Mosasaurs
Interactions between armies and ecosystems in the Meuse Region, 1250-1850
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3. Fortifications

INTRODUCTION

Apart from frontiers, there is another kind of militarized landscape that plays a significant role in debates about the ecological effects of warfare and military forces. The Meuse Region abounds with abandoned fortifications, from prehistoric and Roman times to the Second World War. Every year thousands of bats seek out bunkers, forts, and ruins for hibernation because of the constant low temperatures and high humidity. Many have also become sanctuaries for rare species of wall vegetation and lichens, or serve as city parks (e.g. Namur, Liège, Jülich). A handful of former fortifications have even been turned into natural reserves to protect the rare species that dwell there. The Bossche Fronten in Maastricht for instance provides a home for one of the northernmost populations of wall lizards (*Podarcis muralis*) aside from many rare flowers, herbs, and lepidoptera (butterflies and moths).²¹³

The object here, as with the previous chapter, is not to question the value of such structures for current ecological conservation, but to expose some of its underlying assumptions. Very few, if any, serious attempts have been made so far to assess to what extent former fortifications' biodiversity is based on or relates to their management when armed forces still controlled them.²¹⁴ Old walls overgrown with various plants or a ruin covered with moss and/or lichens fit well into a romantic idea of nature reclaiming its rightful place, and support a general belief that ecological conservation and peace are intrinsically linked to each other. It also creates a dichotomy between those who want to preserve the structures' heritage and those who primarily seek to maintain its ecological value. The city of Namur for example experienced internal conflicts on the issue whether the trees standing on the former castle should be removed because their roots could damage historical edifices.²¹⁵

Most historical analyses of fortifications by contrast only examine these from the perspective of military architecture, and devote little attention to the ecological aspects of such structures, or even how they were an essential part of a society's fabric. The field of castle studies is an exception, for it has seen an increasing number of studies since the year 2000 that aspire to go beyond the traditional image of ’strongholds’. Such new approaches are


²¹⁵ Boosten, Jansen and Borkent, *Beplantingen*, 108-111; Bragard et al., *Namur, la citadelle hollandaise*, 140-142.
invaluable in understanding interactions between armed forces and ecosystems. Medieval sources in fact do not use the term 'castle', but generally refer to noble 'houses'. This new emphasis on a castle's basic function as a residence is especially important since it has led to a better understanding of landscape elements that figure as symbols for lordship (woodlands, ponds, gardens, etc.). Still, arguing that most castles had no military function, or at least that this function was subordinate at best, as Robert Liddiard has done, might be equally missing the point.²¹⁶

In the case of fortifications the key assumption that hinders a proper understanding of their ecological role, is the imposition of the military-civilian dichotomy on a complex historical reality. Besides the stereotypical forts, bunkers, and 'castles', medieval and early modern fortifications included hedges, ditches, churches, and even mills. Given that distinctions between armies and general society were not drawn very rigidly before the eighteenth or nineteenth century, it is only natural that many fortifications had multiple functions, and were well integrated into people's daily lives. Every inaccessible place, including caves, quarries, woodlands, and marshes, could of course become a refuge in times of insecurity. This does not automatically turn it into a 'fortification'. Churches for instance had an essential refuge function, but one can only consider them as real fortifications if they incorporated features such as arrow or gun slits, and battlements with or without murder holes (machicoulis).²¹⁷

A fortification will therefore be defined in this study as a material reinforcement or barrier constructed or adapted to strengthen a place against attack. It is therefore invariably manmade to some extent, for even rivers, hedges, or woodlands need to be modified to military needs in order to become defensible. A fortification is by definition a protective structure, even if it can be used for offensive purposes, and it is mostly part of one or multiple ecosystems rather than an ecosystem in itself. It adds to the overall advantage of the defender versus the attacker, thus making it easier for combatants that are inadequately trained, armed or inferior in number to defend themselves against their assailants.

This chapter studies the ecological influences of these divers types of fortifications when they still had military value and were maintained with this function in mind. It thus considers fortifications as militarized landscapes in order to establish a link between the historical management of defensive edifices, and their current ecological state. The main aim is to consider whether armed forces had a significant role in bringing about and conserving landscape elements that are now considered valuable for ecological conservation, and to what extent they preserved these structures in a manner currently prescribed by environmental organisations. If this were the case, than this chapter lays the second keystone for the

²¹⁶ Coulson, Castles; Creighton, 'Castle Studies'; Liddiard, Castles, 70-96, 151-152.
argument that armed forces preserved ecosystems centuries before the rise of environmentalism.

The first section starts with a reappraisal of fortifications' diversity, and the ways they are linked to their surrounding landscapes. It stresses the importance of stone fortifications as a key element of continuity between the High Middle Ages and the nineteenth century. This also involves the questioning of the traditional narrative on the supposed revolutionary impact of gunpowder weapons on fortifications, a central element of the Military Revolution thesis (see introduction). The subsequent section addresses the difficulties armed forces faced when trying to impose their views on landscape defence, and the effects of state formation and political changes on these ongoing struggles. This segment notably considers to what extent the adoption of extensive star-shaped fortifications with large permanent garrisons was a logical solution to the challenges posed by warfare in the Meuse Region. It thus prepares the way for the third part, which will highlight the relationship between fortifications' particular ecology and regular maintenance. This final section examines conflicts and cooperation between different actors: humans as well as animals and plants, and intends to pinpoint armies' role in bringing about specific ecological influences.

3.1 DEFENCE SYSTEMS

3.1.1 Fortifications: A Reappraisal

This thesis defines fortifications as material reinforcements or barriers constructed or adapted to strengthen a place against attack. In this context the question against whom people were trying to defend oneself becomes of major importance. One of the reasons why many types of fortifications have been left largely unexamined until now is that scholars assume that a certain scale is a prerequisite for using the term 'warfare', and 'armies'. If one does not accept that huge armed forces with the latest siege equipment were the only threat, than the military function of less elaborate defensive structures is much harder to ignore. Such an approach also has the advantage of contradicting the simplistic, but widespread, idea that rural areas are essentially undefended, or 'flat' (plat pays, platteland).218

The safety provided by fortifications often went beyond warfare and armies, as attested by two examples from late medieval fiscal accounts. In 1467-1468 a wild animal (schamper Tier) was captured near the Landwehr of Aachen, and then shown to the city council. The city's accounts do not identify the species, but since it was put on display, it is reasonable to suggest that it was considered rare for some reason. It might have been a lynx, given that this is an animal that is native to the area, but very rarely seen. The 1495 accounts

218 Ferrand, 'Les murs, le guet et la communauté'; Gaier, 'La fonction'.

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of the high bailiff of 's Hertogenbosch on the other hand specify that he sent members of the city's shooting guilds to the village of Liessel, between Eindhoven and Venlo, to bring a notorious highwayman, who had been taken prisoner by the villagers at their landweer, to him.\textsuperscript{219}

It is significant that the term Landwehr or landweer, frequently used to describe earthen embankments with hedges planted on top of them, originally referred to the duty of a population to defend the land if called upon. Given this origin, the word chiefly appears in sources from German-speaking lands, as well as the Northern Netherlands. It is possible that such defences were more elaborate in those areas, but one can find similar structures throughout the Meuse Region. They are just not called Landwehren. The Bishop of Liège for instance ordered the construction of a huge ditch and earthen embankments along the frontier with Brabant in the 1454.\textsuperscript{220} Hedges, with or without ditches, are one of the most ubiquitous, but also most neglected object of study as fortifications. Similar defences can be found in many parts of Europe, in Sub Saharan Africa, the Yucatan, and Southeast Asia. Caesar already mentioned their use by the Nervii, probably in the Scheldt basin, in the first century B.C. It is an agricultural technique that could easily be converted to warfare.\textsuperscript{221}

Many hedges would have been composed of common hawthorn (Crataegus monogyna), which is still used in the Meuse Region today. Alternatives could include blackthorn, seabuckthorn, and non-thorn bearing trees or shrubs such as beech, oak, and hazel, depending on the hedge's primary function. Woodlands acting as barriers in frontier landscapes could also be called 'hedges' for instance (e.g. the Haies d'Avesnes). A hawthorn hedge is the most difficult to get through, but its wood is an unsuitable source of either fuel or timber. The 'laying' of a hedge, a general term to describe techniques to cut and intertwine branches in such a way that the hedge becomes an impassable wall, was likewise a common way to turn a hedge into a more formidable defence, but also made it a far less productive wood supplier. Some hedges were not even composed of living plants, as the use of wooden poles with willow branches woven between them was a common alternative.\textsuperscript{222}

\textsuperscript{219} ARB, 1107 Rekeningen Hoogschout 's Hertogenbosch, inv. nr. 12996, 080.1.2.12 (transcript Henk Beijers Archiefcollectie); Cummins, The Hound and the Hawk, 150; Kraus, Die Aachener Stadtrechnungen, 426.


\textsuperscript{221} Caesar, Gallic War, Book 2, chapters 17-26; Charney, Southeast Asian Warfare, 92; Palka, 'Ancient Maya Defensive Barricades', 428; Seignobos, 'Pre-Colonial Plant Systems'; Spring, Great Walls, 295-296.

\textsuperscript{222} Brokamp, 'Landweren', vol. I, 46-48; Burny, Hagen, 26-28, 33; Capelle, 'Landwehrbau', 26-28; de Groot, De stadsrekeningen, 1385 f. 6, 1386 f. 7, 1387 f. 5; 8; Delacourt, La chasse, 14-44; Duceppe-Lamarre, Chasse et pâturage, 240-241; Kraus, Die Aachener Stadtrechnungen, 155; Kuppers, 'De
The late-medieval accounts of cities like Geldern, Grave, and Venlo indeed suggest that many structures were actually combinations of living hedges and fences, as they mention the use of wooden poles, planks, willow branches, and thorns. Given that it takes several years before a newly planted hedge becomes a real obstacle, and that it is always possible that gaps appear because individual plants die, it was common practice to combine living with non-living materials. Once a hedge has matured, however, it is far easier to maintain than fences or palisades. A small town like Bree for example, located in the Campine, planted three thousand eight hundred thorn bushes and twelve willows on the slope next to the city moat in 1507-1508. This corresponds closely with the known length of the city walls; about twelve hundred and twenty nine meters.

It is exactly this maintenance argument, aside from the resistance to artillery fire, which led famous engineers such as Daniel Specklin (1536-1589), Sébastien Le Prestre de Vauban (1633-1707), and Henri-Alexis Brialmont (1821-1903), to recommend their planting. Thorn bushes in particular performed a similar function to barbed wire, and it is illuminating that the demise of hedges, first in military contexts (late nineteenth century), then in agriculture (mostly after the Second World War) corresponds closely to the latter's adoption. Jean d' Haynin (1423-1495), a nobleman from Hainaut, obtained first hand experience of hedges' defensive value during the Burgundian invasions of the Prince-Bishopric of Liège in 1466-1468, and later wrote down a description of these encounters in his memoirs. According to this exceptional witness account the hedges were eventually overcome, but only after the soldiers dismounted, and they had great difficulty getting through. Hedges seem to have been especially valuable as anti-cavalry obstacles in open landscapes, such as Hesbaye, but d' Haynin also mentions that the villagers of Loverval, near Charleroi, turned their woodlands into more effective barriers by constructing hedges (les bois estoient hayez).

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stadsrekeningen', 105, 134, 220; Luys, 'De Wolfsgraaf'; Vaughn, Hawthorn, 46-54; Vera, Grazing ecology, 159-162; Weerth, 'Westfälische Landwehren', 160-161.

223 SLC, Archief Gemeente Grave, inv. nr. 217, f. 7r.; 94r., 217r., 258r., 267r., 277v., inv. nr. 218, f. 173v., 175v.; de Groot, De stadsrekeningen, 1384 f. 5, 1385 f. 7, 8, 39, 1386 f. 7, 1387 f. 24, 26, 28, 1388 f. 9, 15, 26, 1394 f. 9-10, 1396 f. 16, 1397 f. 8-9, 1399a f. 8, 1400 f. 6, 1402 f. 9, 20, 1404 f. 24, 1405 f. 14, 1406 f. 8, 1407 f. 15, 1408 f.10, 1409 f. 10-12, 14, 1412 f.41, 1415 f.28; Kuppers, 'De stadsrekeningen', 8-11, 20-22, 35, 48-49, 61, 83, 124.

224 Informacie up de staet faculleyt ende gelegenhteyt, 332; Bragard, 'Soldats et jardiniers', 95-96; Bragard et al., Namur et ses enceintes, 42; de Groot, De stadsrekeningen, 1377 f. 6, 1400 f.7, 1408 f. 9; Hanssen, Inventaris, 455; Marchal, Inventaire, 155; Marwede, Die Befestigung, 39-43; Moreau, Bolwerk der Nederlanden, 128; Pagnotta, Les églises fortifiées, 21-23; Rizzo, 'La prévôté de Marville', 28; van Nispen, Willemstad, 36.


It is possible that events similar to those described by Jean d' Haynin found their way into literary works as well, for tales of medieval romance are enduring testimonies to the efficacy of these hedges. In the famous *Roman de la Rose*, from the second half of the thirteenth century, the narrator fell in love with a rose that grew in an enclosed garden protected by a thorn hedge, and later had to rescue her from the fortress where she was held prisoner (see figure 3.1). It served as a major inspiration for the *Roman de Perceforest*, written in the County of Hainaut in the early fourteenth century. This remarkable story tells of the deeds of a knight errant who also had to pass through thorns and dense woodlands to reach his beloved. It is one of the earliest written versions of the fairy tale later known as 'Sleeping Beauty'.

![Figure 3.1 Fortress defended by water-filled moats and a rose hedge, miniature from a fifteenth-century manuscript of the Roman de la Rose (BL, Harley MS 4425), f. 39.](image)

Hedges are one of the most important, but not the only type of fortification that is often neglected because it does not fit well in the traditional military-civilian dichotomy. Many churches in the Meuse Region were also fortified, a logical consequence of their role as ultimate refuge. The church of Saint-Pierrevillers, near Verdun, had its own chimney, a well,

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228 Bryant (ed.), *Perceforest*; Horgan, *The Romance of the Rose*. 
and possibly an oven to make bread (see figure 3.2). Relatively large numbers have been preserved in the southern half of the Meuse Region, but they existed elsewhere as well. The city accounts of Grave specify for example that its citizens besieged the church of Herpen in 1463. Some of them had defensive value that went beyond mere local defence. John the Fearless, duke of Burgundy (1404-1419), insisted for example in 1408, during the peace settlement with Liège, that the walls of all fortified churchyards located next to the Sambre had to be demolished, which is difficult to understand if they were mere refuges for the villagers.

