FORTIFIED SITES,

THE UNEXPECTED NATURAL RESOURCES

Walls and Gardens
Muren en Tuinen
Murailles et Jardins

For a lively fortified heritage

"Investing in your future"
Crossborder cooperation programme 2007-2013 Part-financed by the European Union (European Regional Development Fund)

Nord le Département
Chef de file / Lead Partner

west-vlaanderen
de gedreven provincie






WALLS AND GARDENS

The "Walls and Gardens" project – with the Département du Nord as Lead Partner – was set up within the framework of the European 2 Seas Interreg IVA cross-border programme (2007-2013). It has mobilized 22 partners from 4 different countries: France, the UK, Belgium and the Netherlands.

The objective of "Walls and Gardens" is to give the natural environment linked to fortified sites greater consideration, while enhancing and promoting the cultural value of this exceptional heritage.

The total project budget amounts to around €10.5 million, including €5.2 million ERDF. This European co-financing has allowed for the development of 16 sites, which are viewed as pilot sites for the studies carried out within the framework of the project.

The decision by all partners to work together as a network and exchange know-how has improved approaches to the rich ecological diversity present at the fortifications, thanks to shared experience and management practice.

The project has also provided a better understanding of the territory's heritage value and improved the cultural mediation implemented for each of these exceptional and unique sites.

Publications were created for local residents and tourists and a digital mobile application was developed, featuring a series of guided tours. The aim is to provide a better understanding of the history of the fortifications, often inseparable from the history of national boundaries and the wars that shaped their development over the centuries. It is also important to raise local residents and visitors' awareness about using and respecting these areas to ensure that their rich ecological diversity is preserved and that they continue to provide shelter for various plant and animal species, as well as offering an opportunity to discover nature.

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Bergues © P. Houzé.

EDITORIAL

Continuing on from the European "Septentrion" project (2003 - 2008), aiming to transform fortified towns into sustainable towns, the European "Walls and Gardens" project (2009 - 2014) has contributed to raising awareness of the rich ecological diversity present at fortified sites.

This project has mobilized 22 French, Belgian, British and Dutch partners with a goal of working together to better understand, preserve and promote this "living fortified heritage", by offering local residents and tourists accessibility and the means to understand these sites. The ecological management of fortified sites was one of the key issues covered by the "Walls and Gardens" project.

An ecological study, coordinated by the Province of West Flanders and involving exchange of experience, inventories, workshops, site visits and specialized approaches, resulted in the publication of technical specifications and this brochure, produced in three different languages.

Created by the Environmental Department of the Département du Nord, this brochure targets all those interested in managing fortifications as vulnerable natural sites. It presents and illustrates this "unexpected nature" which has developed over the centuries, alongside the history of the fortifications and the expansion of urban areas.

The future of fortifications' rich ecological diversity depends on the level of interest shown by those responsible for the sites and the pursuit of proactive policies. We hope that the brochure will contribute to this goal throughout the project territory.

Didier MANIER
President of the Conseil général du Nord

Guido DECORTE
Member of the Provincial Executive
Province of West Flanders

SUMMARY

INTRODUCTION

Coordinated by the Province of West Flanders, research into the ecological management of defensive sites was carried out in conjunction with all the partners.

Taking account of the architectural characteristics of fortified sites, it included an inventory of the various species of wildlife and was supported by practices implemented by the individual partners. The findings were analyzed and presented in the form of themed technical specifications. Designed as a methodological guide to be used by site managers or a specialized public (media, students, etc.), the work can be consulted on the project website [1].

This brochure provides a more concise overview of the research findings.

The action entitled "landscape and ecological management of fortified sites" invited the partners to reflect on issues relating to the conservation and protection of fortified sites from the point of view of architecture, landscape and ecology.

Of the 22 partners, 16 have carried out works involving investment, ecological development or mediation assistance, implementing certain recommendations outlined during the exchange of experience.

The overall project approach was supported by various partner institutions and associations. The Département du Nord, the Province of West Flanders and Essex County Council accompanied these works by carrying out communication activities and creating products for tourists to promote the sites.

An almanac, presenting the annual biorhythms specific to the ecosystems* of fortified sites, and an e-book, explaining the history and terminology of fortifications, coordinated and published under the aegis of the city of Ypres, have also been created [2].

A tourist guide, covering the four countries involved in the project, was also produced thanks to work carried out in conjunction with the Association pour la mise en valeur des espaces fortifiés de la région Nord-Pas-de-Calais. Its publication coincided with the 11th Euro-regional Fortified Heritage Days, in which partners from both networks participated.

"Walls and Gardens" was assisted by the Conseil d'Architecture, d'Urbanisme et d'Environnement (CAUE) du Nord which created the project website and supplied content. The various products mentioned can be found on the website.

Ecological engineers working on behalf of the cities, local authorities and the CAUE provided expertise for the research and work carried out. This international collaboration offered an effective way of cross-referencing viewpoints and recommendations from Dutch, Belgian, British and French stakeholders.

