of objects [8]. At the turn of the 20th century, normal practice was to camouflage both fixed and field fortifications. Professor Bogdanowski (1896) described camouflage as various devices or efforts aimed at hiding, covering or optically deforming fortifications or their parts [1]. The visual aspects connected with fortifications derive from mimetism, which in the world of animals was researched by A. H. Thayer (1849-1921) [11]. His observations were utilised in the 'human world of armed conflicts', in painting warships in the so-called dazzle camouflage, which made it difficult for the enemy to accurately determine the distance to them while aiming guns.

Form, shadow, texture and colour are unique features of land, which to a large extent determine measures to be taken to mask various facilities. Although such technical solutions as painting or covering roads with camouflage nets were also applied, greenery played the predominant role in introducing camouflage. Planting extensive sections of fortresses with various species of flora became a universally accepted practice. Furthermore, it was officially governed by technical regulations and quickly became a landscape-affecting factor. Plants used for camouflaging fortresses included above all local trees and bushes, which did not require introduction. It is also for this reason that variety was preferred; from formal and linear arrangements, e.g. in the form of lanes, through arrangements typical of rural burial grounds or cultivated green areas, to solitar trees, informal and loose tree clumps. Where possible, greenery was thickened and filled in, to make it similar to that in areas adjacent to fortress

plots. Naturally, the character of the camouflage depended on landscape type; it was different in strongly urbanised areas and different in suburban or rural areas. The plant camouflage was designed to look naturalistically, with its soft lines to a large extent mimicking the natural landscape of tree stands and loose groups of trees. The use of rhythm and formal plantings forming geometric arrangements was to imitate burial grounds, brickyards, parks, gardens, orchards and standard lines of vegetation along transport routes. Landscape camouflage was also used to blur outlines of fortress facilities against the background of earthen embankments and the horizon. The diversification of tree species, varied forms and habits was necessary to create a natural space, in which monocultures were avoided, among other things, in order to protect plants against pests. The variety of form was also connected with the need to ensure sufficient protection against observation from air, at the same time enabling own observation points to be set up for instance in trees.

However, trees and bushes were used for military purposes for much longer. They were utilised to create obstacles around fortresses. However, sometimes vegetation made defence more difficult. In 1806, at *Festung Silberberg* (Fortress *Srebrna Góra*), which guarded a strategically important mountain pass, in fear of Napoleonic soldiers, extensive stretches of forest around the town's defences were felled. This created approaches open to own artillery and making an attack by the enemy's infantry difficult. The tree stumps were used to erect defensive facilities: palisades, barricades and blockhouses.

Role of vegetation in fortifications

At present, however, because of a change in the nature of armed conflicts and the way in which wars are waged, the old plantings perform ecological, protective and aesthetic functions. Formerly, vegetation played varied functions related to fortifications. It was used in screens, obstacles (Fig. 1), technical applications (e.g. as a building material, for ground stabilisation), but also for decoration. Vegetation connected with garrisons was used inside fortresses, performing the function referred to above in representative locations, barracks or gardens. In turn, tactical green was connected with supply and transport routes related to the fortress's logistics. The following groups of greenery [10] can be distinguished:

- 1) Obstacle-type green, formed in approaches and midfields around fortifications. Used independently or as an element accompanying moats, pits and infantry obstacles in the form of barbed wire entanglements, often hidden in land depressions. Appropriately selected and planted bushes and trees could also be used as live obstacles. Also forests were used as obstacles, but this topic goes beyond the scope of this paper.
- 2) Camouflage green, intended for optical deformation and to confuse enemy observers to make them interpret landscape features wrongly. It was formed by existing groups of trees and bushes, typical of suburban areas, such as alleys,