![Figure 3.2 Church of Saint-Pierrevillers. Note the murder holes or machicoulis. (photograph by the author).](image)

The use of fortified mills, and forges, is even more poorly understood than that of fortified churches. Mills were a prime target for raiders because they had an essential socio-economic function, represented wealth, and their dependence on water or wind energy made them stand apart of the rest of a settlement. Forges were vulnerable because of their role in arms production, and the need to have access to running water. Fortifying both mills and forges could thus become a valid option in times of insecurity. The most conspicuous are two of the largest forges in the Meuse Region, those of Nouzon, near Charleville, and Ster (Vaux-sous-De Stavelot, Chronique, 113; Gaier, 'Le destin militaire'; Genicot, Les églises mosanes, 276-303; Girardot, 'Les forteresses', 7, 17-29, 38-44; Harrison, Castles of God; Pagnotta, Les églises fortifiées; Rousseau, 'Tours domaniales'; Rousseau, 'A propos de la recherche de la sécurité'; Willems (ed.), Rymkronyk, 130; Wright, Knights and Peasants, 102-115.

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Chèvremont near Liège), which even accommodated small garrisons in the seventeenth and eighteenth century.\textsuperscript{231}

A more typical example emerges from a surviving contract, dating to 1571, between the lord of Sévigny, near Rocroi, and a master mason regarding the building of a new windmill. It explicitly states that the building had to include machicoulis, a protruding battlement with murder holes, and a barbacane, fortified gateway, to defend it.\textsuperscript{232} Perhaps the most striking case is the so-called 'Tomp', a fifteenth-century windmill in the north of the Prince-Bishopric of Liège (Achel). This structure was studied as a noble tower for decades, simply because it included obvious defensive features (gun slits, a hedge/fence, and a ditch).\textsuperscript{233}

Noble houses, 'castles', certainly constitute one of the most archetypical fortifications, but even here considerable confusion exists. First of all, relatively few of such noble houses would have resembled the classical castle as it is traditionally depicted. Jacques de Hemricourt, a nobleman from Liège, wrote in the late fourteenth-century a history of the famous feud between two of the most powerful noble families in the Prince-Bishopric: the War of d'Awans and de Waroux (1297-1335).\textsuperscript{234} In this book he makes a distinction between three types of noble houses: a fortress (forteresse), a tower (tour), and a simple house (plat maison). The first would have corresponded closely to the stereotypical medieval stronghold, while the others refer to simpler structures. It is in fact unclear whether a plat maison could be considered as a fortification at all.\textsuperscript{235}

Still, even the smaller types of noble house, which were also the most common, would have had some defensive worth. The Dutch/German word for a manor house with a tower, a blokhuis, is the same term used to describe temporary fortifications constructed during armed conflicts to either block access to a besieged city or fortress, or control traffic on a major river such as the Meuse.\textsuperscript{236} A fourteenth-century book of fiefs from the County of Loon, for example, mentions unam assisiam, cum una turri dicta vulgariter blockehuys, located near the village of Millen, close to Maastricht in 1367. It is likely that when the Count of Loon agreed to participate in the siege of Gripekoven, near Roermond, in 1354, and provide thirty men-at-arms and thirty crossbowmen as garrisons for two blokhuizen, that these


\textsuperscript{232} Barbe, Laverdine and Parizel, \textit{Moulins}, 16-17; Matthieu, ‘Construction d’un fort avancé’.

\textsuperscript{233} Claassen, \textit{Van mottoren tot kasteel}, 27-34; Doperé and Ubregts, \textit{De donjon}, 130.

\textsuperscript{234} Masson, ‘La guerre’.


\textsuperscript{236} Girardot, 'Les forteresses', 29-38; Laurent, \textit{Aachener Stadtrechnungen}, 291; Waale, \textit{De Arkelse oorlog}, 129.
structures were closely modelled on such noble houses. It demonstrates that medieval fortifications were multiple-function structures well intergrated into people's daily lives.237

3.1.2 Cooperation and Communication

Broadening our definition of the range of structures that functioned as fortifications is only the first step. In order to come to a better understanding of army-ecosystem interactions at landscape level, we need to consider them as elements in larger defence systems rather than as isolated points of resistance. No fortification is impregnable. The aim of an fortification is to convince an attacker that conquering it requires so much blood, time, money, and energy, that it will not be worth the effort. Creating systems of defence, that is organizing communication and cooperation between the defenders of individual fortifications, adds to the strength of the whole. In ideal circumstances defence systems ensure that the entire landscape works against the enemy. Given that the establishment of such defence systems is well known for early modern and nineteenth-century states (e.g. the Hollandic Water Line or Vauban's pré carré), this section emphasizes their functioning in the absence of permanent armed forces.

The most important, most elaborate fortifications, the very core of defence systems, were invariably made of stone. Stone stood as the preferable building material because of its durability and resistance to the two most common assault techniques: setting fire and breaking down obstacles with an axe.238 Fire in particular presented a very serious threat: fiscal accounts from castellans and city councils specify that the roofs of towers and gates in major fortresses, such as Valkenburg, and prominent cities, such as Maastricht, were made of straw until well into the fifteenth or sixteenth century.239

The Meuse Region itself was a well-known centre of stone production. The Meuse valley from Givet to Maastricht more specifically had a good reputation for the quality of its limestone, and transported them along the Meuse. A few isolated shipments ended up as far as Utrecht and Frisia. River cobbles, silex, schists or sandstone provided the main alternatives, sandstone being especially common in the Eifel and Ardennes. Because land transport was so expensive such natural stone constituted only a relatively small part of building materials, bricks being the main component of most stone structures. However, since bricks were generally made from local materials, many of these can be considered calcereous as well.

237 For context of the 1354 siege see Stercken, Königtum und Territorialgewalten, 39-54. de Borman, Le livre, 55-56; Ennen, Quellen, 394-395.
238 See especially Raynaud, 'A la Hache !', 346-349.
239 SLC, Archief Gemeente Grave, inv. nr. 217, f. 17v; Informacie up de staet faculteyt ende gelegentheyt, 464; de Groot, De stadsrekeningen, 1385 f. 21, 1388 f. 8, 1398 f.10, 1403 f.12, 1407 f. 17; Genicot (ed.), Les Tours, 92-94; Gentenaar and Hupperetz, ‘Personeel en werkzaamheden’, 179, 184; Kappelhof, ‘De heren en drossaarden’, 24-25; Klaversma, Weert tussen 1062 en 1602, 41; Marwede, Die Befestigung, 36-38; Moreau, Bolwerk der Nederlanden, 95-96; Uitterhoeve, Burg Rode, 14.
Fortresses located on rocky hilltops, such as Poilvache or Valkenburg were simply built or expanded by broadening the moat.²⁴⁰

Figure 3.3 Madonna and chancellor Rolin, early fifteenth century (detail). Painting by Jan van Eyck (Paris, Musée du Louvre). Note the peafowl in the foreground, whose presence in castle contexts is also attested archaeologically (see below).

The background of a well-known fifteenth-century painting, 'Madonna of Chancellor Rolin', shows divers stone fortifications scattered throughout a landscape, which is centred on a major river (see figure 3.3). It is possible that the artist, Jan van Eyck, who came probably from Maaseik, had his native region in mind when he made this artwork. Jean Lejeune has in fact identified the stone bridge as the Pont des Arches of the city of Liège. This bridge, fortified by a massive gateway, existed from the eleventh century until its destruction by a massive flooding of the Meuse in 1409. It protected the city's core from the district on the right riverbank, Outre-Meuse, which lacked city walls until the thirteenth century.²⁴¹

The landscape created by Jan van Eyck is more or less fictional, as one of the city's towers is based on the Dom Tower in Utrecht, but actual defences in the Meuse Region might still have looked quite similar to it. The paintings of the brothers van Eyck are indeed famous for their realism and detail. The city of Givet, located more or less in the middle of the Meuse basin, on the French side of the French-Belgian border, still retains traces of a medieval

²⁴⁰ Coenen, 'Een kasteel', 61, 66; Doperé, 'Steengroeven', 102-110; Genicot (ed.), Les Tours, 78-82; Gentenaar and Hupperetz, 'Personeel en werkzaamheden', 174, 176, 182-183; Marwede, Die Befestigung, 17-21; Moreau, Bolwerk der Nederlanden; Mouroux, 'Stenay, ville militaire', 44; Olson, 'Medieval Stone Production', 189-208; Rhoen, Aachen, 124-131; Roosens, 'Habsburgse defensiepolitiek', 262-263, 346; Silvertant, Valckenborgh, 87-89, 95-107; Uitterhoeve, Burg Rode, 12.
defence system that depended on cooperation between different fortifications. Givet is today mostly associated with the imposing fortress of Charlemont, which overlooks the actual city and housed a military training unit as recently as 2009, but this is a relatively recent addition (sixteenth-seventeenth century) to a far more older and complex militarized landscape (see figure 3.4).242

Figure 3.4 The fortress of Charlemont and the Saint-Victoire tower with the church of Givet Saint-Hilaire on the right foreground (photograph by the author).

Givet constituted the core of the castellany of Agimont, named after the stronghold that dominated the area until its capture by French soldiers in 1554. The construction of Charlemont, which started in 1555, was a direct response to this invasion. The fortress of Agimont might have dominated the landscape, but it did not allow the controlling of river traffic. This was especially vital since Givet was a key station for collecting tolls from traffic on the Meuse from the early Middle Ages onwards. Another fortress, located immediately adjacent to the Meuse, performed that role from the thirteenth century until its destruction, after the French takeover in 1680. The so-called Saint-Victor tower is now its only remnant.243 Neither of these two fortresses would have been very helpful, however, to the people living on the right riverbank (petit-Givet or Givet Notre-Dame as opposed to grand-Givet or Givet Saint-Hilaire). It is for that reason that the oldest ecclesiastical core of the city, the church of Notre-Dame, located on the junction of the La Houille and the Meuse, was fortified as well. Today, little of the original medieval building remains, a result of

242 Bertrand, ‘Une construction continue’; Bertrand, ‘Givet-Charlemont’.
bombardment in the late seventeenth century, but a surviving map from 1643 clearly depicts it as a fortified church with walls and a ditch.\textsuperscript{244}

There are still other fortifications in the area, such as the towers of Schoute-s’i-plout (twelfth century), and Maugis (fifteenth century), but due to the absence of written records, even less is known about them than about the other medieval fortifications. Their locations, the first parallel to the Saint-Victor tower, the second on the plateau near Charlemont, suggest that they might have served as a system of defence. A similar emphasis on landscape control existed in the small city-state of Aachen, where the watchtowers in the \textit{Landwehr} stood in direct visual contact with the towers of the city walls. This emphasis on visual control, reminiscent of the original meaning of the term landscape (land- scape; view, or scenery of a collection of lands), is essential to understand individual fortifications as part of larger defence systems, but cannot be seen in isolation from other ways of communication.\textsuperscript{245}

Once a threat was identified and located mobilisation of defending forces generally occurred through sound.\textsuperscript{246} Horns, drums, and gunshots could all raise the alarm, but none of these instruments could rival the importance of the \textit{bancloque} or \textit{stormklok}, kept in the bell tower of a parish church, belfry, or fortress, to assemble the ban’s population in case of alarm (some villages did not have a bancloque, but instead sounded all church bells at the same time). When this bell called all able-bodied adult males had to assemble and prepare to either defend the community, pursue criminals or supress a fire. This bell was also the heaviest and largest one because its sound needs to carry across the entire territory of the ban. The reach of the \textit{bancloque} corresponded to the limits of the ban’s jurisdiction.\textsuperscript{247}

Because the sound needed to carry so far, it could be picked up by nearby villages as well, so that the population of a relatively wide area rushed to arms. The chronicle of Jean d’Outremeuse (1338-1399) recounts that in 1321 when peasants from Lantinne and Marmeffe, located near the river Meaigne, spotted invading forces from Flanders and Namur whilst working in the fields, they ran back to their villages and sounded the church bells, after which one village after another raised the alarm, until 'the whole of Hesbaye' was alerted. The villagers, men and women, armed with sticks, swords, lances, and clubs, assembled near Lantinne, and joined forces with local noblemen, who came on horseback. The invading

\textsuperscript{244} Bertrand, ‘Givet-Charlemont’; Bertrand, ‘Givet-Saint-Hilaire’, 45-47.
forces tried to reach the comparative safety of nearby woods, but were cut off and defeated. This case is of particular interest because it sheds some light on the role of women in medieval warfare. Jean d'Outremeuse claims that they took the weapons of enemies who had surrendered and joined the fighting; one woman even took four men prisoner herself. Mobilising local inhabitants to fight off pillagers or small invading forces would remain a basic defensive strategy up to the eighteenth century (see 5.3).

Organising defence systems was rarely such a straightforward process, however. These are examples of relatively homogenous political units. Authority over the city of Maastricht for instance was shared between the duke of Brabant and the bishop of Liège, and to make matters even more complicated the city's hinterland included several imperial immediacies, lordships that were held directly in fief from the emperor. When Maastricht became involved in a conflict between Brabant and Jülich-Guelders in 1396, the city council made known to several lords in the area (those of Kortessem, Stein, Elsloo, Rekem, Neerharen, Born, Pietersheim, and Mopertingen) that if any raiders passed through their lordships, they had to sound the bells and pursue them, or the city would recompense itself double for the damage done by confiscating their goods or those of their subjects, and taking them prisoner. The lords in question were fief holders of the duke, and some might have been citizens of Maastricht, but theoretically the city had no authority to command them.

This order, while threatening, was not an isolated incident, for both cities and rulers did their best to convince more or less independent lords or village communities to cooperate with them, and join their defence system. A classic example are agreements between a particular nobleman on the one hand, and a ruler or city on the other, which stipulated that the former would provide armed service when required, or that the latter could treat his fortress as an 'open house', meaning that they had access to it during armed conflicts. Yet such contracts invariably included caveats that a nobleman could not be forced to fight against a ruler who he owned fealty, a consideration of particular importance in the politically fragmented Meuse Region.