One of the project objectives was to establish solid references relating to the ecological development and maintenance of fortified sites, in order to promote contemporary and innovative management practices.

The aim of this publication is to highlight the unexpected natural resources of fortified sites, their rich diversity and the need to preserve it. ■

NOTES :

1. www.wallsandgardens.eu
2. *Everything you ever wanted to know about fortifications but were too afraid to ask, coordinated by Philippe Vanderghote, Paul Gilman and Wilbert Weber*

THE 16 "WALLS AND GARDENS" LOCATIONS: A VARIED RANGE OF EXPERIMENTAL SITES

LILLE

Developing the future Champ de Mars, linking the Citadel to the Old Town.

WATTEN

Works to improve accessibility to the abbey site

VEURNE

Designing a park redrawing the outline of the former bastions and ditches that were once part of Vauban's 'Pré Carré' system.

HELLEVOETSLUIS

Restoring the sea-facing defences (fronts I and II), to create a pleasant walking route.

FRANCE

BERGUES

Creating a footpath to facilitate visitor access to the Saint-Winoc crown-works.

GRAVELINES

Restoring an underground chamber, situated within the fortified wall, revealing the remains of earlier structures (15th - 17th century).

MONTREUIL-SUR-MER

Series of works to render the Bastion de Bouillon accessible to the public.

BELGIUM

LE FORT DUFFEL

Developing this element of the Antwerp fortifications, reconciling shelter for bats and accommodating visitors.

YPRES

Creating an interpretation centre in the former casemates and planting a garden of dye-plants on the ramparts.

ENGLAND

CHATHAM (MEDWAY COUNCIL)

Constructing the RSME Bicentenary Bridge, linking Fort Amherst to the Great Lines Heritage Park, bearing witness to the fortified defences along the River Medway.

CASSEL

Restoring the 19th century "Alpine way", leading up to the park at the top of Mont Cassel.

HARDELOT

Landscaping works at the Château d'Hardelot fortifications to create a Tudor-style garden.

SAINT-OMER

Restoring the former prison built on the castle mound, a vestige of the town's earliest fortifications.

BRUGES

Creating a museum on the history of the fortifications in the Gentpoort and restoring a vegetable garden at the foot of the ramparts.

NETHERLANDS

VLISSINGEN

Restoring the city's former Napoleonic casemates, which have been transformed into a history interpretation centre.

JAYWICK (ESSEX COUNTY COUNCIL)

Improving access to the Martello tower, a surviving feature of the system designed to defend the English coastline, which has been transformed into a cultural centre.

CHAPTER 1: OVERVIEW

Château d'Hardelot and the Condette wetlands © P. Fruitier, juin 2014.

HISTORIC AND GEOGRAPHIC FEATURES

Long-recognised as strategic regions, the Northern French plains, Flanders and the Southern Netherlands feature one of Europe's highest concentrations of fortified towns. Traces of fortifications on the East coast of England, which played a key role in thwarting attacks from mainland Europe, are also of considerable interest. A frontier-land, bordered by the North Sea, it was fought over by major European powers right up until World War 2.

A landscape of vast plains, marshlands and waterways, punctuated by occasional low hills and rises. Although marshlands and forests slow down the enemy in the event of attack, rivers facilitate their advance, offering a course to follow before seizing control of land, towns and wealthy abbeys. Defence systems have therefore always been a feature of the landscape.

Fortified sites were mainly established near estuaries or along tidal rivers like Coalhouse and Tilbury forts, on the banks of the Thames, or the town of Gravelines, built at the mouth of the River Aa. Some were set up on the valley floor or on the edge of wetlands, like Lille Citadel in the Deûle valley, the Saint-Omer fortifications at the heart of the Audomarois marshes or Château d'Hardelot alongside the Condette marshlands. Still others are situated on valley slopes, like the Montreuil ramparts overlooking the Canche valley.

Fortified dwelling sites, known as oppida, were established back in Gallo-Roman times to protect the land against Caesar's advance. Through the ages, fortified walls were constructed, to which wooden towers were later added.

In the Middle Ages, mounds or knolls were raised using earth from the surrounding ditch, thus creating a castrum, at once a seigniorial dwelling and fortified redoubt. In Saint-Omer, the former prison, built on the castle mound, received ERDF funds for restoration within the framework of the Walls and Gardens project. Circular fortifications were also built on the coast, as is the case in Bergues or Veurne, which are contemporary with those constructed in Zeeland and Holland.

View over lowlands from Mount Cassel © M. Méreau.

Towns developed during the 12th century and the Counts of Flanders became increasingly powerful. In a bid to demonstrate their authority and protect their territory, they drained coastal areas and the Aa marshlands to establish fortified towns along the coastline (Gravelines, Dunkirk, Calais), which served as fore-ports for earlier towns (Bergues, Saint-Omer, Ypres).

In the 13th century, Philippe Auguste captured Saint-Omer and reinforced the ramparts at Montreuil-sur-mer.

In the late 14th century, after the Hundred Years War, boundary walls were built around towns which passed to and fro, under French or Burgundian domination.