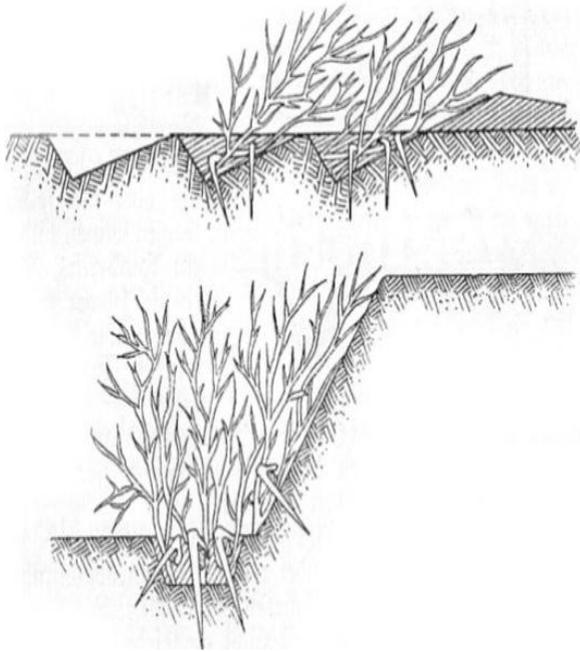


Fig. 1. Tree branches and bushes sharpened and pointed towards an advancing enemy [14].

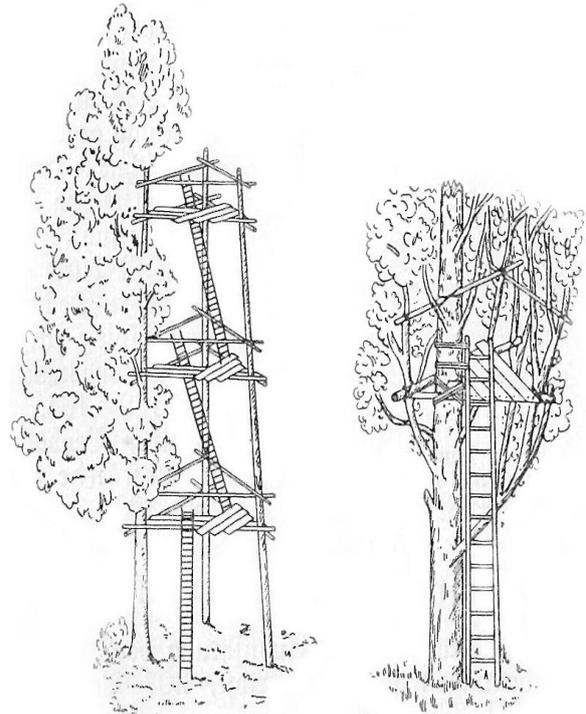


Fig. 2. Combined trees/bushes & wire obstacles [14].

lanes, clumps of trees, orchards, parks or burial ground green. Their areas were covered with vegetation made to resemble nearby farmlands or urban greenery (parks, burial grounds) and clumps of trees or bushes (as well as town forests, cultivated land, etc.) typical of a given part of the town.

- 3) Green performing an obscuring-and-accompanying function (Fig. 2), whose purpose was to make movement of own troops more difficult to detect by the enemy. To this end, principally trees with a round or wide-spreading form and fast-growing bushes were used. These were planted along routes connecting detached fortifications with storehouses, food warehouses, ammunition depots, railway lines, fortress roads and stake storages.

The intended camouflaging effects [9] can be roughly divided into:

- a) Deformation, used as a deliberate loss of features indicating the intended use of the camouflaged fortifications.
- b) Confusion, i.e. an intended obscuring of the location of the camouflaged facilities.
- c) Misinformation, understood as measures designed to make the determination of the actual use of a facility more difficult, where such a facility cannot be camouflaged, whatever the reason.
- 4) Green performing an accompanying-and-masking function, planted to obscure transport routes (roads, railway lines, etc.). How effective was obscuring-and-accompanying green in camouflaging infrastructure and troops to an outside observer is shown in the table.

TABLE 1
Visibility of items (people and objects) depending
on the distance of observation
[Source: Środulska-Wielgus, J., 2002, p. 135]

Item	Type of object or facility	Distance in metres (approx.)
1	Detached house	5,000
2	Single tree	3,000
3	Smaller tree, bush, single individual	1,000-2,000
4	Human figure, telephone pole, tree silhouette and trunk, house window	900-1,000
5	General outline of a human figure (movements of arms or legs), large tree branches	700-800
6	Tree branches, barbed wire entanglements	500-600
7	Colours, details of a human figure, outlines of headwear, clothing, small twigs, window shutters, weapon type (machine gun, Kalashnikov assault rifle)	300-400
8	Face oval and clothing colours, tree types	250-300
9	Face outline, clothing and weapon details, leaves on trees, barbed wire	150-200
10	Face features, e.g. nose or mouth, leaf shape, tree bark	70-100