On the other hand of the spectrum, cooperation between the different elements that constitute a premodern territory could hardly be taken for granted. The numerous messages that rulers, cities, and individual lords sent to one another in wartime, payments for which

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248 d'Outremeuse, Ly myreur des histors, vol. 6, 258-263.
249 Adriaenssen, Staatsvormend geweld, 404; Deloffre, 'Guerres et brigandages', 284, 354, 384, 397; Jacob, Bruyères, 101; Rousseau, 'Tours domainiales', 258-261.
251 Girardot, 'Les forteresses', 44-55; Kraus, Regesten, vol. 6, nr. 2; Laurent and Quicke, L'accession de la Maison de Bourgogne, 382; Noordzij, Gelre, 143-145; van den Brand and Manders, Vesting 't Genneperhuys, 60; van Doorninck and Molhuysen (eds.), Briefwisseling, 48.
252 Burgers and Damen, 'Feudal Obligation or Paid service', 788.
appear regularly in accounts, certainly give a perception of regular cooperation and communication, but defence primarily remained a local matter.\footnote{Burgers, 'De steden van Holland', 283-288; Deloffre, 'Guerres et brigandages'; Dinstühler (ed), Die Jülicher Landrentmeister-Rechnung, 60-75; Gentenaar and Hupperetz, 'Personeel en werkzaamheden', 187, 210-213; Roosens, 'Habsburgse defensiepolitiek', 94-100; Uitterhoeve, Burg Rode, 28-30; Ward, 'Holland', 185-189.} The small city of Tongres for instance refused the bishop's soldiers entry in December 1566, and only acceded to its ruler's demands after extended negotiations, during which he promised to pay for their upkeep. The bishop likewise had to ask the city of Liège in 1568 to lend him six of his cannon so he could force the lord of Seraing to open up his 'house' for common defence.\footnote{SAT, Resoluties, inv. nr. 2, f. 262, 264v.; Bormans, 'Table des registres', 271. See also Deloffre, 'Guerres et brigandages', 266.}

While than cities and noblemen had good reasons to fear their loss of autonomy and status, it was the mass of lowly peasants that paid the heaviest price. The duke of Bar instituted a policy of \textit{traîre à forteresse} in the mid-fourteenth century, meaning that the rural population had to seek refuge in fortresses with their movable belongings in case of attack. This reinforced their dependency on local lords, and undermined the relative increase in status and autonomy they had gained during the preceding period. In exchange for protection during a period of insecurity, the Hundred Years War, they were forced to perform labour duties typically associated with serfs: maintenance work on a ruler's fortress, notably cleaning the moat, and delivering certain supplies, such as wood, free of charge. Some also had to perform guard duty. The significant development is thus that obligations that had previously been bought off now had to be performed physically again, or were imposed for the first time.\footnote{ADM, B 1879, f. 131r.; 1907, f. 2-3; Coulson, Castles, 285-290; Girardot, 'Les forteresses', 9-14; Girardot, Le droit et la terre, vol. 2, 474-478; Kraemer, 'Arme et refuge', 50; Servais, Annales historiques, vol. 1, 96, 178, 261; Villa-Sébline Nicole, La sénéchaussée, 190, 192. See also Hoppenbrouwers, 'Een middeleeuwse samenleving', 16 for an example from the area near the Meuse estuary.}

The southern half of the Meuse Region was hardly unique in this (re)imposition of labour duties. The Habsburgs and bishops of Liège similarly ordered peasants to help expand or maintain the fortifications of nearby fortresses and cities during the sixteenth and seventeenth century. The temptation to use them as a cheap source of manual labour simply proved too great.\footnote{Bodard (ed.), Recueil des ordonnances, 30, 44, 53-54, 82, 85, 87-88; Cuppens, 'Opoeteren', 327-330; de Waha, 'Château et village', 423-426; Girardot, 'Les forteresses', 15-16; Habets, 'Costumen', 167-170; Hasquin, Une mutation le 'Pays de Charleroi', 231; Hoppenbrouwers, 'Een middeleeuwse samenleving', 590-591; Kaisin, Annales historiques, 92, 113, 199; Lefebvre, 'Bastogne', 338-339; Maes, De geschiedenis van Bree, vol. 2, 20; Nihoul, 'Châtelet', 93; Roosens, 'De invloed van de vestingbouw'; Van den Brand, 'Spaanse vestingbouwwerkzaamheden', 82-83; von Below, 'Die Leistungen'.} A notarial act from Maaseik from 1697 lists the complaints of villagers from Haelen, Buggenum, Neer, Heythuysen, and Ophoven, who all had to provide manpower to defend the castle of Horne (the seat of this small county). Most villages had to supply guards, except for Ophoven, which was located at considerable distance and instead had to
clean the castle's moat and ponds once a year. Apparently, they now had to obey a new castellan who demanded six guards instead of four, made them stay day and night instead of soley acting as night watchmen, and tripled the fine for disobedience. Moreover, the guards now had to bring their own firewood, and often had to perform chores, such as helping with the harvest, with just one man standing guard.\footnote{RAH, Notaris Claessens 1663-1702 (microfilmnr. 1462274, item 5) f. 616, act 16 June 1697.}

Such misuse of labour duties encouraged rural populations to maintain or expand their own defences, especially fortified churches, which gave them stronger leverage to refuse newly imposed obligations, but also weakened the organisation of defence systems. It is exactly because of its unpopularity that arrested vagrants or beggers were increasingly forced to construct or maintain fortifications from the mid-sixteenth century onwards (see 5.2). It also reveals the difficulty of organizing and sustaining defence systems in the absence of permanent armed forces.

3.1.3 A Struggle for Basic Maintenance

The imposition of labour duties reflects a crucial but often overlooked problem: that of maintenance. Every manmade structure will eventually disintegrate due to a combination of factors: decay of organic materials, impact of weather and climate, and processes of ecological succession. Ecological succession refers to phases of vegetation growth, which follow each other after a disturbance, in this case the building of a fortification, until a climax stage is reached. In Western Europe this climax stage consists typically of relatively open, park like forests and scrublands. If a stonewall is not maintained, soil will start to accumulate on the wall's surface, and in cracks and fractures. This in turn allows different kinds of plants to establish themselves, first grasses and herbs, then woody plants. Their root system adds to the destabilising of the wall until eventually only ruins remain. Moats filled with stagnant water likewise become shallower over time due to the accumulation of soil and the growth of plants such as reed.\footnote{Peeters et al., \textit{Sloten}, 51-55; Segal, \textit{Ecological Notes}, 46-47, 67-75.}

The results of archaeobotanical research carried out in the former fortress of Lomprez are very informative in this regard. We know from the chronicler Jean de Stavelot that this house was burned down and abandoned in 1445. Apparently only twelve men defended it. Pollen research now reveals that the banks of the moat originally, in the fourteenth century, supported relatively little vegetation, and that vines and fruit-bearing trees (common walnut and hop) grew close to the moat, presumably in a garden (see figure 3.5). Over time, aquatic plants, such as meadowsweet (\textit{Filipendula ulmaria}), made way to weeds such as redschank (\textit{Polygonum persicaria}), which means that the moat turned into land. This process occurred first gradually, and then accelerated, possibly in tandem with the
abandonment of nearby agricultural fields and the use of the moat as a watering trough and for waste desposal. These results can be compared to a study of plant seeds in the castle of Eindhoven from the sixteenth and early seventeenth century. This analysis suggests that the moat was quite shallow and polluted by butchering waste and feces. Historical sources confirm that when the castle was attacked in 1604 the moat was only 1.26 meters deep and constituted no obstacle to the attackers' assault ladders.

Figure 3.5 Miniature of labourers constructing a garden next to a noble house, by Simon Bening (1483-1561), early sixteenth century (MLM, MS. M. 399, f. 4 v.).

Medieval fiscal accounts are filled with references to the construction or maintenance of fortifications, but this does not necessarily prove that defences were well preserved. Many fortifications were so extensive, with city walls measuring at least several kilometres in length, that there was always work to be done. The accounts of the city of Venlo note for instance that master Harman Wegge and his attendants needed 137 days to clean the city's moats in 1411. This hardly indicates regular maintenance. The city council did call upon its citizens to clean the moats in 1409, a war year, but this might not have been enough, or the work was not done properly. Cutting a plant above water level was after all not sufficient; it...

259 de Stavelot, Chronique, 555; Heim, 'Wellin/Lomprez'.
260 Luijten, 'Zaden en vruchten', 240-244. See also Moreau, Bolwerk der Nederlanden, 58, 63-64, 215; Thomas, 'Hygiène', 269-270.
had to be pulled out entirely. Accounts from Maastricht, from 1399-1400, specify that the city bought a hook as well as a scythe to remove grass from the moats.\textsuperscript{261} The cleaning of the moats of Mons was apparently noteworthy enough in 1523, also a war year, for Antoine de Lusy to include it in his chronicle. He explicitly said that the work came at great cost of the city, but that they also profitted from it, because they could sell the grass. The 1581 accounts of the castellany of Longwy even mention that seventy-two villagers had to remove trees and bushes from the fortress moat.\textsuperscript{262}

It is indeed revealing for the haphazard character of the conservation of fortifications that authorities might have not proceed with it if not for external events. Every fortification built next to the Meuse ran the risk of being flooded after which repairs needed carried out, if only to prevent worse disasters in the future. In most cases, however, an imminent enemy threat provided the most convincing reason for spending money on fortifications.\textsuperscript{263} The accounts of the city of Venlo reveal that in 1388, when a French army attempted to invade, the Count of Jülich sent four knights to inspect the defences.\textsuperscript{264} The cutting of wood in the \textit{Landwehr} that defended the frontier between the Duchy of Limbourg against attacks from the Prince-Bishopric of Liège had always been a punishable offense, but in 1468, when Duke Charles the Bold was at war with Liège, an offender risked capital punishment and the confiscation of his possessions, instead of a heavy fine of six rhenish florins.\textsuperscript{265}

Enemy threats thus ensured that military needs came to dominate structures that normally served multiple purposes. The city of Grave for example leased several of its towers and gates to private citizens in the fifteenth century. A 1452 contract, copied into the city's accounts, specified that a widow and her son could rent the tower and associated land located next to their own house on condition that they would construct a slate roof. The city reserved

\begin{footnotesize}
\begin{enumerate}
\item Bodart, \textit{Société et espace urbains}, 123; Boonen, \textquoteright De Maaseiker wallen', 52, 58; Bragard et al., \textit{Namur et ses enceintes}, 56; Engelen, \textquoteleft Stokkem in de grote Europese oorlogen\textquoteright, 167; Kuppers, \textit{De stadsrekeningen}, 8-11, 22, 33-39, 220; Lhoist-Colmon and Gabriel, \textquoteleft La colline\textquoteright, 25, 28; Liégeois, \textquoteleft Compte de la recette de Chiny\textquoteright, 147, 152; Moreau, \textit{Bolwerk der Nederlanden}, 79, 160; Mougeot, \textquoteleft De la périphérie à la frontière\textquoteright, 162; Soetaert, \textit{Inondations urbaines}, 33, 36-37; Unger and Bezemer, \textit{Oudste stadsrekeningen}, 63-64, 66; van den Brand and Manders, \textit{Vesting \textquoteright Genneperhuys}, 386-387.
\item de Groot, \textit{De stadsrekeningen}, 1388 f. 8. See also Deloffre, \textit{Guérres et brigandages}, 271, 335; Drooghaag, \textquoteleft Visitation en Limbourg et Outre-Meuse\textquoteright.
\item Yans, \textit{Histoire économique du duché de Limbourg}, 106. See also Geldern, Stadtarchiv, A, nr. G9, Stadtrechnung, f. 140r., 177 (1590-1591) (transcript Rien van den Brand); SAT, Resoluties, inv. nr. 1, f. 184r., 2, f. 211v, 266v.-267; Bormans, \textit{Table des registres\textquoteright}, vol. 12, 13; De Graaf, \textit{Oorlog}, 240; de Groot, \textit{De stadsrekeningen}, 1403 f. 8, 12, 1409 f. 15; Jacobs, \textit{Justitie en politie}, 146; Moreau, \textit{Bolwerk der Nederlanden}, 103; Roland (ed.), \textit{Chronique Namuroise\textquoteright}, 120-121; van der Eerden-Vonk, \textit{Raadsverdragen}, 234, 238.
\end{enumerate}
\end{footnotesize}
the right to take full control over the tower again in case of war. In an agreement from 1480 the city council of Maastricht similarly let a section of the city wall of Wijck for four years to a citizen, who could fish in the moat, and pollard the willows. These willows would have served as sources of wood, and their roots stabilised the soil. The fact that some towers were named after individual guilds (e.g. the Lakenmakerstoren in Tongres) suggests that in some cases the latter were responsible for maintenance or defence of specific stretches of the city wall.

Private citizens also owned gardens or fields next to the walls and made posterns to allowed them to go in and out the city without having to pass through one of the main gates. It goes without saying that such entrances had to be filled up with solid masonry if there was any threat of an attack. This in turn created different problems. A councillor act from the city of Namur, dating to 1430, when troops from Liège invaded the county, indicates that waste kept piling up alongside three houses, built next to the city wall, because the nearby postern had been closed. A surviving copy of a 1396 charter kept in the archives of the bailiwick of Alden Biesen demonstrates that the city council of Maastricht even went a step further and granted the Teutonic Order custody over one of the city gates, located within the gardens of the bailiwick. This privilege still applied in 1784, when the chief engineer of Maastricht ordered his assistants to investigate how a sortie, a small gate, in the commandery's orchard could be secured without violating the institution's rights.

Responsibility for the upkeep of fortifications lay with bodies or individuals who, at least theoretically, were concerned with the common good. This involved the upholding of law and order, as well as socio-economic concerns and public health. It is unlikely that city councils, castellans, or high bailiffs would have given priority to military matters above all others unless a specific threat gave them a good reason to do so. The use of fortifications for other functions besides warfare can be considered as a practical way to ensure basic maintenance. It also means that a considerable part of maintenance work would not have been

266 SLC, Archief Gemeente Grave, inv. nr. 217, f. 194r., 220r., 263r., inv. nr. 218, f. 34r., 43r., 54r., 131r.
269 Bodart, Société et espace urbains, 101.
mentioned in accounts. Gateways and towers typically became living spaces for gatekeepers, gunners or watchmen, and served as storage places for gunpowder and prisons. Some were even used to store archives (e.g. a tower in the castle of Namur). Because city councils kept fish in the moats or allowed the construction of water mills some citizens would have had an incentive to clean and deepen the ditches. A thirteenth-century charter from Liège shows that the city council leased part of the moat to a private citizen on condition that he made sure it remained at least two meters wide.

This ambiguity is mirrored in the contested presence of animals in or near the fortifications. The accounts of Rotterdam from the year 1426-1427, for example, include a payment for the making of a fence so that livestock would not be able to walk on the walls. This suggests that a considerable part of the city's fortifications were still composed of earth, and that citizens did not respect official regulations against the pasture of animals. Still, when Albrecht Dürer published his fortification treatise in 1527 he also suggested that the moats could accomodate animal parks as well as ranges for target practice. Toponyms in Liège and Maastricht indicate that this advice was based on actual practice, for they imply the presence of rabbit warrens (Tour aux Lapins and Konijnenberg) in or next to the city walls. Many rulers, such as the dukes of Guelders, even incorporated impressive menageries, which included lions, in their residences.

Archaeozoogical research is far more informative in this regard than written sources. The study of animal bones in fortress moats and waste pits has revealed the remains of animals that would have lived in or around these noble houses: peafowl, swans, pigeons, dogs, horses, sparrow and gosh hawks. Many of these species might have moved around more or less unimpeded, swans' wings usually being clipped, but birds of prey typically stayed in cages when not being involved in a noble hunt. Still, these reports also make clear that most bones found are the remains of species that had been eaten by the occupants, and did not necessarily live near the fortifications. Others might come from animals that were just killed

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273 Lemoine, L’enceinte, 56-57.