The 16th century brought greater artillery precision and increased weapon range, necessitating modifications to the ramparts. The bastion was invented in Italy, allowing for cross-fire and preventing dead angles at the foot of towers. Charles V brought Italian engineers to Northern France to modernize defences. The new defensive system was first







put into practice at Fort Rammekens, near Vlissingen.

In the late 17th century, Louis XIV launched a campaign to take control of Flanders. The city of Lille fell to the French in 1667. The following year, Vauban built the "Queen of Citadels" and commenced work on modernizing the region's strongholds to form a "Pré Carré" (a square or duelling field). This double line of bastioned fortifications stretched from the North Sea to the River Meuse, closing in a territory which lacked natural obstacles and marking the border between the Kingdom of France and the Netherlands.

View of River Thames from Coalhouse © P. Vanderghote.

View within Fort Tilbury © M. Méreau.

Progress made in artillery rendered bastioned defences obsolete in the mid 19th century. Over time, walled fortifications were partly dismantled to leave room for the expanding town. Following the Franco-Prussian war in 1870, General Seré de Rivière was placed in charge of implementing an "iron curtain", a network of isolated forts to provide mutual cover. At the same time, General Henri-Alexis Brialmont was building similar structures around the towns of Antwerp, Liège and Namur in Belgium. Fort Duffel is one such example.

In England, strategic rivers were protected by a system of bastioned forts, such as Tilbury, Amherst and, more recently, Coalhouse Fort.

Between 1804 and 1812, a series of small, thick-walled "Martello Towers" of around 12 metres high, were built along the coastline to defend the British Isles against the Napoleonic threat. These squat towers were capable of resisting cannon fire and accommodating a single heavy artillery piece, on a platform in the roof, with an uninterrupted 360° view. A surviving Martello tower in Jaywick (Essex) has been transformed into an exhibition venue.

Thus, the sites included in the Walls and Gardens project come in a variety of different forms: from the castle mound to Napoleonic forts, via Medieval fortifications and those designed by Vauban, they illustrate key evolutions in military history. Defensive systems were very similar on either side of the various national boundaries and the sites now share the same conservation and development issues. Inspired by French history, this chapter illustrates the way these defences developed over the centuries, are an experience common to different countries. Former enemies, they are now determined to offer this military heritage a new future and preserve its exceptional living environment which has also evolved.

OVERVIEW

Plant and animal populations began developing as soon as the structures were built and have survived despite changes to their environment. One of the current challenges is to maintain and preserve these relictual populations, confined in once isolated sites that are now situated in an urban environment, as is the case in Duffel or in the forts linking Hellevoetsluis to Brielle in the Netherlands.

Interpretation trail at Bergues © P. Houzé.

PRESENT-DAY CONDITION OF THE SITES

LIrrespective of the period during which they were built, the fortifications feature a number of specific elements: buildings, ramparts, trenches, embankments, shelters, glacis... each of which constitute "natural" habitats* for a rich diversity of plants and animals.

Fortified sites often stand out against their environment in terms of soil, land relief and the presence of water and deliberate planting. Soil conditions were significantly disturbed during construction works and large-scale masonry structures were erected. Tunnels and chambers were dug and specific species planted.

Not all the areas studied within the framework of this project have evolved in the same way. Since losing their initial military function, a number of them have been allocated new roles, as recreational areas for example, others have remained unused and some have even been damaged. Interest in fortified heritage is fairly recent.

Major restoration campaigns have been undertaken since the second half of the 20th century. In the majority of cases, restoration work disturbed or even destroyed shelters and other elements crucial to the survival of plants and animals. Indeed, ecological concerns were a low priority at that time.

Restoration work is still underway or scheduled at various sites, such as Gravelines, Ypres, Hellevoetsluis and Fort Amherst. Exchange of expertise and methodological reflection carried out within the "Walls and Gardens" partnership, have enabled the town of Bergues to devise a project to develop and promote the Saint-Winoc crown-works. Accessible to people with reduced mobility, this 1.2km footpath was specifically designed to capture the spirit of the site by mirroring its specific geometry, as well as preserving the most vulnerable elements of the protected natural area. Partial and selective clearing of the ramparts was carried out ahead of landscaping (removal of ivy, trees and shrubs) in order to stop the process by which the structure is gradually weakening.

Fortified sites offer tourists and local residents history-steeped locations for walking and discovery. Set up in former casemates or city gates, interpretation centres provide information on the history of the site and town that is often quite new to the general public. This is the case in Bruges, Ypres, Vlissingen, Hellevoetsluis, Fort Amherst and the Jaywick Martello Tower.

At sites where fortifications are harder to visualize, various mediation tools are available to enhance visitors' understanding. Devoid of any masonry, all that remains of Watten's 17th century fortifications, which protected the town and the abbey, are the earthen bastions. With the exception of the castle mound, the fortifications have disappeared entirely in Veurne, however a public park showing the traces of the bastions and ditches was recently landscaped to evoke the history of this former stronghold in the first line of Vauban's Pré Carré defences.