Materials and methods of historical analysis

The study object – *Festung Breslau* (Fig. 3) – was built in the Prussian Empire in the early 20th century, and has been within the Polish territory since 1945. The fortress encompassed both banks of the Odra River, and was divided into right- and left-bank sectors [13]. It was used as a storage place and was capable of perimeter defence against an army equipped with field combat assets. It was an important crossing point on the Odra River and boasted a well-developed railway network and industrial hinterland. During the final stage of its development, there were erected some hydro engineering facilities, including fortress weirs that enabled the approaches to be flooded to create water obstacles on the tributaries of the Odra River: Czarna Woda, Śleza, Widawa and Oława [6]. The fortress's extension was accompanied by a very fast development of aviation, which also had an impact on camouflaging the fortifications. Taking into account that observations could be conducted not only from balloons, masking vegetation was planted within the fortress's plots and along its roads.

During the last 25 years, the studies into *Festung Breslau* have primarily focused on building structures (Infantry Forts – IST, Infantry Shelters – IR, Mobilization shelters – U), and less on aspects related to landscape, ecology, land development or the condition of the existing vegetation. The current status of studies into the historical vegetation connected with *Festung Breslau* indicates a very limited availability of historical materials in the form of documents and planting plans. In this respect, the authors have used the topographic maps to be found at Archives de la Societe des Nations in Geneve and a description of the fortress construction. To some limited extent, also the results of surveys and analyses done as part of practicals by students of the Institute of Landscape Architecture in Wrocław in the years 2005-2006, presented in a 2007 publication by Potyrała [7], were used.

The most interesting piece of information about *Festung Breslau* is to be found in a report concerning the arrangement of artillery, drawn up by a so-called artillery officer (*Artillerie Offizier von Platz*) on 29 June 1911 [16]. The report claims that the southern line of defence had weak points as regards movement of own artillery and its possible retreat on roads (non-masked retreat routes). We also learn that visibility from the identified artillery positions was limited to hills from which close aims could be struck with direct fire. Similarly, a freight ring railway embankment, along which five artillery positions were placed, was also not protected (Fig. 7). The passages under the embankment had a strategic importance and also required protection, including camouflage.

The required trees and bushes were consequently planted, which was attested by a site visit and a regular arrangement of the vegetation.

Because some archival materials survive, we can trace the history of the construction of the fortifications making up the fortress's defense core. Certain general conclusions regarding the planning and arrangement of greenery can be drawn. Between 1880 and 1905 infantry forts were erected in Wrocław. Of importance was also the period 1910-1912, when the bunkers on the right-hand bank of the Odra River were redeveloped into infantry bunkers (*Infanterie Stutzpunkt*) [12]. The areas around and between the forts and the bunkers were designed to provide appropriate shelling fields. During the redevelopment, concrete firing sites, bunkers for guards and emergency services were added, and most probably during this stage proper work connected with vegetation camouflage was done. To the best of the author's knowledge, there are no sources containing information about trunk circumference, crown size or tree spacing. Tentative field observations indicate that some trees were already growing in the fortress plots when the fortifications were started to be built. Such information could only be provided by invasive studies of individual specimens by means of, for instance, a Pressler drill.

A tentative analysis of the stand of trees was conducted on the basis of a general survey. The age of the was determined using a table drawn up by Prof. Longin Majdecki, by measuring their diameter at a height of 130 cm. No results of previous surveys of stands were available, and so the analysis was principally based on field measurements taken in the years 2010–2012. It is worth noting that the adopted tree age determination method is not very accurate, as the trees covered by the analysis had been growing in various habitats in different parts of the city, with different groundwater levels, soil and other factors.

Some general information can be found in the 'Technical guidelines on how to make fortifications unrecognizable to the enemy' issued by the General Inspection of the Engineer Corps in Berlin in 1905 (T.V. A 27) [17]. The guidelines specified that camouflage should be prepared using local species of trees and bushes grown in nurseries arranged in the hinterland of the fortresses in which they were to be planted. The planting plan was to include detailed steps individually adapted to specific fortress structures, taking account of the local habitat conditions. The steps were taken and then their effectiveness was verified from ground and air during peace time in order to make any necessary adjustments before war broke out. The list below includes the species of trees and

bushes grown in fortress nurseries and enumerated in the Guidelines referred to above.

a) coniferous trees (*Nadelhölzer*)