274 Unger and Bezemer, Oudste stadsrekeningen, 55; van der Eerden-Vonk, Raadsverdragen, 119, 202.

275 Dürer, Befestigung, D; Moreau, Bolwerk der Nederlanden, 84; Ulrix, ‘Le rempart d’Avroy’. See also Hoppenbrouwers, ‘Een middeleeuwse samenleving’, 16; Jordan, ‘Grün in Festungen’, 100; Lemoine, L’enceinte, 44; Mouroux, ‘Stenay, ville du Clermontois’, 179.

and discarded. In the fortress of Franchimont for instance the bones of a long-eared owl have been found, which date to the late Middle Ages.277

Incidental references in fiscal accounts corroborate a general impression that unwanted animals were ruthlessly pursued and exterminated. The city of Mons for example paid a bounty in 1324 for the killing of an otter, which threatened the extensive fish stocks introduced into the moat. The accounts of the high bailiff of Montfort from 1397-1398 likewise indicate that someone was sent to Maastricht to buy lime for the capturing of house sparrows, which had established themselves in the fortress. The steward of Hambach paid a mice catcher for the killing of no less than one hundred and eight 'large mice', probably rats, in 1440-1441.278

Similar remarks can be made about plants. Archeobotanical research becomes ever more important and, as argued above, provides some of the best evidence we have regarding plant growth in or near fortifications. Their results can be complemented with scarce written evidence. An exceptional inventory of the gardens of the lordship of Chimay in 1606, for instance, lists no less than one hundred and twenty different species.279 Plants that expanded beyond these controlled contexts might initially have survived relatively unscathed, but sooner or later they would be curtailed just the same. The accounts of the city of Grave thus mention the cutting down of an elder that grew next to the city wall in 1453.280 Exactly because fortifications were well integrated into people's daily lives proper maintenance was rarely an easy matter.

3.2 IMPOSING MILITARY PERCEPTIONS

3.2.1 Gunpowder and Stone Fortifications

The first section demonstrated that fortifications were far more divers than traditionally claimed, and that they have to be studied as part of larger defence systems. It also brought the difficulty of their conservation to the fore: fortifications' multiple functions were simultaneously a response to, and the source of, basic maintenance problems. This segment is specifically concerned with armed forces' reaction to these issues: the militarizing of

278 Dinstühler (ed), Die Jülicher Landrentmeister-Rechnung, 82-83; Gentenaar and Hupperetz, ‘Personeel en werkzaamheden', 210; Marchal, Inventaire, 168, 170, 172; Piérard, Les plus anciens comptes, vol. 1, 185.
fortifications from the sixteenth century onwards. This eventually created a divergence between a handful of permanent garrisons and a mass of traditional fortifications that were only militarized during armed conflicts.

In the Meuse Region, most settlements only constructed stone fortifications (fortresses, city walls, churches) from the eleventh century onwards. A handful had the advantage of being able to lay claim to continuity with a long distant past. The city of Tongres for example relied on its fourth-century walls until the thirteenth century. At that point they built a new city wall, and merged it with sections of its second-century walls, which had been abandoned in Late Antiquity as being too extensive to be defensible. The remains of this composite structure continue to define the city's historical core until this very day. The most important cities in the Meuse Region, Verdun, Namur, Liège, Maastricht, Aachen, and 's Hertogenbosch, even built several city walls during the High and Late Middle Ages to accommodate population growth. It is typically the second city wall, built in the thirteenth to fifteenth century, which remained in use until the nineteenth century. Given the time, cost, and effort needed to build such elaborate stone structures, it comes as no surprise that in many late medieval cities large parts of the walls were still made of earth rather than stone.281

This continuity between the High Middle Ages and the nineteenth century is remarkable in light of the common emphasis on the supposedly 'revolutionary' effects of gunpowder weapons on fortifications, especially in the fifteenth and sixteenth century. Medieval walls were not abandoned, but simply became part of early modern defences. There are in fact only two examples of major fortifications where the original medieval core was discarded in favour of an entirely new structure: Givet-Agimont (mid-sixteenth century) and Longwy (late seventeenth century).282 The famous engineer de Vauban, who was paradoxically also the mastermind behind the reshaping of Longwy, declared in his report of the 1692 siege of Namur that medieval walls were 'the best of all'.283

This is not to deny the significant effect gunpowder weapons had on fortifications. It is meant to demonstrate that many studies about military architecture, especially those affiliated with the 'Military Revolution' thesis, underestimate the continued value of medieval fortifications. Armed forces in the Meuse Region were familiar with gunpowder weapons by the mid-fourteenth century at the latest, as mentioned in the introduction. The initial, mainly

281 Baillien, Tongeren, 35-44, 53-58; Baillien en Helsen, 'De afbraak'; Bragard, Le château; Bragard et al., Namur et ses enceintes; de Waha, 'Binche', 127-128; Faucherre, 'L’apport de l’enceinte'; Lemoine, L’enceinte, 10-27; Moreau, Bolwerk der Nederlanden; Rhoen, Aachen; van Drunen, 's Hertogenbosch, 171.

282 Bertrand, 'Une construction continue'; Bertrand, 'Givet-Charlemont'; Bragard et al., Namur et ses enceintes; Garcin, De Longwy et Vauban; Moreau, Bolwerk der Nederlanden; van Drunen, 's Hertogenbosch, 171-174.

fifteenth-century, adaptations to gunpowder weapons were relatively simple and consisted of constructing so-called *barbicans* to shield the gates from direct artillery fire, and adding bulwarks to provide firing platforms. When the effectiveness of gunpowder weapons increased, fortification design had to respond as well: by the mid-sixteenth century the famous *trace italienne*, low thick stonewalls with bastions that had to eliminate blind angles, was introduced to the Low Countries.  

![Figure 3.6 Fortifications of the city and citadel of Jülich in 1693. Published in de Fer, *Les forces de l'Europe et le theatre de la guerre* (RA, RP-OB-83.033A-44).](image)

Very few settlements in the Meuse Region, however, could rely on such elaborate defences in the Italian manner; only the fortifications of Jülich, and a few new forts (e.g. Philippeville, Mariembourg) were built entirely in this style (see figure 3.6). In most cases renewal consisted simply of adapting the old medieval walls to new demands, which meant constructing new bastions, lowering the towers to the same height as the walls, and making both walls and towers wider by building an earthen embankment behind them or filling them with earth. Lowering the walls made them more vulnerable to an assault so the moats had to be enlarged and deepened as well. These works required so much earth that even household

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284 DeVries, 'Facing the New Military Technology'; Parker, *The Military Revolution*, 6-16, 26-32, 163-167; Rogers, 'The artillery'.  
waste, manure, and soil from gardens and cemeteries had to fill the new defences in emergencies. Practical measures thus lie at the origin of the so-called Old Dutch system of defence, which developed in the Eighty Years War, and combined earthen walls with the extensive use of water and vegetation. Such fortifications are much faster and cheaper to construct than the extensive stonewalls of the Italian system, and at least as effective.  

Eventually this tendency to place the weight of the defence on depth rather than height led to the construction of ever more ditches and earthen walls that kept expanding into the surrounding countryside in order to make sure that the enemy’s artillery would not be able to make a breach in the updated medieval wall, the scarp. The early modern fortress adopted a very peculiar star-shaped form with, in principle, perfect symmetry. Because of the development of ever more effective artillery, the construction of detached forts, located ever further away from the actual city that needed defending, also became a necessity. A classic example is the fort of Sint-Pieter, where the 1780 mosasaur skull was found. This fort was built in 1702 to avoid a repetition of the 1673 siege of Maastricht, when French artillery batteries located on the Sint-Pietersberg made a breach in the city walls. From the 1850’s onwards, the adoption of new types of breech-loading artillery made even these updated fortifications useless, and stimulated the construction of an entirely new series of fortresses, such as the famous Brialmont forts around Liège.

The literature on military architecture is quite extensive, but surprisingly few scholars have commented on the ecological effects of these changes, or even on the extensive use of plants. Noteworthy exceptions are Philippe Bragard's and Klaus Jordan’s studies on the function of plants in fortifications, which also clarify how complex the building of these earthen walls must have been. In the Low Countries labourers used special techniques to construct earthen defences, called gazonnage or placage, a fundamental detail that is generally overlooked. These methods date back to at least the fifteenth century and consisted of constructing several layers of earth (placage) or grass blocks (gazonnage) with bundles of branches (fascines) in between. The earth had to be rather thick (black), and was often filled with seeds or roots of plants in order to add to the strength of the whole. These techniques were a prerequisite for constructing walls with a slope of forty-five or sixty degrees, designed to resist both canon balls and infantry assaults, as such steep walls can not be constructed by simply making a mound of earth. They also required considerable cost and effort, as the actual construction has to be done by skilled artisans, and blocks of grass had to be dug out in nearby meadows. Because of its complexity and cost gazonnage was abandoned in the late

286 Bragard et al., Namur et ses enceintes, 45-53; Jacobs, Justitie en politie, 148; Moreau, Bolwerk der Nederlanden, 48-59, 68-70, 124-130; Nijssen, Vanderbeken and Wouters, Loonse ridders, 37-44; Sartelet, La principauté, 25-26, 33, 36.

eighteenth-early nineteenth century, and *placage* in the later nineteenth century. From that moment on, the earth was simply piled and the grass was sown later.  

Figure 3.7 Schematic depiction of the planting of trees and a hawthorn hedge on an earthen embankment, seventeenth century (Dilich, *Peribologia*, CLI).

A second, and far-better-known element in the increased use of plants was the planting of trees on the top of the *scarp* or main wall from the late sixteenth century onwards. The most common species were field elm, lime tree, aspen, oak, willow, and common walnut. Gunners preferred field elm above all others for the making of gun carriages and engineers appreciated its extensive root system. During the nineteenth century engineering treatises increasingly recommended planting Lombardy and Canadian poplars, man-made varieties of the black poplar, which have a very straight silhouette, produced good timber, and grow relatively fast. This large-scale introduction of trees served multiple purposes: their roots reduced erosion, strengthened the wall against artillery fire, and made mining more difficult. The trees' crown denied the enemy a view of the inner city, and provided shade for guards stationed on top of the walls (see figure 3.7). The trunks also served as a welcome source of timber, especially since many garrisons lacked access to extensive woodlands.

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Other considerations, aesthetic ones, played a role as well. When brigadier de Pichard, commander of the citadel of Liège, wanted to convince the estates, always reluctant to spend any more on military matters than necessary, of the need to provide funding to buy trees in 1744, he mentioned in his request that field elm provided suitable wood for gun carriages. It was only five years later that another staff officer, captain Colson, who lived in the citadel and had his own garden there, arranged with one of the councillors of Liège to buy field elms and lime trees in Amsterdam and transport them to Liège. By 1750 two hundred and fifty trees embellished the citadel, and were maintained by gardeners. Once these trees grew too big they were sold rather than cut down for financial reasons (1786). Technological improvements thus simultaneaously brought about fortifications' expansion, and a relative increase in the use of plants, which does not mean that military concerns always governed their exact use.

3.2.2 The Rise of Military Engineers

The gradual encompassment of medieval stone walls in extensive layers of earthen walls and ditches have to be interpreted in the context of the history of science. While master masons, architects, and artillermen served as military engineers throughout the Middle Ages, during the fifteenth and sixteenth century the knowledge required for such matters, especially fortress building, became so complicated that it stimulated the development of the engineer as a profession. The first engineers who appeared in the Meuse Region in the early sixteenth century came from Italy. By the turn of the century the Low Countries and other parts of the Holy Roman Empire supplied engineers of their own. These men were highly sought-after specialists, but not members of the military in the strict sense of the word. Distinctions between 'military', and 'civic' engineers only came about in the late seventeenth and early eighteenth century. A major dividing line did exist, however, between the architects who designed or improved fortifications (ingénieurs de places), and officers who had experience in assaulting them (ingénieurs de tranchées).

The development of the engineer profession was of major importance for the ways armed forces interacted with ecological systems, because it provided them with far more tools to influence landscapes, in the form of maps, drainage techniques, channel building, mining, ballistics, etc. Local hydrography had after all exerted significant influence on the construction of medieval fortifications. The city accounts of Geldern indicate that in the

Muller, 'Bouillon', 71; Speckle, Architectura, 27r, 31r, 108v, 109r; van Bavel et al., De kroniek, 400; van den Brand and Manders, Vesting 't Genneperhuys, 388.
290 AEL, Etats, inv. nr. 3007; de Ville, De la charge de gouverneurs, 79; Lawrence, City trees.
292 Blanchard, Les ingénieurs, 105-114.
fourteenth century living hedges, as opposed to fences or combinations of both, could only be found on the east side of the city, near the Yssumer and Gelder Tor. Given that the river Niers, which is connected to the city's moats, runs much further to the west, it is likely that the water level in this part of the moats was very low, and they could occasionally even have fallen dry. The planting of living hedges might thus have compensated for a local deficiency of water as a barrier.\footnote{Kuppers, 'De stadsrekeningen', 9, 21, 134, 147, 316; Marwede, \textit{Die Befestigung}, 43; See also Caminada-Voorham, \textit{Loeweinstein}, 52; Richer of Saint-Rémi, \textit{Histories}, vol. I, 94-95.}

Medieval armies did have knowledge of water management, and mining, and certainly applied this during sieges (see below), but this was relatively basic in comparison to the large-scale projects early modern engineers designed. Medieval fortresses located on hills for example rarely had access to running water, and thus depended on cisterns or wells. The well of the fortress of Huy measured almost ninety-nine metres in 1702. They could also construct or destroy dams, dikes and sluices for defensive purposes. The castellan of Valkenburg for instance ordered the building of a dam in the Geul in 1465 to ensure that the water in the city's moat remained deep enough during the prospective siege.\footnote{Difficulties associated with water management probably go a long way to explain why most noble houses were located near streams or water logged terrain rather than hills. Becquet, 'Montaigle', 125, 129; Bragard et al., \textit{La termitière}, 54-56; Desbrière, \textit{Cartes et mémoires}, 25; Genicot (ed.), \textit{Les Tours}, 104-106, 163-165, 177-180; Gleue, \textit{Ohne Wasser keine Burg}, 14-18, 25-39; Helmich, \textit{Journaal}, 226; Renes, \textit{Landschappen}, 155; Muller, 'Bouillon', 44; Rorive, \textit{La guerre de siège}, 154; Thomas, 'Hygiène', 256-264; van Bavel et al., \textit{De kroniek}, 275, 324; van de Venne, \textit{Het beleg}, 40.}

By the 1700's the principal fortresses in the Meuse Region depended for their defence on inundation basins and moats that could be filled with water through complex systems of sluices and channels. Breaching or building dams was easily enough, but allowed very little control over the extent of the inundated area, the water level, and the speed of the inundation's completion. A major turning point was thus the construction of ever more extensive systems of inundation sluices from the late sixteenth century onwards. Such devices were only effective, however, if they could be secured against enemy attacks as well as local inhabitants who opposed the flooding of their lands. The securing of water management systems therefore encouraged the building of even more fortifications, such as detached forts.\footnote{Debrabant, 'Le Quesnoy'; Gilbert, \textit{Le siège de Stenay}, 40; Groussard, 'Vauban et l'eau'; Moreau, \textit{Bolwerk der Nederlanden}, 257-266; Nijhof and Steketee, 'Sluis', 99-101; Parmentier, \textit{Pays de Charleroi}, 92; Stevin, \textit{Fortification}; van den Brand and Manders, \textit{Vesting t Genneperhuys}, 279, 320.}

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still been preserved, measuring about ten kilometres in length (see figure 3.8). They also mirror their overhead neighbours in complexity, as the main galleries are joined by guardrooms, connecting points and so-called listening galleries, used to spot any enemy attempts to mine the walls. Given the general humidity of these underground constructions, small splits were left in the walls to close them off at short notice, as it was impractical to install wooden doors in peacetime. Ventilation shafts, some six meters in length, were indispensable as were small channels designed to dispose of the excess water. The galleries could also be used to store supplies, be it only during short periods of time due to the humidity and shield the defenders during bombardments.296

Figure 3.8 Eighteenth-century mining galleries of Philippeville (photograph by the author).