Other sites are still used and occupied by the army, such as Lille Citadel which houses

Interpretation panels at the Montagne de Watten © M. Méreau.

Aerial view of Veurne © Veurne.

the Headquarters of the Rapid Reaction Corps - France. During the 20th century, the external fortifications (ditches, ramparts, embankments) were gradually given over to civilian use and recently rediscovered their ecological role as part of a recreational park with a heritage focus.

Designed to defend the dockyard from land-based attacks, Fort Amherst (Chatham, GB) housed a number of British army units until World War 2. It is now owned by a registered charity which is currently managing and restoring the fort with the support of Medway Council. The RSME Bicentenary Bridge was built by the Royal Engineers in 2012. A wooden structure, it spans one of Chatham's defensive ditches, allowing residents to cross between Gillingham and Chatham and enabling visitors to discover this fortified site in Kent.

Several international charters and conventions govern heritage conservation and restoration in the four partner countries: the Charter of Athens (1930), the European Cultural Convention (1954), the Charter of Venice (1964), the Charter for the Protection of Archaeological Heritage (1990), the European Convention on Landscape (2000), the Faro Convention (2005) and the Ename Charter (2008). Once ratified by the Member States, European Council conventions provide the basis for national and regional legislation.

A number of existing sites have also been assigned a specific protected status. This varies between the different countries. In France, it is either the Heritage Code or the Environment Code that governs the protection of fortified sites.

As well as eliminating key heritage and historic resources, dismantling fortifications results in the destruction of natural areas.

OVERVIEW

Centranthus ruber © V. Levive.

ECOLOGY AND MANAGEMENT

Once confined within the military heritage domain, fortifications have since been recognized as new recreational and cultural sites and important natural environments. Providing a veritable green oasis in landscapes that are often highly urbanized, fortified sites shelter a variety of different species in a natural environment that is becoming richer and more diversified over the passing centuries.

It is important to remember that, like ecosystems*, fortifications operate in a network. Many fortified sites are part of a larger structure (boundary wall, defensive line, etc.). This overall structure and its constituent elements are of equal importance when considering the ecological value of fortified sites.

Because of their specific features, they offer a wide variety of ecological conditions and house a wide range of habitats* for plants and animals.

A host of different species therefore thrive in the various types of environment and habitat*: walls, buildings, whether earth-covered or not, buried or visible, ditches and moats, expanses of water, embankments and glacis.

Typical fort showing planting

Ramparts, moats and walls have allowed a specific fauna and flora to develop, suited to the individual living conditions offered by these structures. Built elements of fortifications serve as man-made substitutes for natural cliffs, rock-faces, caves and cavities.

These locations offer the highly variable conditions required for establishing fauna and flora populations (dryness, humidity, warmth, coolness, light, darkness, high levels of limestone) and for the different uses they make of the site (reproduction, overwintering, feeding, etc.).






The living conditions here are particularly suited to bats, for example, especially since alternative hibernation sites are becoming rare: hollow trees are removed and buildings are restored or bricked up. Similarly, cracks and spaces within the walls have gradually provided alternative habitats* for cliff-face plants, particularly welcome in a region where cliffs are rather rare.

One of the key qualities of these fortified sites can be attributed to their considerable age. Several centuries old and generally situated in unspoilt natural surroundings (free of pollution and relatively undisturbed by human presence), fortifications have been colonized by fauna and flora. Several species were already present when the fortifications were built, some have been maintained and are still present, thanks to the specific conditions available at these sites. However, they are directly threatened by restoration, management and development activities, as well as the everyday use of the sites.

Preserving and developing the ecological value of fortified sites therefore requires appropriate and sustainable management practices, based on a precise knowledge of the species and habitats* present. There may well be tensions between the conservation and restoration of cultural heritage, natural heritage and visitor traffic. Reconciling natural and urban areas is not always an easy task.

It was long believed that towns and cities were scarcely affected or unaffected by nature conservation policies, or exclusively involved in managing ordinary biodiversity. Yet, for some time now, fortified towns have played host to extraordinary biodiversity. For example, over forty plant species growing in Lille Citadel in the early 20th century are now protected by law. Some of these species are still present today: a number survived since that time and others reappeared when the conditions required for them to grow were recreated (thanks to restoration of water features, turf-stripping*, removal of infill material or clearing works). Wildlife populations are also affected, including emblematic species such as the peregrine falcon (Falco peregrinus) and the common kingfisher (Alcedo atthis). One of the remaining key challenges in an urban area is the need to raise awareness amongst the general public and teach the importance of preserving natural heritage.

In order to minimize any tensions, those responsible for fortified sites are required to integrate several objectives within a management plan. The plan should define the challenges raised by the site, as well as objectives relating to conservation, accommodating visitors and promoting cultural value, on the basis of a detailed inventory of the site in question (geography, climate, history, visitor traffic, fauna, flora, etc.). It then outlines the actions required to successfully balance biodiversity, tourism, recreational pursuits and heritage conservation.

As well as offering these territories significant heritage value, fortifications are of considerable ecological value. Allowing the public to enjoy a site with this type of history and landscape means fulfilling a key demand: reconciling nature, site use and heritage.