Abies alba
Abies procera
Larix
Pinus sylvestris
Picea abies

b) deciduous trees (*Laubhölzer*)

Aesculus alba
Alnus
Betula
Carpinus
Fagus
Fraxinus
Quercus (pedunculate oak)
Platanus
Populus (e.g. *alba*, *tremula*)
Robinia pseudoacacia
Sorbus
Tilia
Ulmus

c) shrubs (*Straücher*)

Caragana pygmaea
Berberis vulgaris
Ligustrum vulgare
Crataegus monogyna (hawthorn, slow growth rate)

Lonicera
Salix alba
Salix acutifolia
Corylus avellana
Laburnum anagyroides

d) fruit trees (*Obstbäume*)

Cerasus
Juglans regia
Malus
Prunus (*Prunus spinosa*, blackthorn)

Also earthwork and coverings of finished embankments were taken into consideration:

a) seeds (*Samensorten*) (50-60 seeds per square metre)

Cereals (*Hordeum*, *Avena*, *Triticum*)
Grasses
Fagopyrum
Lupinus
Vicia sativa
Trifolium
Sinapis alba (appropriate)
Seradella
Brassica napus
Medicago
Rapistrum Crantz
Ammophila arenaria
Pisum

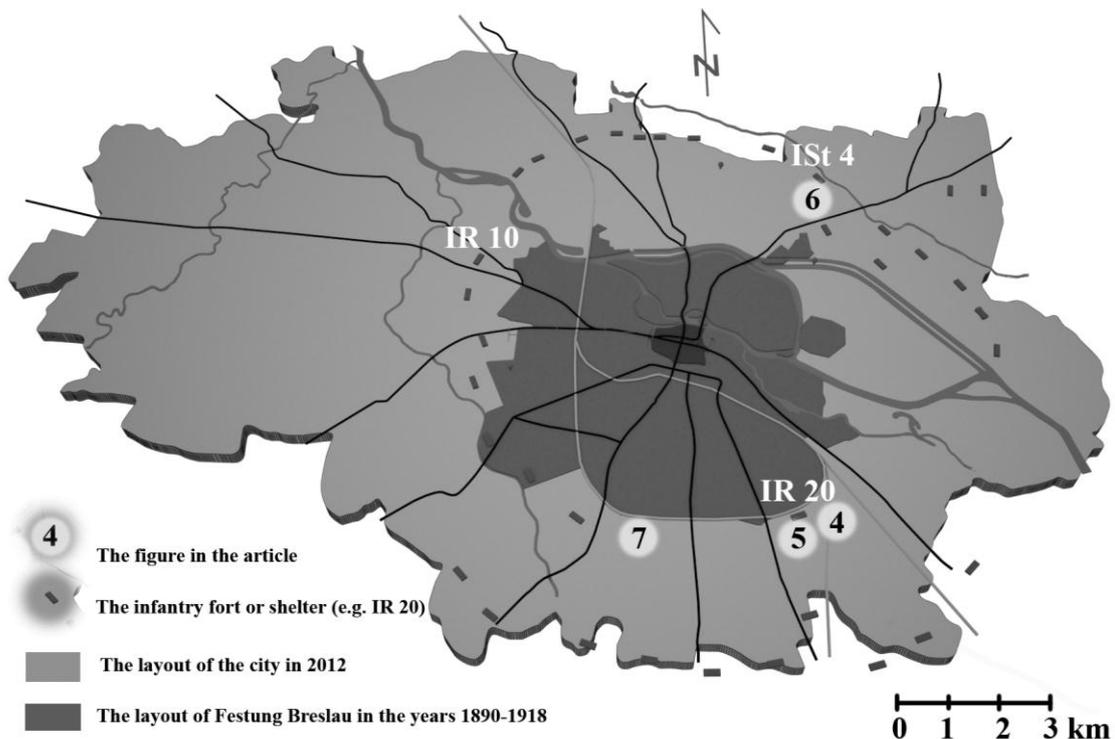


Fig. 3. The layout of *Festung Breslau* in 1914, and the fortress against a 2012 city map
[Source: construction by author, 2013].