Nevertheless, even engineers had to take the environmental constraints posed by the landscapes they sought to defend into account. Casemates, cellars, and water-filled ditches were common enough, but only two fortresses depended on both inundations and mining galleries: Verdun and Maastricht. Engineers also focussed on the Meuse's tributaries to establish inundations because its main current proved too strong to control. The Maastricht inundation thus operated with water from the river Jeker/Geer (see figure 3.11).297

296 Bragard et al., La termitière; Moreau, Bolwerk der Nederlanden, 202, 283-318; Notermans, Fort Sint-Pieter, 36; Silvertant, Valckenborgh, 209-217.
297 Bragard and Decamps, 'Maubeuge; Moreau, Bolwerk der Nederlanden; Groussard, 'Vauban et l'eau'; Muller, 'Bouillon', 68-69; Soetaert, Inondations urbaines, 19.
The landscape modifications that did succeed came moreover at a very high cost of manpower and resources. The registers of the French Hôtel des Invalides give an original perspective on the difficulties faced when constructing or improving fortifications in the late seventeenth and early eighteenth century. During this period of intensive warfare thousands of soldiers became invalids, which involved the writing down of service records that would otherwise not have been preserved. Later in the eighteenth century the number of soldiers admitted to the invalides was gradually brought down, by providing pensions to veterans. These lists reveal that one soldier got affected with rheumatism because he spent long hours constructing sluices in Sedan, another one, a miner, fell down the rocks when making staircases for the fortress of Dinant, and many others got wounded during mine explosions because the hard underground in Givet necessitated their use.

The important role of engineers in the changing relationship between armed forces and the ecosystems they interacted with lays in their role as government representatives as well as the increased potential of landscape modification that their profession represented. By the eighteenth century appointing military engineers to oversee the conservation of fortifications had become the norm, as revealed by the administration they left us. The combination of these specialists with the institution of more extensive guard systems (see 5.1.) gave military forces much more leeway in imposing their view on fortifications, and urban defences in particular. The military engineer was the 'expert' who knew best how to defend a landscape, and the permanent military garrison provided him with the means to enforce his view, against the wishes of local residents if necessary.

In a minority of cases the authority of military engineers became so all-encompassing that governments even charged them with tasks that had very little or nothing to do with military matters. The engineer brigade stationed in the Austrian Netherlands enjoyed a particularly high reputation, and became an important tool of government control. A typical example is the government in Brussels' order to Philippe De Laing, general-major of the engineers, to devise measures to prevent the flooding of the Meuse in the 1760’s. In the kingdom of France by contrast a military engineer academy was only founded in 1749-1750, after its civilian equivalent (1747), and in the Dutch Republic control over water was even more strongly concentrated in the hands of water boards. Nevertheless, military engineers were quick to exploit opportunities created by natural disasters. In 1757, when

299 SHD, GR, 2Xy09 Jan La Plaine; 2Xy12 Claude Croissant dit La Jeunesse; 2Xy13 Jean du Bord dit St Jean, Hubert Grangé dit Beaupré; 2Xy14 Jean Du Barry dit Leytoure; 2Xy22 Jean François Bourguignon dit Jassemin, Antoine Collardon dit Comtois; 2Xy25 François Paquet dit Belmont, Jan Bap.te Mazuret dit La Tulippe (Transcript www.hoteldesinvalides.org).
300 See for instance RHCL, 07.E01, inv. nr. 1 Guarnisoensboek.
301 Breuer, 'Matériaux', 342, 346, 350.
melting ice water from the Rhine and Meuse basins destroyed dikes and flooded large areas of land, Dutch military engineers came to the aid of local governments, and simultaneously charted the regional hydrography to provide the military with a new mechanism of control. Engineers played a key role in military forces' growing control over landscapes, but their efforts were not unchallenged nor without their limitations.

3.2.3 Political Change and Abandonment

The previous sections studied the ecological consequences of the introduction of gunpowder weapons and subsequent development of the (military) engineer profession. The sheer cost of and complications resulting from adaptations to fortifications have been mentioned repeatedly, but one logical consequence has been left unexamined: the fact that these changes, impressive as they were, only applied to a handful of major fortresses of which Heusden, 's Hertogenbosch, Venlo, Maastricht, Namur, Givet, Maubeuge, Mézières, Sedan, Longwy, and Verdun were the most important. The growing gap from the sixteenth century onwards between a handful of up to date fortresses with permanent garrisons and the great mass of more traditional fortifications, is relatively well known within military history. The main issue is that most scholars assume that these latter defences simply lost their military value altogether.

It cannot be emphasized enough that large armed forces of thousands of soldiers with the latest siege equipment did not constitute the most typical army, even in a zone as strategic as the Meuse Region. For most people up to the eighteenth century the most common, the most direct, threat remained that of relatively small bands of raiders who stole, kidnapped and burned, or extorted money not to do so. More traditional fortifications, well imbedded in people's daily lives, retained their effectiveness because bringing up artillery was such a complex process. It is revealing that many churches in the French département of the Meuse were not fortified in the Middle Ages, but only in the sixteenth or even seventeenth century, when political turmoil created a climate of insecurity.

Another noteworthy example are so-called schansen, forts made from blocks of earth and fascines (the word schans originally referred to such a bundle of branches), which spread throughout the Campine during the Eighty Years War. Some of the first forts appeared around parish churches, which again confirms these buildings' central defensive role in rural areas. Most forts, however, were entirely new constructions in the most inaccessible part of the

303 Adriaenssen, Staatsvormend geweld, 403-404; Douxchamps-Lefèvre, Inventaire, vol. 3, 345; Girardot, 'Les forteresses', 24-25; Jenniges, Das Land zwischen Venn und Schneifel, 83-84; Pagnotta, Les églises fortifiées; Richer, Abrégé chronologique, 234, 251.
community; marshes or heathlands. These *schansen*, one half to two hectares large, existed in peace as well as war, and were in fact miniature villages or hamlets, since some villages had several *schansen*, in which every household had a plot of land, and was obliged to help with its maintenance. They only disappeared in the late eighteenth and nineteenth century.  

The spread of gunpowder did make many medieval fortifications redundant, but this was hardly the linear process traditionally made out to be. The diary of Splinter Helmich, a citizen from Utrecht who joined the 'Sea Beggars' and participated in the taking of Den Briel, is a good example. He fought as captain of his own company in the area around Venlo and Roermond in the 1570's, and regularly encountered medieval fortresses and village churches, which were unable to resist cannon, but remained quite effective against an unsupported infantry unit. A special set of rules thus came to apply, which allowed the members of such a fortification to negotiate surrender, and depart unmolested, provided that the besiegers had not yet brought up artillery. Once the cannon had started to fire, the besieged forfeited their right to mercy. Yet such a harsh treatment of prisoners of war was also related to the particular circumstances of the Dutch Revolt and religious strife more generally. Military treatises from the 1700's still gave practical advice on how to adapt traditional defensive structures, such as hedges, churches, or castles, for use as field fortifications, and in these cases there is no question of executing defenders for holding out against artillery fire. The assumption that traditional fortifications lost their military value might therefore originate in the fact that sixteenth-and seventeenth-century handbooks rarely mention them. During the eighteenth century the number of military manuals and theoretical works published increased considerably, and this stimulated the discussion of subjects rarely mentioned explicitely before. Medieval fortifications did not lose their defensive value as result of ineffectiveness, but because violent encounters between soldiers and local residents became increasingly rare (see 4.1 and 5.3). This meant that the general population felt increasingly less pressure to maintain multiple-function structures with respect to defensive needs. So-called *fermes en carré*, built in Hesbaye during the eighteenth and nineteenth century, are a good example. These resemble medieval fortresses, but only functioned as fortifications in exceptional circumstances.

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The continuous importance of more old-fashioned fortifications, despite the spread of ever more effective gunpowder weapons, goes a long way to explain the Prince-Bishopric of Liège's deviation from a general pattern towards the adoption of ever more extensive fortifications. The great majority of its fortresses and city walls saw few adaptations after the early sixteenth century, the citadel of Liège, constructed in the mid-seventeenth century, being the only modern fortress erected by order of the bishop. The Prince-Bishopric correspondingly retained only a handful of permanent garrisons in the medieval fortresses of Bouillon, Dinant, Huy, and Stokkem, as well as the citadel of Liège. Most of these forces were also quite small to contemporary standards: a surviving muster list of the soldiers stationed in the fortress of Stokkem in 1655 indicates that the garrison consisted of a mere forty-two men: the high bailiff, two lieutenants, and three squads of thirteen men headed by a corporal. By the eighteenth century only one garrison remained: a single infantry regiment of six hundred men that housed in the partially demolished citadel of Liège.\textsuperscript{308}

This exceptionality has its origin in the bishopric's policy of neutrality, adopted in the late fifteenth century, but is also related to the constant conflicts between the bishops and their own subjects, which made the latter reluctant to provide funds for military forces that would have given their ruler too much power. In 1636 Bishop Ferdinand of Bavaria (1612-1650) even directed the infamous Imperial general Johan von Werth against his own subjects in order to bring them to obedience. The building of the citadel of Liège was a repercussion of this open war. The downside of this policy was the Prince-Bishopric's vulnerability to almost every potentate that sought to take advantage of the strategic value of the Meuse.\textsuperscript{309}

Attempts by the Habsburgs, French monarchs, and the Dutch Republic to secure their own frontiers, their 'garden', came regularly at the expense of the Prince-Bishopric: Givet, Mariembourg, Philippeville, and Bouillon were more or less forcibly ceded to Spain and France for strategic reasons, while the fortresses of Charleroi and Maastricht expanded their defences by encroaching upon the bishop's territory. When the French army occupied large parts of the principality of Liège during the Franco-Dutch War (1672-1678) they turned the cities of Dinant and Maaseik, Stokkem being considered too small, into fortresses capable of resisting modern siege artillery. When they retreated again, in 1678 in the case of Maaseik and 1698 for Dinant, they demolished everything, including large parts of the original medieval defences.\textsuperscript{310}

Similar processes could be observed in other parts of the Meuse Region that were unfortunate enough to lay on the edges or outside the French and Dutch 'gardens'. The French army ruined fortifications in the Duchy of Bar-Lorraine and the Spanish Netherlands on a large scale in the second half of the seventeenth century, and the Dutch army demolished parts of the medieval fortress of Valkenburg with explosives in 1672. An undefended fortification is after all a liability rather than an asset. The inclusion of a handful of up to date fortresses and cities as the only proper fortifications within military structures, with all other being dismissed as either irrelevant or simple field fortifications, was thus not left to chance, but enforced violently. Still, since city walls and noble houses were too large to be destroyed at short notice, soldiers just created breaches with explosives to make them indefensible. These structures eventually turned into ruins because local residents no longer maintained them.\[311\]

The final demise of all existing fortifications in the Meuse Region, medieval as well as early modern, originated as much in changing political contexts as in technological developments. Emperor Joseph II's wish to expel Dutch garrisons stationed in the Austrian Netherlands, a result of the so-called Barrière treaties in 1697-1715, led him to order to the demolition of large parts of the fortifications of Namur in 1782. The French takeover of most of Western Europe in 1795-1814 likewise entailed the neglect of almost all remaining fortifications in the Meuse Region. The fortresses of Verdun and Givet for instance simply became gaols for British prisoners of war.\[312\] The creation of a new kingdom of the Netherlands and the Belgian secession fifteen years later did seem to reverse this trend, since Liège, Huy, Dinant, Charleroi, Namur, and Bouillon were refortified, but these new forts were again replaced by the Brialmont fortresses around Liège and Namur in the last decades of the nineteenth century. The Dutch army also decided to abandon the fortresses of Maastricht and Venlo in the 1860's because of their isolated position, and fell back on the New Hollandic Water Line.\[313\] These developments did not spell the end of plants in fortifications; their use was even expanded towards the end of the nineteenth century because of an increasing emphasis on camouflage. What matters is that the thread linking medieval fortifications to nineteenth century garrisons had finally been severed.

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3.3 CONSERVING FORTIFICATIONS

3.3.1 A Question of Proper Use

Technological change in combination with increasing distinctions between armies and the general population brought about a divergence between a handful of defences that became permanently incorporated into military structures, and the great majority which were only militarized during armed conflicts, or lost their defensive value altogether. The next object of study is thus logically how armed forces sought to conserve fortifications, as opposed to fortifications as multifunctional structures maintained by the general population. This focus on military management of fortifications allows the making of a comparison between their current ecological value and historical management practices.