This heritage conceals a wealth of natural resources that are sometimes fragile and often unexpected... ■

CHAPTER 2: UNEXPECTED NATURE

Moat, reed nursery and widdow trees next to Hellevoetsluis © P. Fore.

Despite the widespread belief that fortifications are completely devoid of vegetation, deliberate planting has always been an integral part of defensive structures for military and economic reasons. Nature, therefore, has a historic right to its position within fortifications.

Certain species, which were present before the fortification, are still present today, mainly plants like sea arrowgrass (*Triglochin maritimum*) and bee orchids (*Ophrys apifera*).

"HISTORIC" NATURE

- HISTORIC DEFENSIVE ROLE OF PLANTING

Deliberate planting was used to provide protection, defence and camouflage. Trees were used to conceal buildings and hide cannons, set up on the ramparts.

Large earth banks and planted vegetation are the most commonly used technique in military fortifications, rather than brick and stone structures.

Trees such as ash (*Fraxinus sp.*), elm (*Ulmus sp.*), willow (*Salix sp.*), oak (*Quercus sp.*) and birch (*Betula sp.*) thus belong to the original forest stands. Hedges were often planted on the banks of ditches and moats and used as barriers. These were mainly varieties such as hawthorn (*Crataegus sp.*), blackthorn (*Prunus spinosa*), locust (*Robinia sp.*) and broom (*Genista anglica*).

Strategies clearly varied from one site to another, due to geographic, geological and hydrological differences, they also varied between times of peace and times of war and in accordance with developing siege techniques and tactics.

The publication of military manuals and the capture of enemy fortifications led to exchange and imitation. This explains the striking similarities between fortified sites in different countries.

Thus, in 1695 in Hellevoetsluis (Netherlands), hedges and trees were only planted on the fortification's Eastern side. Existing vegetation was preserved towards the North Sea to allow for gunfire.

In a publication entitled *La science des ingénieurs* (1734), Bernard Forrest de Bélidor (1698-1761) outlines how ramparts can be consolidated using three rows of trees: the first at the foot of the ramparts, the second at a distance of two or three feet (90-120 cm)






from the terreplein, and the last on the slope of the fortified wall.

Hawthorn hedges and elm trees were planted in Brielle (Netherlands). Hawthorn hedges provide an additional defensive element around moats or alongside ditches, creating an obstacle for an attacking force. Elm trees offer good shade in summer and their dark colour can be used to hide the outline of the fortification.

The Elm, relict tree from military plantations? © V. Levive.

Thus, Johannes Gerrit Willem Merkès, in *Verhandeling over het belang der vestingen voor den staat* (1827) recommended that a double row of trees should be planted to camouflage defending soldiers, as well as coppice wood on the glacis.

The roots of this coppice would create an obstacle to hamper the digging of galleries or trenches.

By the late 19th century and early 20th century, planting was mainly used for camouflage. In his Nederlandse Militaire Handboeken (1861), Van Kerkwijk recommended creating a dark and feathered screen of planting inside the rampart to hide the outline of the fort. This screen consisted of trees and shrubs with dark leaves, such as Ulmus sp. – and species with a similar appearance. Bushes were more specifically planted on the earth covering buildings, on the superior slopes or 'plongées', as well as adding to tree screens. This arrangement prevented people and equipment from being distinctly silhouetted against the clear sky.

- HISTORIC ECONOMIC ROLE OF PLANTING

Planting strategies were also of interest from an economic point of view, since they were used for production purposes.

Trees provided a stock of wood in the event of siege. This was then used for heating, cooking and as a structural material.

Trees, especially elms, were a valuable economic commodity in times of peace.

Embankments and glacis served as grazing grounds for a number of different reasons. Animals could be used to "mow" the grass naturally and served as an essential source of food for troops during times of war.

UNEXPECTED NATURE

- NATURE'S HISTORIC RECREATIONAL ROLE

Fortifications have also served more recreational purposes.

Despite being constructed for military reasons, the sites gradually began to accommodate various forms of mixed use. Using military fortifications for recreational purposes is not a new phenomenon. Thus, back in the 19th century, grassy structures were used as venues for leisure activities. The 'Promenade du Préfet' on Lille ramparts and the walkways created on Antwerp's tree-lined ramparts are two such examples.

Public park in Saint-Omer in the former fortifications © M. Méreau.

In the past, fortified areas were sometimes converted into public and landscaped parks, as was the case for the Saint-Omer park which was created when the town's fortifications were dismantled. Similarly, walkways have been created along the line once occupied by the ramparts in Bruges and Ypres. These landscaping works, which often date back to the second half of the 19th century, are now part of the history of these sites.

The sites of ramparts are often preserved from any urbanization by the application of military easements prohibiting any construction work. These areas thus become land reserves of considerable importance.

However, historic natural resources are confronted with spontaneous natural development after the fortifications were decommissioned, as well as urban expansion which leads to sites being used as leisure areas. A number of plant and animal species (wall plants, bats) have adapted to these specific environments, but their survival now requires careful monitoring.