Results

Camouflage green at *Festung Breslau* was to be found principally in approaches to various facilities, often along fortress plots and in the neck portions of forts and infantry bunkers. Some facilities were built below the ground surface, lower than the neighbouring areas (e.g. IR 10, IR 20), and their earth forms were planted with vegetation, which had a positive impact on their concealment. In this way, landscape based on natural and soft lines was formed (e. g. forts along the Widawa River), thanks to which the outlines of individual fortifications, which could otherwise have been seen against the horizon, were blurred. Their areas were covered with vegetation made to resemble nearby farmlands or urban greenery (parks, burial grounds) and clumps of trees or bushes (as well as town forests, cultivated land, etc.) typical of a given part of the town.

On most fortress plots, along the neck sections and along the boundaries of the fortress plots and infantry bunkers there survive historical lanes (Fig. 4–7). They are composed of the tree species (mainly deciduous) listed in the ‘Guidelines’; the oldest specimens are 100–140 years old. They include primarily:

Acer platanoides
Acer pseudoplatanus
Aesculus hippocastanum
Carpinus betulus
Fraxinus excelsior
Robinia pseudoacacia
Quercus robur
Tilia cordata

The trees were accompanied by thorny or spiny bushes, which – if need be – were turned into obstacles in approaches to fortress guns. Today, we can see the following species:

Berberis vulgaris
Ligustrum vulgare
Crataegus monogyna (with the trunk circumference of some specimens reaching 120 cm - ISt 5)

In 1945, territorially, the city of Wrocław (former *Breslau*) found itself within the Polish People’s Republic. In the years 1960-1989, additional bushes were planted; the species used were those popular in green areas or allotment gardens, e.g.:

Pinus strobus
Pinus mugo
Picea omorica
Taxus baccata
Juniperus communis

Populus hybridis

Symphoricarpos albus

After 1905, *Festung Breslau* saw some planned planting of vegetation for masking purposes. It was during this period that most probably the first trees and bushes were planted, after they had reached the size required for specific locations. According to the 1905 ‘Guidelines’, they could be grown in city-owned nurseries (*Staatliche Baumschule*), e.g. near today’s *Szczytnicki* Park, at market gardens (*Gartnerei*) or in nurseries of ornamental plants for horticulture (*Gartenbau*). There is no doubt that planting for camouflage was designed and carried out after landscape analysis, with a view to ensuring appropriate conditions for deception and disguise. Since then, trees and bushes have become an integral part of the fortress, subject to registration and observation by spies.

Apart from planting new camouflage vegetation, care was taken of the existing plants, e.g. withered trees were replaced or healthy trees regularly pruned. This was aimed at making structures look like areas of natural green. On the other hand, the later, 1910 Guidelines for waging warfare by fortresses [14] included instructions for preparing the fortress for possible defence, specifying that areas connected with suburban development could be used as sites capable of putting up defence, provided some field fortifications are first prepared. Some relevant information was provided in mobilization plans, which usually identified lanes and alleys to be cut down or to be turned into obstacles on access roads to the fortress. This applies, for instance, to *Festung Glogau* (Fortress Głogów).

Currently, the infantry former forts and shelters of *Festung Breslau* are grown over with herbaceous plants, grass, bushes, trees and other plants (Fig. 8). Coniferous species occur occasionally or not at all. Successive generations of plants deriving from camouflage green have been growing without the required care and appropriate management. Despite the above, some historical plants have survived and can now be admired in the form of lanes along the neck sections and approaches to forts as well as along former fort roads in vegetation screens. At present, such green has an ecological value, but on none of the fortress facilities it is managed for purposes related to recreation or ecological education. In the south of the city, clusters of tree clumps on unfinished 1914 positions constitute an excellent shelter for birds and other animals. On a macro scale, the historical green related to the camouflage function constitutes a valuable element of urban green, whose formation requires connectors in the form of patches and corridors.



Fig. 4. An alley of lime trees (*Tilia cordata*) along Wiaduktowa Street near IR 20 in the autumn [Source: photo by author 2012].



Fig. 7. A line of ash trees (*Fraxinus excelsior*) along Koszycka Street next to a freight railway line in Wrocław [Source: photo by author 2012].



Fig. 5. A line of bare oak trees (*Quercus robur*) dating back to the early 1930s along Konduktorska Street [Source: photo by author 2012].



Fig. 8. A line of black locust trees (*Robinia pseudoacacia*) along the neck of IR 20 in Wiaduktowa Street next to a freight railway line in Wrocław [Source: photo by author 2012].