The militarizing of fortifications, the fact that armed forces, initially just soldiers and later military forces in the strict sense of the word, took over control of defensive structures, was a very gradual process. Individual watchmen and sentinels were ubiquitous in medieval fortifications, but acted as urban officials or members of noble households (see 5.1). The first permanent garrisons only became established when the kings of France ordered the creation of small units of soldiers, so-called mortes-payes, in the last decades of the fifteenth century. The Habsburgs and bishops of Liège followed this example during the sixteenth century, but the number of soldiers engaged in such garrison duty remained relatively limited, rarely exceeding a single infantry company, and more importantly, was restricted to a handful of strategic fortresses and newly established forts in frontier contexts (e.g. Charlemont, Mariembourg, Philippeville).314

Even though many such fortifications were closely integrated into urban defences the influence they could exert was rather small. Particularly revealing is a court record from Stokkem, dating to 1610-1612, regarding a man who built (pig)stables on or next to the city walls. The high bailiff had apparently ordered him to tear down the stables on multiple occasions, but the offending citizen claimed that his authority did not extend beyond the old medieval fortress.315 Cities were not surprisingly very reluctant to accept garrisons, perceiving them as a threat to their autonomy, until the prolonged and large-scale wars of the late sixteenth and seventeenth century (French Wars of Religion, Eighty and Thirty Years War) forced them to submit. The city of ’s Hertogenbosch for instance enlisted soldiers of their own during conflicts between Brabant and Guelders in the fifteenth and early sixteenth century, but by the 1560’s it had to accept the presence of Spanish soldiers sent by their monarch.316

314 Contamine, Guerre, état et société, 290; Dauphant, Le royaume des quatre rivières, 244-245.
315 RAH, Schepenbank Stokkem, inv. nr. 162, Paulus Jeghers.
316 Adriaenssen, Staatsvormend geweld, 37, 42, 46, 111; Gudde, Garnizoen, 7, 13-28.
Aspirations of urban autonomy hardly ended with the establishment of large permanent garrisons. While soldiers could more or less impose control over the newly established earthen outworks and outlying forts, authority over the original city wall continued to be divided. This was the only part of the fortifications citizens could access, albeit with restrictions: in peacetime they could walk there during the day. The governor of Maastricht for example made his soldiers construct the oldest public park of the city next to its main wall in 1653. This park, which still exists, was probably built to gain the citizens' favour, but might have had the additional advantage of keeping them away from the rest of the fortifications. The records kept by the chief engineer in Maastricht reveal that he had to compensate the city council in 1741 for seven trees, which stood on the main wall and were cut down to be used as wood for gun emplacements. In December 1745 he even started an inquiry to find out to whom the trees on the walls actually belonged.317

Military control of fortifications ultimately rested on two pillars: the imposing of a more extensive guard system and the attribution of responsibility for fortification maintenance to (military) engineers. These engineers in their turn hired contractors to execute the necessary works. A surviving agreement from nineteenth-century Maastricht specified that plants such as rush had to be removed from the water-filled moats two times a year, which seems like an improvement compared to earlier practices. This outsourcing of government tasks was a characteristic element of early modern warfare, but also created obvious security concerns. The constructing and maintenance of underground casemates or mining galleries, the most covert elements in fortifications, thus became the prerogative of military miners during the eighteenth century, as proven by surviving reports from Namur. They were not accessible to anyone else except engineers and high-ranking officers.318

The increasing involvement of soldiers in fortification maintenance can also be seen in this light, although their main function seems to have been that of an inexpensive labour force. An early example comes from an account regarding the fortification of Geldern in 1597-1598. It includes payments to two soldiers for cutting fascines, and digging.319 By the late seventeenth century soldiers regularly worked on fortifications to earn some extra pay, either as day labourers with the contractors or under the direct orders of military engineers. Particularly instructive for the low status attributed to this kind of work is that in the Dutch

317 NA, Raad van State, inv. nr. 2057, Garnisoensorderboek, 2/10/1785; RHCL, 07.E01., inv. nr. 1 Guarnisoensboek, B 22/12/1741, 17/12/1745; Cremers, Kaaij and Steenbergen, Bolwerken, 27-28; Dardart, 'La rue à Sedan', 178; Haanen, 'Het eerste stadspark'; Hubert, Les garnisons de la Barrière, 204.
318 NA, Raad van State, inv. nr. 2599 Records concerning the construction of casemates by miners of the garrison of Namur; RHCL, 07.E01., inv. nr. 1 Guarnisoensboek, 9 Contracts regarding the maintenance of the fortifications of Maastricht; Moreau, Bolwerk der Nederlanden, 286, 289, 296, 299, 307.
319 RHCL, 01.002 Rekenkamer Roermond, inv. nr. 385 Accounts fortification Geldern, 1597-1598 (transcript Rien van den Brand,).
army forced labour on the fortifications became the official punishment for desertion in 1748.  

The use of large numbers of labourers became a necessity because of the vulnerability of these steep earthen walls to erosion. The average life expectancy of such a wall, if not maintained, would be around three to four years. This explains why military authorities were overly concerned with limiting access to the fortifications. Garrison orders from Namur, dating to June 1714, even forbade soldiers to lie on the grass. French regulations from 1750 similarly specified that governors could not cut the grass on the walls more than two times a year, and that they had to make sure that no one damaged these structures. A garrison's staff officers were after all entitled to the income generated by the fortifications: hay production and the renting out of fisheries in the moats.

Two contracts from Maastricht, dating to 1710 and 1716, reveal that a representative of the garrison commander rented a considerable part of the outworks along the river Jeker/Geer to a sheep merchant. Such agreements must have been quite common, but they have rarely been preserved, possibly because officers considered them part of their private archive. Sheep are quite agile, and in contrast to cows or horses, would not have damaged earthen walls in any significant way. Other governors, such as those of 's Hertogenbosch, cut the grass as much as possible, which in turn prompted the Dutch government to buy off their entitlements, and grant contractors the right to cut the grass instead.

This renting out of the fortifications in peacetime was, unfortunately for the military officers involved, not the only holdover of medieval practices. Local residents continued to perceive fortifications as multiple function structures, but instead of an accommodating city council, they now saw themselves confronted with an organisation that had little patience for such matters. Many citizens considered fortifications as an appropriate, perhaps the only suitable, place for pasturing livestock, waste disposal, bleaching or drying linen, fishing, and playing games. The French engineer de Vauban lamented in a letter sent to the French Minister of War, Chamillart, in 1703 that the fortifications of Namur were in horrific state. Everyone and everything could access them at will, they were filled with gardens, and groups of dogs assembled here and chased mice and moles. Medieval walls were already closely

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321 NA, Raad van State, inv. nr. 2079, order 28/6/1714; Ordonnance du roi (June 25, 1750) article DCLCIV; Caminada-Voorham, Loevestein, 51-54; Sangers and Simons, Geschiedenis, 94-95, 105.
322 BHIC, 178, inv. nr. 188, f. 632r.; 326, f. 301r.; 331, f. 20r., 332, f. 124r., RHCL, 07.E01, inv. nr. 1 Guarnisoensboek, B 1/6/1756; Ordonnance du roi (June 25, 1750) article DCLCIV; Caminada-Voorham, Loevestein, 93-94; Gaber, Les fortifications, 30-32; Moreau, Bolwerk der Nederlanden, 76-77, 149; Parmentier, Pays de Charleroi, 67, 79, 114.
associated with such activities, and low earthen embankments would have been even more appealing.\textsuperscript{325}

Yet soldiers were also not without fault where the damaging of fortifications was concerned. Aside from fishing, hunting, and digging for loam (see 5.1), many also established gardens in or near the fortifications. The governor of the fortress of Gennep, which controlled the junction of the Niers and the Meuse, gave two subordinate officers on 5 May 1650 permission to establish gardens in the empty space behind the guardhouse. Their example inspired others and only one year later, in March 1651, when government representatives (\textit{gecommitteerden}) inspected the defences, citizens and soldiers had already expanded their gardens to such an extent that in many places the walls had become too small to accommodate cannon. They had to be removed immediately, but appeared again during the 1654 and 1671 inspections.\textsuperscript{326} This example makes clear that officers had no issue with gardens as such; they would have recognised the value of having access to fresh vegetables, but wanted to ensure that they did not impede defensive efforts. This meant in practice that generally only officers and military hospitals had their own gardens. Some of these would still have been quite large. The officers’ gardens in the eighteenth-century fortress of Montmédy measured no less than six hundred square metres.\textsuperscript{327}

Remarkably enough, it is quite unclear to what extent military officers, and engineers in particular, had the minimum of botanic knowledge necessary to ensure the wellbeing of the plants in fortifications. The French engineer de Cormontaingne gave some brief advice on how to remove worms and moss from the trees standing on walls in a 1741 treatise, but this was quite uncommon. The French military engineering school in Mézières, founded in 1748-1751, did not consider botany to be a very important subject, and put it only occasionally on the curriculum.\textsuperscript{328} Some of the most detailed instructions regarding the cultivation of plants come from a journal on military engineering, which published an article on tree planting in 1829. This piece listed existing regulations applied within the garrison of Verdun, and addressed an apparently widespread concern among engineers at that time: that the planting of trees in fortifications often failed. The author, an engineer captain, blamed the carelessness and ignorance of the entrepreneurs and labourers who had to carry out this task. His own directives are relatively basic. He mentions for instance that plants raised in nurseries might have difficulty adapting to the soil of the fortifications and recommends specific

\textsuperscript{325} Bragard, \textit{Dictionnaire}, 312-313.
\textsuperscript{326} van den Brand and Manders, \textit{Vesting 't Genneperhuys}, 384-388.
\textsuperscript{327} AEL, Etats, inv. nr. 3007; Barbe, 'Rocroy', 119-120; Bragard, 'Soldats et jardiniers', 87-88; Daudet (ed.), \textit{Les Mémoires}, 182; Hubert, \textit{Les garnisons de la Barrière}, 220; Mourroux, 'Stenay, ville militaire', 42; Muller, 'Arlon, Bastogne, Laroche, Marche', 264; Muller, 'Bouillon', 76; Sartelet, \textit{La principauté}, 60, 61, 63; See also Ottersbach, 'Der Garten in der Festung'.
species for different soil types. The exceptionality of this captain's interest in botanical matters is confirmed by the fact that his name also appears in a horticultural journal, in which he describes a rare apple variety found at Verdun.329

Surviving records from the nineteenth-century garrison of Maastricht confirm this impression. This stronghold, like many other large garrisons, disposed of a plant nursery that occupied a surface of more than one acre. In the year 1824 the director of the fortifications offered a contract for the delivery of five thousand field elms, sixteen thousand willows, eight thousand birches, eight thousand alders, two thousand hazel shrubs, two thousand oaks, and one thousand beech trees. Most of these would have been planted as coppice wood near the Boschpoort, on the northwest side of the city. Another fourteen baskets with acorns and thornapple seeds, seven pounds of alder and birch seed, eight thousand young ash trees, and three thousand Canadian poplars had to be supplied for the garrison's plant nursery. Even if one takes into account the sheer size of the fortifications and that the garrison initiated a major planting program in this period, the number of plants that perished on a yearly basis must have been enormous. The year 1825 again saw the planting of at least one thousand six hundred and and seventy trees (ninehundred and fifty Canadian poplars, four hundred and fifty field elms, one hundred and seventy five ash trees, seventy Lombardy poplars and twenty five nut trees) and the planting of forty four thousand young trees and shrubs in the nursery.330 Military forces considerably expanded their control over fortifications, but they never fully succeeded in imposing their views on a complex ecological reality.

3.3.2 Fortifications Under Siege
Maintaining fortifications was clearly no easy matter, neither for medieval city councils and high bailiffs, nor for early modern military organisations. It was far from obvious that armies could enforce their views on how fortifications should be managed. We will now turn to the one, perhaps the only, circumstance in which military views predominated at the expense of all others: an actual siege. The term siege is interpreted here is a formal blockade of a fortification with the object of conquering it through attrition or direct assault, not a sudden attack. This means that the focus will be on the most extensive and stereotypical fortifications: fortresses and cities.

An actual siege was a rather rare event, the cities of Maastricht and Namur, both key locations for controlling the Meuse River, experienced only fourteen and eight sieges respectively in the 1250-1850 period. This was a logical consequence of the difficulties associated with the transport of artillery, and the financial cost a siege entailed. An additional

330 RHCL, 07.E01, inv. nr. 9 Performance specifications concerning the maintenance of the fortifications of Maastricht, nr. 76; Lienard, ‘Le fort’, 103.
consideration in medieval contexts was that only a limited number of people, mostly residing in major urban settlements, had the experience necessary to construct or maintain complicated siege equipment. The siege of the fortress of Sampigny in 1358 thus necessitated the transportation of 'two large machines' and a battering ram from Verdun to this fortress on ten wagons, thirty carts and the mobilisation of six hundred sergents de pieds (infantrymen) as guards.\textsuperscript{331} When the urban militia of Aachen participated in the siege of the fortress of Reifferscheid in 1385 they had to move a trebuchet, broken down into its constituent parts, over a distance of about sixty kilometers, a task that took sixty-one horses, fourteen wagons, and five days. Reassembling and erecting the device before the besieged fortress took another six days and twelve skilled artisans, and the stones had to be specially brought from Nideggen. The burden of using this equipment was in fact so considerable that the cities of Aachen and Cologne shared the costs.\textsuperscript{332}

When a siege did happen, however, it produced ecological effects that can only be compared to a natural disaster. At first glance, it thus appears that the only occasion armed forces could really control defence structures was also the moment their very existence was threatened. This can best be described as succeeding steps of increasing intensity. Simple preparation for an enemy attack, not necessarily as siege (see 5.1), entailed that all vegetation and structures in the immediate surroundings of a fortress or city that could benefit the enemy, such as trees, hedges, buildings, ditches, and even hollow lanes, had to be demolished or levelled. Such destruction initially applied to everything within bowshot range, but later to the effective reach of a gun or cannon.\textsuperscript{333} On the night of 25 to 26 January 1407, for example, watchmen from the city of Maubeuge observed fires near the fortress of La Buissière. One of the city's messengers went there the next day to investigate. It turned out that the fortress' occupants had set fire to the hedges and bushes around the defences as a precaution.\textsuperscript{334} The actual execution of such orders must often have met with strong opposition for the resolutions of the city council of Liège reveal that the mayors were even permitted to enlist guards armed with halberds to accompany them on their inspection tours in 1568.\textsuperscript{335}

It is exactly because of the reactions such orders generated that permanent garrisons in the eighteenth and especially nineteenth century imposed restrictions in peace as well as

\textsuperscript{331} Champion, \textit{Guillaume de Flavy}, 127; Kraemer, 'Arme et refuge', 51; Servais, \textit{Annales historiques}, vol. 1, 68-69.
\textsuperscript{332} Laurent, \textit{Aachener Stadtrechnungen}, 287-295.
\textsuperscript{334} Deloffre, ‘Guerres et brigandages’, 272. See also Gentenaar and Hupperetz, ‘Personeel en werkzaamheden’, 186.
\textsuperscript{335} Bormans, ‘Table des registres’, 268;
wartime. The French Republic codified and expanded existing regulations when it stipulated in 1791 that nobody could build anything within a radius of two hundred fifty meters around the outermost defences. Easily destructible structures, such as wooden buildings or plants, were allowed within a radius of four hundred and fifty metres, but these could be destroyed in wartime without compensation. Especially instructive of the ecological effects of such a policy is a military map from 1753, which depicts the cities of Mézières and Charleville. These cities have a very different street pattern because the former had a medieval origin, while the latter was constructed according to a prearranged plan in 1606 by Charles I Gonzague, duke of Nevers and Rethel, as capital of his new principality. The most crucial difference between them is not their street pattern, however, but the fact that Mézières was a key fortress in the defence of France's northern frontier, while Charleville lost its defensive value in the late seventeenth century. Wide-open fields thus encircled Mézières, while Charleville counted numerous gardens in its immediate surroundings (see figure 3.9).