Fort Amherst, Chatham © P. Corens.

VERSATILE NATURE

- FROM BUILDING IN NATURE TO NATURE IN BUILDINGS

At the time they were first built, fortifications were surrounded by areas that had remained largely unspoilt by human presence. They immediately "offered" specific, and sometimes rare habitats* which soon began playing a role as alternative habitats* to their natural counterparts: walls replaced cliffs, casemates replaced caves and moats replaced rivers and marshlands further along the valley.






Fortifications have lost their military value and function over time and the civilian uses which have developed in the interim are often detrimental to natural environments.

Nowadays fortified sites often provide pockets of natural diversity, where wild species continue to thrive or at least survive. Hence the recent understanding that human intervention is required to protect them and encourage the return of improved biodiversity.

In Bergues, for example, a heron colony set up home ten to fifteen years ago, at the demilune in the Hondschoote crown-works. Herons and little egrets (*Egretta garzetta*) use this bastion for nesting purposes. A veritable island, sheltered from predators and undisturbed by visitors, it thus plays home to a fairly large colony. Grey wagtails (*Motacilla cinerea*) also nest at this site. Moreover, the site also provides a winter roost for species such as the great egret (*Ardea alba*), Eurasian jackdaw (*Coloeus monedula*) and stock pigeon (*Columba oenas*).

Vegetation is, along with water, the main factor in rampart's deterioration. Fort Amherst, Chatham © P. Corens.

Coloeus monedula © T. Tancrez .

- ISSUE OF TREES GROWING IN OR CLOSE TO WALLS

The main enemies faced by walls are time and the climate: passing time wears the stone and cracks the facing, while weather often brings water and ice.

Trees are never far behind, arriving uninvited, as a colonizing force, and taking root deep within the stone, which facilitates the infiltration of water.

© E. Wauters.

UNEXPECTED NATURE

Ash trees, elder trees, elms, sycamore, buddleia... many are the trees and bushes invading the constructions © Y. Tison.

Trees and stone fortifications are not always the most compatible of partners and maintenance measures already established several centuries ago are still relevant today.

At the end of World War 2, many sites were abandoned or closed down since technological advances had rendered them redundant. Without maintenance, wildlife has developed spontaneously and now occupies new habitats*.

Urbanization has also gained ground since that time: certain fortifications, which were originally on the outskirts of towns and villages now find themselves in the centre of towns or cities.

The inaccessibility of certain parts of fortified sites - ditches, in particular - creates very interesting ecological conditions. Walls shelter a host of species which thrive on rock-faces (chasmophytes*). Species normally associated with the Mediterranean sometimes develop on the Southern slopes of ramparts (spreading pellitory *Parietaria officinalis*, common wall lizard *Podarcis muralis*), while North-facing slopes house species normally associated with mountainous areas (brittle bladderfern *Cystopteris fragilis*).

- FORTIFICATIONS AND CURRENT USES: NATURE IN THE TOWN

Attitudes towards nature have changed and observing, understanding and preserving plant and animal species has gained a new level of importance. In an increasingly urban civilisation, fortified sites are particularly favourable locations for discovering nature. Their close proximity to towns and cities reinforces this exceptional value as venues for observation and education. Moreover, they also play a key role in the conservation of wildlife species. Having sought shelter in fortifications for some time now, bats are the best-known and most common example. Fully protected, bat species must be treated with as much care as the ramparts themselves.

- NATURE SPECIFIC TO FORTIFIED SITES

The different elements which make up fortified sites are frequented by a vast array of species, some of them being specific to these sites.

The woods, for example, shelter species of woodpecker and bats. Bats use hollow trees for shelter in winter and summer. Cracks, cavities and loose bark are also of interest to woodpeckers.

A diverse variety of plant life has developed in ditches and insects thrive in the moats. The sharp incline of certain slopes makes them relatively inaccessible, so that when the sites lost their military function, plant life was able to develop with little disturbance. This often makes them very important from an ecological point of view.

The glacis (external slope rising gently towards the fort) is also of considerable interest for biodiversity: its intermediate



FOCUS
Nature and fortification, by Philippe Vanardois



Erithacus rubecula, Picus viridis, Fringilla coelebs. © T. Tancrez.

position between the fortification and its environment attracts species which are less sensitive to disturbance.

However, certain habitats* do require partial restoration. Very rich, open habitats*, colonized by vegetation some time ago, when plant biodiversity was still highly diversified, have been lost and turned into wasteland or spontaneous afforestation.

A certain number of species living in and around fortifications have been depicted by the naturalist illustrator, Philippe Vanardois. While many of them are common, some are specific to the ecological habitats* and conditions offered by fortified sites. The specific species which live in these sites, particularly well-suited to their requirements, include greater horseshoe bats (*Rhinolophus ferrumequinum*), spreading pellitories (*Parietaria judaica*), wallflowers (*Erysimum cheiri*), common wall lizards (*Podarcis muralis*), Eurasian kestrels (*Falco tinninculus*) and cave-dwelling* Eurasian Jackdaws (*Coloeus monedula*).