Fig. 6. A line of bare ash trees near ISt 4 (*Fraxinus excelsior*) dating back to the early 1910s along Przejazdowa Street. [Source: photo by author 2012].

Discussion

During the study no planting plans for Festung Breslau were found, which made interpretation of the existing green arrangements significantly more difficult. However, such plans may still be available in the source materials that have been inaccessible to the authors to date. According to the authors' knowledge, the unique character of the solutions applied at each of the German fortresses during the historical period in question was a direct result of the recommendations set out in the technical guidelines. Such a latitude allowed adaptation of vegetation to the current needs arising from the lie of the land, the land cover, the river network, and the strategic situation of the fortress and its structures. This was for instance the case at Festung Thorn (*Toruń*), the greenery of whose forts and accompanying facilities was characterised as similar to that to be found in the surviving natural habitats near *Toruń*. However,

it also has a number of semi-natural plant communities, which grow in the neighbouring post-forest land [2] In this regard, Festung Breslau calls for further studies to establish similarities and differences between natural vegetation and that introduced into the fortress plots and midfields. Furthermore, as far as the camouflage green of *Festung Breslau* is concerned, the authors believe that it was a special period of the development of urban green and allotment gardens as well as the introduction of roadside plants.

The beginning of the 20th century saw Wrocław (*Breslau*) as a city and fortress modern in terms of architecture and the development of technology. At the time, city planners were fond of the garden-city concept (*Gartenstädte*). This was a result of the activities of Sir Ebenezer Howard and the city planning method he proposed in 1889. At that time, Wilhelmine Germany followed the rules of *Heimatschutz*, i.e. a homeland protection style combining landscape and nature protection [3].

All historical vegetation related to camouflaging *Festung Breslau's* facilities should be analysed from the perspective of the two Guidelines referred to in the paper: the 1905 Technical guidelines on how to make fortifications unrecognizable to the enemy and the 1910 Guidelines for waging warfare by fortresses. Because of this, the purpose and character of plants can only be determined with a high degree of probability in the case of fortress plots. All the other areas call for extra care and careful formulation of conclusions as to the origin and locations of trees and bushes with the camouflage function, covering-and-accompanying function or ornamental function. The age of the trees and bushes, even if corresponding to the period in which plant camouflage was started, cannot be regarded as the exclusive determinant of the proper role of a given plant.

Perhaps in future, chronology-based analysis can be used, if appropriate methods are applied, to recognize individual species and their locations. Each fortress plot together with its facilities requires special archival and field studies, focused on the site and its immediate surroundings. Such an approach ensures optimisation of the gathering of data relating to the planting process and of the attempt to recreate the planting process. All signal signs overlooked in the field may result in obtaining incorrect information, on a principle similar to intended misleading of the enemy's observers watching the fortress from the outside, probably against the outfield masks.

As disclosed by preliminary studies into selected facilities, *Festung Breslau's* tactical green is still in a state allowing its partial recreation within the fortress plots. However, due to the lack of care, it collides with the fortifications and technical facilities existing in the plots. No necessary fill-in vegetation is planted in the former fortress plots either. Although Wrocław had no typical castling roads, the city had fortress roads connected with its transport infrastructure. The bringing of roads up to modern standards irretrievably deprives many of them of post-fortress camouflage plants. Tactical green, although planted according to typical guidelines, deserves to be preserved, because of its consciously composed nature and integrity with the fortress's facilities. Studies into this are still in progress. 2014 will see the centenary of the outbreak of WWI and the 124th anniversary of the creation of *Festung Breslau* (1890-1918). In the authors' opinion, further studies are needed into the theoretical aspects, but also the practical aspects of the fortress green – by attempting to fill in and redesign it – of Infantry Fort No. 6, which is looked after by the Wrocław Fortification Association.