Figure 3.9 Military map depicting Mézières and Charleville in 1753 (BNF, département Cartes et plans, GE D-14449).

336 'Le blocus de Rocroi', 33; Ordonnance Corps du Génie (1776), 31-32; Delalleau, Traité de servitudes; Muller, 'Bouillon', 57; Parmentier, Pays de Charleroi, 77; Thewes, Stände, Staat und Militär, 71; van der Woud, Het lege land, 369-372, 476-477; van Mastrigt, Willemstad prinsheerlijk, 199.
337 The French army initially constructed a fort (Mont Olympe) on the Meuse's left riverbank, opposite Charleville, to make sure the city could not serve as a stronghold against France. This fort lost its military value simultaneously with Charleville, but its remnants still appear on the 1753 map (upper right corner). See Hubert, Histoire de Charleville.
Making sure that a potential enemy would be unable to find cover was only the first step in preparing for an appropriate defence. The defenders also had to restore or expand the fortifications, and store sufficient supplies. This inevitably entailed further encroachments on nearby woodlands (see 4.1). When Waultrin de Fillers, general receiver and forester of Longwy, organized this fortress for a potential siege in 1474-1475, he ordered the construction of a horse-drawn mill and the cleaning of the well and the latrines. The fortress had to be ready to accommodate a far larger number of occupants, man and animal, than normal and for an unknown length of time. The defenders also had to restore or expand the fortifications, and store sufficient supplies. This inevitably entailed further encroachments on nearby woodlands (see 4.1). Two members of the garrison of Montaigle, near Dinant, also received a financial reward in 1465 to remove large amounts of compost and waste from the fortress, that had accumulated there as result of the many men-at-arms who came to garrison it in combination with the livestock brought there for safekeeping. It filled the courtyard and soiled the water of the well.

The construction of horse-drawn mills, also attested in fifteenth-century Valkenburg, would have been a practical response to the fact that the defenders could lose access to the wind or water mills they normally used. Early modern cities often constructed windmills on their walls, which would have safeguarded them against a direct enemy attack, but still made them very vulnerable to a bombardment. If mills became unusable, grain could no longer be turned into flour, which would effectively have made available grain stocks next to useless. The Burgundian army for instance forced the city of Tongres to surrender after only eight days in 1482 by damming the river Jeker, on which the city's water mills depended. An earlier attempt by Liégeois troops besieging Maastricht in 1408 failed because the citizens constructed new water mills on the Meuse, which was too large to be diverted. Military garrisons also ran into conflicts with millers because water mills slowed down watercourses, which in turn obstructed defensive inundations. The French governor of Maastricht thus forbade the millers of Tongres to work in July 1678 until the inundation of the fields to the south of Maastricht, which also depended on the Jeker, was finished.

Inundations were a regular feature of many sieges, and as argued before, became increasingly complex through the involvement of engineers. One of the most famous engineering feats is the Dutch siege of ’s Hertogenbosch in 1629, where Dutch engineers nullified the defenders' main ecological advantage: the waterlogged soil around the city, aggravated by the deliberate inundation of the rivers Aa, Dieze and Dommel. The besiegers built twenty-one horse-drawn mills, connected them to the inundation by special channels,

338 ADM, B 1879, f. 130v.-141r.
340 Barbe, Laverdine and Parizel, Moulins, 18; Marchal, Inventaire, 328-329; Milot, ‘Les garnisons’, 733; Parmentier, Pays de Charleroi, 65; Sartelet, Sedan, 77; van de Venne, Het beleg, 18.
342 Ordonnance Corps du Génie (1776), 33-35; van den Brand and Manders, Vesting ’t Genneperhuys, 415; Vandewal, Moerenpoort, 14.
and then drained the area surrounding the fortress. They also rechanneled the Aa and Dommel to create a new inundation between themselves and a Spanish relief army. This event has become one of the most renowned feats of the Eighty Years War, but was actually not that exceptional. Dutch forces already used similar drainage techniques during the 1593 siege of Geertruidenberg.\footnote{De Cauwer, \textit{Tranen van bloed}, 76, 125; De Graaf, \textit{Oorlog}, 237-241, 527-532; Gilbert, \textit{Le siège de Stenay}, 40; van Bavel et al., \textit{De kroniek}, 331-343; Verschure, \textit{Overleven buiten de Hollandse tuin}, 134-136.} The renown of the 1629 siege is probably based on the numerous prints and paintings made to commemorate it (see figure 3.10). A noteworthy detail is that the bottom image depicts a soldier fishing. This seems to have been a common practice, even though it could be dangerous. The chronicle of the Sint-Geertuiklooster mentions that a soldier was hit by a cannon ball and lost both his legs when fishing in the Dommel.\footnote{van Bavel et al., \textit{De kroniek}, 335.}

![Etching of the Dutch siege of ’s Hertogenbosch in 1629 (detail), by Cornelis Danckerts (1603-1656), 1630 (RA, RP-P-OB-77.706).](image)

Such inundations could serve both defensive and offensive purposes. The siege of Aachen in 1248 for example saw the besieging army, joined by pilgrims from the Low Countries, Flanders, Picardy, and Brabant, built a huge dam in the river Wurm in order to flood a considerable part of the city. The expertise for building this huge dam is, in the same way as
the aforementioned siege of 's Hertogenbosch, traditionally attributed to pilgrims originating from Frisia, but the *Chronicon Regia Coloniensis* clearly states that they only arrived after the dam had been built. More landlocked areas might therefore have had their own experts in hydrological knowledge.\textsuperscript{345} Chronicles from the Prince-Bishopric of Liège in particular indicate that miners were regularly involved in attempts to divert watercourses during sieges. They undoubtedly used their experience in digging coalmines. As late as 1826-1827 the Netherlands regiment of sappers and miners, which was stationed in Grave and recruited most of its personnel in the Maastricht-Liège area, saved the city from the flooding of the Meuse by reinforcing the river dikes.\textsuperscript{346}

The role of these miners in water management logically derived from their main function: the construction of mining galleries during sieges. Mining warfare and the digging of trenches became increasingly complex from the Late Middle Ages onwards in parallel with inundations. Miners from Liège were sought after experts in this regard and applied their skills far beyond the Meuse Region proper, since surviving personnel records show that they formed the mainstay of miner units in both the Burgundian army and those of the Dutch Republic. The latter also, and increasingly, depended on peasants originating from the area around Maastricht who had experience in digging out limestone.\textsuperscript{347}

The digging of trenches was a far less skilled endeavour and typically left to soldiers or 'pioneers', unskilled men armed with spades and shovels, often requisitioned from the local population. Engineers and a handful of skilled artisans supervised the work: most engineer units in the eighteenth and nineteenth century included sappers as well as miners, with the former being responsible for digging trenches. The involvement of such experts became a necessity because trenches became ever more extensive over time, as several lines running parallel to the besieged fortress or city had to be connected to each other through so-called approaching trenches, dug in a zigzag way to reduce casualties. When a parallel trench was established close enough to the enemy's main wall, artillery could be brought up to make a breach.\textsuperscript{348}

The emphasis on establishing a breach or diverting streams was primordial, for sieges were governed by rules designed to limit unnecessary suffering. It is indeed suggestive that few sieges, medieval or early modern, lasted longer than two months after the initial

\textsuperscript{345} Rhoen, *Aachen*, 41-46; Waitz (ed.), *Chronica*, 293.  
\textsuperscript{346} Gaier, 'Aux origines'; Moreau, *Bolwerk der Nederlanden*, 102; van Hoof and Roozenbeek, *Grave*, 50.  
investment (The siege of Aachen in 1248, which lasted almost six months is exceptional to both medieval and early modern standards). This also meant that starvation rarely became the main motivation for capitulating, although many disenfranchised groups did suffer because of hunger. Disaffected citizens could be an important cause for surrendering early, since holding out until a besieging force fought its way into a fortress or city meant risking pillage, violence, and possibly massacres. The citizens of Saint-Mihiel thus diverted the watercourse that fed the garrison's gunpowder mill in 1635 so that the governor had no choice but to yield to the besieging French army. By the seventeenth century the object of most sieges simply resolved around the making of a breach in the main wall, which was sufficiently large to allow a potential assault to be made. At that point most defenders surrendered.

Given the general emphasis on reducing unnecessary misery, sieges were in themselves rarely sufficient to cause the destruction or abandonment of fortifications, despite their similarity to natural disasters. The demolition of major defences, such as the city walls of Dinant in 1466 or those of La Mothe in 1645, was time consuming and labour intensive, and therefore a very symbolic political act that should be clearly distinguished from simple attempts to make a fortification indefensible, typically by creating a breach. Even so, repairing the damage of a siege could still be a long and drawn out process. The Sentence de Lille, the peace treaty between Liège and Burgundy from 1408, specified that the citizens of Tongres had to fill the trenches dug during the siege of Maastricht (1407-1408) or pay others to execute this task. The chronicle of the Sint-Geertrui Klooster in ’s Hertogenbosch on the other hand mentions the planting of trees on the walls in the year 1633, which suggests that it took four years to replace the trees cut down during the siege of 1629. Even though most trenches would have been filled again relatively quickly, the disturbances they caused changed the structure of the soil permanently. Archeological research has benefitted significantly in the last decades from the study of soil and crop marks; differences in soil colour and vegetation growth. These are observable from the air, and allow the identification of former fortifications as well as siege trenches. Furthermore, some structures did remain a visible part of the local landscape for decades, sometimes even centuries. French engineers who charted the lands between the Sambre and Meuse in 1787 for instance still depicted old retranchements made in 1689. Four earthen hills constructed within the city of Mézières as artillery platforms (cavaliers) during the siege of 1521 also survived.

349 Abel et Bouteiller (eds.), Journal, 238.
350 Childs, 'Surrender', 158-160; Kortüm, 'Surrender', 50-54; Lynn, 'Honourable Surrender', 107; Toch, 'The Medieval German City'.
351 Brouwers, ‘La reconstruction'; Genicot (ed.), Les tours, 41-44; Glaudemans, Om die wrake wille, 177-184; Lemoine, L’enceinte, 82-85; Paviot, ‘La destruction'; Rorive, La guerre de siège, 199-214; Stercken, Königtum und Territorialgewalten, 130-135.
352 Chevalier, ‘Les "attres" fortifiés', 41; van Bavel et al., De kroniek, 366.
into the eighteenth century. Sieges clearly left scars in the landscape, but they were on their own rarely sufficient to cause fortifications' destruction.

3.3.3 Military Garrisons and Naturalists

Studying the ways armed forces sought to conserve fortifications, or indeed threatened their very existence, is very helpful for understanding these structures' ecological influences, but it still does not allow a convincing comparison to be made between fortifications' historical management and the current importance environmentalists attribute to them. It is for this reason that we will now examine an exceptional source, whose value has been mostly ignored up till now: nineteenth-century naturalist studies of fortifications still actively managed by the military. There are many natural histories or botanical works available for earlier periods, but these rarely provide detailed information where a specific plant could be found. Rembert Dodoens' famous Cruydeboeck from 1554 is an exception, for it notes that the rare red star thistle (*centaurea calcitrapa*) grew on the city walls of Antwerp. This is the first botanical work in the Low Countries to be based on original findings as opposed to compilations of classical works,

Nineteenth-century naturalist studies offer very similar evidence to the *Cruydeboeck*, an more or less accurate identification of species and the inclusion of specific habitats, but on a far larger scale, and the oldest surviving photographs of fortresses and city walls can complement the information they provide. The fortifications of Verdun, Givet, Namur, Maastricht, and ’s Hertogenbosch have been the subject of specific studies, while a few other fortifications (Heusden, Dinant, and Montmédy) are just mentioned briefly in connection with specific species. Some animals and plants are also better studied than others. Most of these works are concerned with botany, two consider bats and one lepidoptera (butterflies and moths). Within botany, there is a strong preference for vascular plants, with mosses receiving far less attention. F.J.J. van Hoven, a military doctor, is the only naturalist to study fungi and lichens, including those growing on the trees standing on top of the main wall of ’s Hertogenbosch. It is because of his work that we know that *Bovista gigantea* could be found in Camp Willem II, a fortified encampment built in Vucht in 1844. The nomenclature employed by these naturalists is problematic as well. Latin names have changed markedly in

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353 Feller, 'Toponymie', 100; Lemoine-Isabéau, *La cartographie*, 53-54; Moranvillé, 'Un incident', 346; Renard, *Toponymie*, 90-91; Sartelet, Mézières, 28; Vanderbeken and Wesemael, 'De belegeringen'.
354 Dodoens, *Cruydeboeck*, vol. 4, Cap. 47, 555-556; Weeda, 'Over de betrouwbaarheid van oude literaturagegevens'.
the last hundred and fifty years, and some plants identified by these scholars are no longer recognised as a separate species. It is also unclear to what extent such studies provide evidence about biodiversity in fortifications before the nineteenth century.\textsuperscript{356}

Still, there can be no doubt these naturalist studies, when put together, offer us a unique glimpse of the species that lived in fortifications when military organisations still managed them. It is far from obvious that they could do so. Outsiders had limited access to defensive structures, with officers being especially concerned about enemy spies. Antoine de Lusy, a citizen of Mons, wrote down in his journal that a man from Bretagne was arrested and executed in 1525 for inspecting the moats of the city (a war year). The eighteenth-century regulations of the garrison stationed in the castle of Namur also state that sentries had to arrest anyone found writing or drawing something near the fortifications, and the published results of a botanist excursion in Givet, dating to 1867, explicitly comment that the naturalists could only pass through the fortress of Charlemont after they obtained permission. A captain of the garrison, an amateur botanist himself, served as their guide.\textsuperscript{357}

It is likewise hardly a coincidence that a military doctor wrote the oldest guide to the flora of 's Hertogenbosch or that the pharmacist L.J.G. Dumoulin published his flora of Maastricht in 1868, the same year the fortifications lost their military status. Such restrictions would also explain why soldiers escorted naturalists visiting the quarries where the 1780 mosasaur skull had been found, and draw attention to doctor Hoffman's military status. Even members of the military would have limited or no access to more restricted parts of the fortifications, which might explain why van Hoven only considers lichens growing on trees and not those on the walls themselves (except one species on the outlying fort Isabella).\textsuperscript{358}