The illustration also depicts a number of more common plant and animal species, such as the European robin (*Erithacus rubecula*), the great crested grebe (*Podiceps cristatus*), the Eurasian coot (*Fulica atra*), the grey heron (*Ardea cinerea*) as well as the common elm (*Ulmus campestris*) and common ivy (*Hedera helix*).

Water-based habitats*, created by moats, trenches and reed-beds, play home to yellow iris (*Iris pseudacorus*), yellow water-lilly (*Nuphar lutea*) and the Eurasian reed-warbler (*Acrocephalus scirpaceus*); while wooded habitats* in fortified sites are frequented by the long-eared owl (*Asio otus*).

FOCUS
Chasmophytic species*

UNEXPECTED NATURE

Certain plants have gradually established themselves in gaps and spaces within the walls. Rooted in cracks in the rock-face and slits in the walls, they colonize the shallow depths of earth accumulated there and live in harsh ecological conditions. Suited to nutrient-poor soils, these pioneer plants make the most of moisture concealed in crevices, which also protect them from excessive exposure to sunlight, wind and adverse weather conditions.

Some wall plants (known as rock-crevice plants*) are valuable from a heritage point of view, due to the scarcity of natural rock faces in Northern France: black spleenwort (*Asplenium adiantum-nigrum*) for example, which grows on the Cassel and Lille fortifications, is included in the regional red list* of threatened species. Moreover, the early hawkweed (*Hieracium glaucinum*), present on the Lille fortifications, is very rare in the Nord-Pas-de-Calais region.

Other species such as the ivy-leaved toadflax (*Cymbalaria muralis*), wall hawkweed (*Hieracium murorum*), wall rue (*Asplenium ruta-muraria*) and spreading pellitory (*Parietaria officinalis*) have also taken up residence in the fortified remains.

Parietaria judaica © E. Wauters.

- INVASIVE EXOTIC SPECIES

It is also worth noting the presence of plant and animal species which adapt a little too well to these habitats*, to the point of becoming invasive. New plants were brought in as new functions were attributed to fortifications, mainly within the context of parks; exotic species were frequently used.

Invasive exotic species are those that establish themselves outside their natural range, following human introduction (either intentional or unintentional) into a given territory, and threaten indigenous* species due to their proliferation. Uncontrolled by consumers, parasites or pathogens in this new host habitat*, they spread quickly and can cause economic and health problems in addition to disturbing the ecological balance.

On the other hand, species such as stinging nettles (*Urtica dioica*), and brambles (*Rubus fruticosus*) can become invasive on a local scale. However, these are indigenous* species, naturally controlled by disease and predators.

Introduced species demonstrating invasive behaviour in fortified areas, include: creeping water primrose (*Ludwigia peploides*), floating pennywort (*Hydrocotyle ranunculoides*), New Zealand pigmyweed (*Crassula helmsii*), Himalayan balsam (*Impatiens glandulifera*), parrot feather (*Myriophyllum aquaticum*), and western waterweed (*Elodea nutallii*). Japanese knotweed (*Fallopia japonica*) and butterfly bush (*Buddleja davidi*i) are also both invasive species, present in a variety of habitats*.

Ondrata zibethicus © T. Tancrez.

FOCUS
Bats

In addition to the plant species mentioned, fish (pumpkinseed sunfish, *Lepomis gibbosus*), certain mammals such as the muskrat (*Ondatra zibethicus*), birds (particularly ducks) and even reptiles (red-eared terrapin, *Trachemys scripta elegans* released into the wild) can also be a source of concern. Muskrats dig burrows in steep banks, making them unstable, and can seriously damage the fortified structures.

By taking over the ecological niches* of local species, invasive exotic species can cause a decline in biodiversity, thus reducing the heritage value of the site.

Florida turtles, freed by their owners are stocked in the ponds of Lille' s zoo. Nevertheless, some are escaping and then become invasive © Y. Tison.

Muskrat burrows © Y. Tison.

This spontaneous and diversified nature, which has successfully developed since the sites were abandoned, is now threatened in turn.

Chiropteras (or bats) are particularly fond of fortified sites. They constitute an ideal habitat*, especially in regions where natural shelter is rare.

Earth-covered buildings, wet ditches, wooded areas and meadows offer a complex network of shelters, hunting grounds, grouping and reproduction sites, satisfying these mammals' different requirements.

Wooded areas provide hunting grounds for example. A number of bat species which favour aquatic environments, such as Daubenton's bat (*Myotis daubentonii*) and pond bats (*Myotis dasycneme*), as well as the majority of other bat species, also use wet ditches. Hollow trees and buried buildings can serve as winter shelter; summer shelters are selected in accordance with their dryness and the warmth they offer.

Fortifications thus offer bats the conditions required for hibernation, i.e. stable temperature and humidity levels, in addition to darkness.
It is important to note that bats are very sensitive to the slightest disturbance during hibernation. Being woken up prematurely can kill them since waking uses up a considerable amount of their precious energy store...