References

1. **Bogdanowski, J.** *Warownie i zieleń Twierdzy Kraków*. Wydawnictwo Literackie Kraków, 1979, p. 116.
2. **Ceynowa-Gieldon, M., Nienartowicz, A.** *Roślinność fortyfikacji dawnej Twierdzy Toruń – przewodnik*. Prace popularno-naukowe No 62. Towarzystwo Naukowe w Toruniu, Toruń 1994, p. 32-33.
3. **Ilkosz, J.** *Hala Stulecia i tereny wystawowe we Wrocławiu – dzieło Maksa Berga*. Via Nova Publishers, Wrocław, 2005, p. 87.
4. **Koluszek, S., Pardela, L.**, *Twierdza Wrocław jako unikalny zabytek Architectura Militaris, Journal of Science of the gen. Tadeusz Kosciuszko Military Academy of Land Forces*, [online: 20.08.2013.]. <http://www.zeszytynaukowe.wso.wroc.pl>, Volume 2 (168), Wrocław, p. 68-82.
5. **Molski, P.**, *Ochrona i zagospodarowanie wybranych zespołów fortyfikacji nowszej w Polsce*, Oficyna Wydawnicza Politechniki Warszawskiej, Seria Architektura 3, Warsaw, 2007, p. 4.
6. **Pardela, L., Olearczyk, D., Stodolak, R., C.W.** *The hydrotechnical structures of Wrocław fortifications*. In: *The 8th International Structural Analysis of Historical Constructions, Wrocław*, Vol: 2, Dolnośląskie Wydawnictwo Edukacyjne, p. 1226.
7. **Potyrala, J.** *Landscape of the forgotten Wrocław Stronghold in the years of 1890–1914, Architectus*, 2007, Volume 1-2 (21-22), p. 51–66.
8. **Rolf, R.** *A Dictionary on Modern Fortification. An Illustrated lexicon on European Fortification in the period 1800-1945*. Middelburg, PRAK Publishing, 2004, p. 71.

9. **Środulska-Wielgus, J.** *Zadrzewienia maskujące Twierdzy Kraków jako element współczesnego krajobrazu miasta.*, In: *Zamki Miasta Warowne Ogrody. Realizacje historycznych założeń fortyfikacyjnych oraz terenów zielonych w miastach zabytkowych*. Strzecha Publishing House, Cracow, 2002, p. 127–146.
10. **Środulska-Wielgus, J.** *Zespoły zieleni fortecznej jako element fenomenu krajobrazu warownego Twierdzy Przemysł*, In: *Fortyfikacja europejskim dziedzictwem kultury, Fortyfikacja Austriacja Twierdza Przemysł, vol. 10*. Strzecha Publishing House, Cracow, 1999, p. 57–79.
11. **Thayer, A.H.**, *Camouflage* [online: 03.08.2013.]. <http://www.jstor.org/stable/7086> The Scientific Monthly. VII, p. 481–494.

Archive materials

12. Archives de la Societe des Nations, Geneve, *Dossier de recensement place de Breslau*, Fascicule I.
13. Bayerische Hauptstaatsarchiv Munchen, MKr 4605/2, 'Die Entwicklung des Deutschen Festugnssystem seit 1870', p. 236-239.
14. *D.V.E. Nr 250, (K.u.F), Anleitung für den Kampf und Festungen*, 1910, Berlin.
15. *D.V.E. Nr 275, Feld-pionier dienst aller waffen*, 1911, Berlin.
16. Service historique de la Défense – Ministère de la Défense, *A report concerning the arrangement of artillery, Artillerie Offizier von Platz*, 29 June 1911, Vincennes.
17. *Technische Vorschrift T.V. A 27*, 1905, Berlin.

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Kopsavilkums. Teritorijas ap nostiprinātām pilsētām pienes papildus vēsturiskās vērtības, kas tika ievestas ainavā daudzus gadsimtus atpakaļ. Vēsturiskā veģetācija pie bijušajiem cietokšņiem bija daļa no „dzīvības aizsardzības sistēmām”. Lielas zemes platības un ceļi tika apstādīti ar atbilstošām augu sugām pēc militāriem norādījumiem. Tika veidots vietējo sugu un zemes konfigurāciju (dabas aizsardzības zonu) apvienojums, aizsardzības stiprinājumi un izvietots karaspēks. Modelēti krūmi žogu veidā, stādīti ātri augoši koki, veidotas joslas pie cietokšņa ceļiem un zemes gabaliem.

Pētījumā par pamatu izmantota informācija par vēsturisko veģetāciju pie cietokšņiem, apkopotas vecās vēsturiskās kartes, analizētas aerofotogrāfijas un veikti lauku pētījumi. Šajā rakstā autori izceļ veģetācijas lomas nozīmi, kuru izmantoja nocietinājumiem. Rakstā analizēts cietokšnis Festung Breslau (Vroclavā) vairāk nekā 120 gadus pēc tā celtniecības.