The plant and animal diversity in military fortifications, as revealed by these naturalist publications, can be explained by drawing attention to the military desire to close off access to these areas, as well as the very landscape diversity these fortifications generated. Military forces' concern with maintaining an open field of fire in combination with their methods of grassland management- mowing the grass only two times a year or pasturing sheep- would in effect have stimulated plant diversity.\textsuperscript{359} This diversity in turn could have attracted different kinds of animals, such as butterflies and moths. Félix Liénard explicitly referred to the ditches of the fortifications and fields near the citadel of Verdun as the best locations for catching lepidoptera.\textsuperscript{360}

\textsuperscript{356} van Hoven, \textit{Flora van 's Hertogenbosch}, 31-34.
\textsuperscript{357} NA, Raad van State, inv. nr. 2078, Orders Castle of Namur, art.2; de Lusy, \textit{Le journal}, 358; Devos, ‘Compte rendu’, 321-322.
\textsuperscript{358} van Hoven, \textit{Flora van 's Hertogenbosch}, 31-32.
\textsuperscript{359} Dierschke and Briemle, \textit{Kulturgrasland}, 26-45; Godron, \textit{Flore}, 62, 258-259; Graatsma et al. (eds.), \textit{De flora}, 105; van Hoven, \textit{Flora van 's Hertogenbosch}.
\textsuperscript{360} Liénard, ‘Catalogue’, 377-378;
Fortifications were also home to a wide range of water plants, a reflection of the fact that plant growth develops easier in still or slow moving water. F.J.J. van Hoven identifies no less than three plants that could be found specifically near the inundation slush of Heusden. Mining galleries by contrast have a similar ecological function to caves because of their high humidity and constant temperatures.\textsuperscript{361} French naturalists identified the fortress of Charlemont as a hibernation place for rare bats, such as the geoffroy’s (\textit{Myotis emarginatus}) and barbastelle (\textit{Barbastella barbastellus}) bat, as early as 1806. Finally, even plants typically associated with woodlands could be found in some fortifications, as Dumoulin discovered a very rare orchid, violet helleborine (\textit{Epipactis purpurata}) in the coppice wood planted in the outworks outside the Boschpoort in Maastricht.\textsuperscript{362}

The most striking element in fortifications, however, proved to be neither of these environments. Stonewalls are home to relatively few species, but the species that they accommodate can be found nowhere else. Steep stonewalls, like those of fortresses, churches or city walls, are, ecologically speaking, quite similar to a rock or mountain environment. A typical example is tower mustard (\textit{Arabis glabra}), a very rare herb that grew on the medieval city walls of Maastricht in 1868. Another typical wall plant, perennial wall-rocket (\textit{diplotaxis tenuifolia}) could be found plentifully on the fortifications of Montmédy, Sedan, Givet and Rocroy in the nineteenth century. Fortifications were especially important for these plants because only a small part was effectively used on a daily basis for living purposes (towers, gates and guard houses). If a wall is heated from the inside the variations in temperature become too extreme during the colder seasons.\textsuperscript{363}

The importance of stonewalls lies indeed not only in their specific construction, but also in the creation of warm microclimates. The term microclimate refers to a local variation of the general climate, from a few square meters to several hectares. This variation can be caused by differences in soil structure, as the presence of stone typically generates higher temperatures, but also by vegetation coverage, presence of water (both of which have a cooling effect), the angle of the incoming sunlight and the wind. These microclimates are crucial for biodiversity because they can support a far greater range of species than a uniform climate.\textsuperscript{364}

One of the most significant environmental impacts of the peculiar star-shaped fortifications of the early modern period might therefore be that they created a mosaic of microclimates, given the variations in sunlight (different angles), humidity (wet or dry moats), and vegetation (trees and hedges). This is confirmed by the study of botanist André Devos

\begin{itemize}
\item van Hoven, \textit{Flora van ’s Hertogenbosch}, 5, 8, 9.
\item Stoutjesdijk and Barkman, \textit{Microclimate}.
\end{itemize}
from 1870, which records that hyssop grew abundantly in the ditches on the south-western flank of the fortress of Charlemont and on the south side of the fortress of Montmédy, locations where the sunlight was most intensif and winds could only exert limited influence. Many of the lepidoptera found in or near the citadel of Verdun were likewise bound to warmer climates.\(^{365}\)

Hyssop is not native to the Meuse Region, but was introduced as a garden plant in the late Middle Ages, being well known for its medical properties. Given that many other plants closely associated with the fortifications can be identified as archaeophytes, it is likely that gardens had a major role in the spread of herbs and flowers to defensive structures.\(^{366}\) These transfers, deliberate or not, would have been facilitated by stonewalls' suitability for plants of Mediterranean origin: a rock environment, warm microclimates and calcareous soils. The fact that limestone constituted one of the most important building materials in the Meuse Region is a crucial element in fortifications' ecology because in Northern Europe the diversity of calcareous soils is much higher than those of an acid nature. This is a result of a historical bottleneck: the Ice Ages. During these periods of global cooling the Mediterranean, with its numerous calcerous soils, provided a refuge for species bound to warmer climates, while Europe north of the Pyrenees and Alps experienced a massive extinction. Fortifications might thus have assisted in the gradual recovery of Northern European ecosystems, a process that started after the last Ice Age and continues to this day. Their role would have been especially important in the context of the so-called Little Ice Age (sixteenth-nineteenth centuries).\(^{367}\)

While the connection between gardens and fortifications is quite strong, it is far from certain who managed them. Devos identified gardens in or near the fortresses of Charlemont, Dinant, Namur, and Huy as the origin of the garden plants that could be found there in the nineteenth century.\(^{368}\) This brings us to the very core of the problem: there were many gardens in or near fortifications, but their cultivation was not a military prerogative. One cannot be certain for instance that hyssop or other garden plants that grew in the fortresses of Charlemont and Montmédy had a military origin, for even these fortresses housed small communities that were not part of the garrison as such.\(^{369}\)


\(^{366}\) Devos, ‘Compte rendu’, 303, 306; Devos, ‘Les plantes naturalisées’, 88, 93, 95, 99; Dumoulin, Guide du botaniste, 16, 18, 19, 42, 59; Lejeune, Flore, 21,136; van Hoven, Flora van ’s Hertogenbosch, 12; Zeven, De Introductie, 83.

\(^{367}\) Ewald, 'The Calcareous Riddle'; Segal, Ecological Notes, 58-67.

\(^{368}\) Devos, 'Deux jours d'herborisation', 124-126.

In some cases garden plants even established themselves despite intense opposition of armed forces. Engineers stationed in Maastricht had to devise new inundation basins in 1764, since the old ones, constructed by French forces in the late seventeenth century, had become unsuitable because citizens used them for gardening. They thus made new basins, demolished the gardens in the process, and then made sure the garrison held reviews there so that no one would try to cultivate these lands again (see figure 3.11). When Dumoulin gave a presentation about the flora of Maastricht in 1832, however, he still mentioned the presence of wild daffodils (*Narcissus pseudonarcissus subsp pseudonarcissus*) on the dikes of the inundation basins; remnants of the gardens destroyed in 1764.370

These daffodils were hardly the only species that survived in fortifications despite attempts to remove them. One of the officers of the Maastricht garrison filled a request with the forestry department in the 1820's to put fox traps in the mining galleries. He claimed that the animals could damage these underground corridors with their burrowing. This might have been a common attitude, for Eduard Lenz, a sapper lieutenant in the Bavarian army, also recommended the eradication of hole-digging animals in his treatise *Ueber technische*

![Figure 3.11 Plan of the fortifications of Maastricht, 1815. Note the extensive inundation basins on the south side (RHCL, 07.E01, inv. nr. 5).](image)

370 NA, Raad van State, inv. nr. 2057, Garnisoensorderboek, 5/10/1785; Graatsma et al. (eds.), *De flora*, 37, 47, 85; Moreau, *Bolwerk der Nederlanden*, 258-262.
Truppen (1827). Contractors tasked with executing basic maintenance tasks similarly had to cut down caterpillar nests, and remove thistles. Bats seem to have survived relatively unscathed, being just considered as a minor nuisance. Lenz simply specified that droppings of bats and other animals had to be cleared from the mining galleries.

The biological diversity these naturalists encountered was therefore to a large extent unintended. It does not follow, however, that the role of the military in bringing about these ecological results was negligible. Military forces created and maintained landscape diversity because it had military value, and this landscape diversity in turn made a remarkable species diversity possible. This can best be illustrated by taking the fortifications of Nijmegen as an example. This city lies just outside the Meuse Region and has been the subject of two different botanical studies, one dating to 1848, the other to 1888, which allow a systematic comparison to be made between plant diversity before and after the city’s defences lost their military value (1874). While some typical wall vegetation survived in those parts of the walls that had not yet been broken down, in most cases ruderal plants (‘weeds’) had replaced them.

The parts of the fortifications that survived onslaughts of urban development typically became incorporated into parks. Others joined older defence structures that had become isolated ruins in the middle of woodlands. Such abandoned fortifications still have ecological value, but their importance mainly lies in the fact that they are green islands in the middle of landscapes that transformed as a result of industrialisation, population growth and an intensification of agriculture. Instead of allowing trees and shrubs to take over former fortifications, which eventually contributes to their destruction, many conservationists now would opt for maintenance that strongly resemble historical management practices. Sheep graze in the largest surviving part of the early modern fortifications of Maastricht, the Hoge Fronten, and most woody plants have been removed (see figure 3.12).

Nevertheless, even ruins of medieval fortresses, abandoned for several centuries, could still play an important ecological role. A recent study of former castle mottes in French woodland environments has demonstrated that they exhibit significant differences in plant species composition, compared to the woodlands that surround them. These ruins act as ecological islands that are valuable from a biological viewpoint because they add diversity to the landscape. They contain more species typical for calcareous and nutrient rich soils, as well as more competitive ruderal species and epizoocoles. A similar study regarding molluscs in

371 Pelzers, de Rijk and Thissen, ‘Zoogdieren’, 168; Lenz, Ueber technische Truppen, 33-34.
372 AEL, Etats, inv. nr. 3007; RHCL, 07.E01, inv. nr. 9 Performance specifications concerning the maintenance of the fortifications of Maastricht, 6/9/1825; Caminada-Voorham, Loevestein, 52; Hasselbrink, Manuductio ad Architecturam Militarem, 177.
374 Cremers, Kaaij and Steenbergen, Bolwerken, 125-129; Lawrence, City trees, 195-198; van der Woud, Het lege land, 324-340.
the Czech Republic has confirmed these results. Even though these medieval fortifications had been abandoned for centuries the chemical changes in the soil structure they brought about retain their influence until this very day.375

![Image](image.jpg)

Figure 3.12. The Hoge Fronten in Maastricht, now a natural reserve (photograph by the author).

CONCLUSION

The current plant and animal variety in discarded fortifications is a logical consequence of these structures' ecology when they still had military value. Neglect is not a prerequisite for fortifications to be biologically significant. Up to a certain point it is even counterproductive, for the landscape diversity typical for fortifications depends on human involvement and regular maintenance. Armed forces sought to preserve stonewalls, hedges, grasslands, and moats because these served defensive needs. Plants, earth, and natural stone remained fortifications' main components until concrete and barbed wire replaced them in the later nineteenth century. In the case of the Meuse Region continuity was in fact so strong that many stone fortifications built during the High Middle Ages retained their defensive role into the nineteenth century. Their presence defined militarized landscapes across the centuries.

375 Closset-Kopp and Decocq, ‘Remnant Artificial Habitats’; Jurickova and Kucera, ‘Ruins of Medieval Castles’.
Fortifications were historically far more diverse and complex than the stereotypical military structures they are traditionally associated with: fortresses, forts, and city walls. Many defensive structures, especially in the countryside, were closely integrated into people's daily lives. Churches could be fortified because of their important refuge function, and fences/hedges controlled the movements of people as well as animals. These edifices were often part of larger systems of defence, which relied on cooperation between different communities. The relative balance of power could have a major role on how such systems operated. If villagers had their own defences they were far less likely to execute menial maintenance tasks for cities or noble lords in exchange for the right to seek refuge. Fortifications' multiple functions besides defence were indeed both a major asset and a source of problems. Many people had incentives to preserve fortifications, but they often did so in ways that compromised military defence. Typical examples are the renting out of towers or gateways as living spaces or the establishment of gardens next to the city walls.

Major changes within armed forces themselves brought about a divergence between traditional fortifications as multiple function structures, and a handful of defences that armies, and later military organisations, controlled more or less on a permanent basis. The development of gunpowder weapons and the rise of the engineer profession had a central role in bringing about this divergence. The growing emphasis on defence in depth stimulated the increasing use of water, earthen embankments, and plants (grass, hedges, and trees) in fortifications, and led to the construction of permanent mining galleries. While a handful of fortifications came to depend on ever more complex forms of landscape defence, most were reduced to mere 'field fortifications' unable to resist a formal siege, or lost their military significance entirely. This was a calculated response to questions of military defence rather than a sign of backwardness. The financial cost of such fortifications was enormous, and the most common threat remained armies passing through or relatively small raiding parties.

Conservation of this handful of extensive fortifications that armed forces controlled permanently was hardly more straightforward than that of their more traditional counterparts. Military control of fortifications, constantly challenged by local residents, was based on the guard systems they imposed in combination with armies taking responsibility for fortification upkeep. Contractors ensured that walls were regularly maintained, that the grass was cut periodically, that the moats were sufficiently deep, and that any dead shrubs or trees were replaced. At the same time staff officers still leased large stretches of the fortifications they were responsible for to sheep merchants or fishermen to gain some extra income. A formal siege exerted ecological influences similar to a natural disaster, but ultimately rarely threatened the continuity of fortification maintenance. Preparation for a potential siege even became increasingly incorporated in regular fortification management, notably through he
introduction of rules that had to ensure the immediate surroundings of fortifications remained open.

The biodiversity value of fortifications, as reflected in the studies of nineteenth-century naturalists, was directly related to the defensive value of preserving various landscape elements in a relatively concise space. At the same time many species spread to fortifications unintentionally, or even despite military opposition. This applied especially to garden plants, but also to species classified as pests, such as weeds, caterpillars and foxes. The chapter consequently does not claim that armies deliberately made fortifications a suitable place for numerous species of plants and animals, only that the need for military defence created circumstances that allowed flora and fauna to thrive. The species biodiversity nineteenth-century naturalists observed would not have occurred if armed forces had not intervened. Many conservationists even manage former fortifications in a manner that strongly resembles premodern practices. A ruin in the middle of woodlands on the other hand can also have ecological value. Everything depends on local circumstances and establishing priorities. Leaving a former fortress covered with woody plants alone would be preferable if forest ecosystems are very rare in that specific area. One just has to keep in mind that in such instances abandoned fortifications become valuable because humans have overexploited ecosystems to such an extent that every green island in a sea of grey becomes significant. This is quite something else than fortifications' historical contribution to landscape diversity.