UNEXPECTED NATURE

HERITAGE WILDLIFE

Some animal and plant species are protected, others are considered to be of heritage interest* due to their rareness.

Regulatory provisions covering the protection of fauna and flora exist in each different country. Various different protection levels have been defined: regional (regional red list*) or provincial, national (national red list*), European (Natura 2000* network, international conventions), or even worldwide (IUCN* red list*).

The IUCN* red list* evaluates the conservation status of plant and animal species on a worldwide scale. It can be broken down for individual countries or regions of the world.

International conventions, such as the Convention on Biological Diversity, the Bern Convention and the Bonn Convention, govern the protection of certain species on a European scale.

Fortified sites often play host to rare, threatened and protected species within habitats* of ecological value such as walls, embankments and glacis.

Favoured by bats, the habitats* are often protected in their own right and designated as Special Areas of Conservation (SACs) within the framework of the Natura 2000* network, as per the European "Habitats-Fauna-Flora" directive of 1992. The fortified sites at East Tilbury, Duffel and Hardelot are examples of this. The two European directives, upon which the Natura 2000* network was founded, define the species and habitats* of Community interest, which are endangered within the European Union. The list includes several species of bat. Thus, the Montreuil-sur-mer fortifications are part of the Natura 2000* network, and house a relatively well-protected population of bats.

Moreover, the fortified sites at Bergues (ramparts), Watten and Le Quesnoy (moats and ponds) have been listed as natural areas of importance for ecology, fauna and flora (ZNIEFF).

By way of an example, the fortifications in Lille boast over forty plant species of considerable heritage value; these include black spleenwort (*Asplenium adiantrum-nigrum*), which is also present on the Cassel fortifications and features on the regional red list*. Some of these species have reappeared following the introduction of appropriate management measures. A rare species, bird's-foot (*Ornithopus perpusillus*) has reappeared after turf-stripping* was implemented in Hellevoetsluis. ■

Le Quesnoy © DR

To the right :
Hart's-tongue fern (*Asplenium scolopendrium*) in the foreground and a rare species, the soft shield fern (*Polystichum setiferum*), in the background © Y. Tison.

CHAPTER 3: WHAT ABOUT THE FUTURE?

Lille © P. Houzé.

CHALLENGES FOR FORTIFIED SITES

Fortified sites face a number of different challenges:

- the challenges of restoration, in terms of historic, landscape and cultural heritage;
- the challenges of accommodating visitors and visitor traffic, relating to the different uses at the site;
- the challenges of ecological isolation, which are exacerbated in an urban environment;
- the challenges of preserving biodiversity.

Depending on the context, fortified sites are viewed as public parks, family-oriented gardens, walking venues, or even sports grounds and adventure courses. Though often visited by nature enthusiasts, they are also popular with campers, cyclists and motocross fans. Not all these activities are always compatible with the objectives of preserving natural, historic and landscape heritage.

Moreover, the areas around fortified sites have often evolved in such a way that natural habitats* are gradually lost (industrialization, urbanization, intensive agriculture).

Consequently, fortified sites have become shelters of significant ecological value due to their considerable age. However, this isolation phenomenon can lead to a decline in the site's wild fauna and flora populations due to the increasing scarcity of exchange between individuals.

The continuity of the ecological network, a prerequisite for its proper function, therefore depends on preserving ecological corridors* and links between the different sites; hence the importance of harmonizing the restoration of similar fortified sites, an approach undertaken within the framework of the Walls and Gardens project, through shared cross-border experience, in order to allow this exchange.

Ecological isolation mainly affects fauna, since certain plant species are capable of surviving in seed form in a dormant state in the ground (with germination capacity of over a century in some cases!) until the seeds are uncovered during works at the site. There are a number of different types of ecological corridor*: hedges, embankments, paths, ditches, waterways. They provide a link between different shelter sites.






The existence of biological connections between the sites is a prerequisite to the conservation of natural habitats* and associated species. The notion of ecological network extends beyond national boundaries...

Managing fortified sites must therefore involve a comprehensive approach, focusing on three key areas: use, heritage and nature.

Ecological objectives sometimes clash with those involving the preservation of historic heritage value or with the different ways in which the site is used. However, maintaining wildlife in an urban environment and applying the principles of sustainable development are essential to satisfying the challenges of educating the public and raising their awareness of nature, as well as ensuring the continuity of the network of natural areas within the territory, particularly in the urban sector (within the framework of France's TVB ecological network*, and 'dark corridors'*).

All these challenges must be taken on board in order to reconcile the site's development from the point of view of culture (through the restoration of architectural and landscape heritage), tourism (by considering the different uses of the site and facilitating visitor access to the sites) and preserving biodiversity (by implementing targeted ecological management practice).

HOW CAN THESE CHALLENGES BE RECONCILED?

Seeking to reconcile the challenges of use, heritage and nature within the framework of the management, development and restoration of fortified sites seems both appropriate and necessary.

To achieve this, educating the public and raising their awareness of the ecological challenges faced by these sites plays a key role. Consultation with the different users of the fortifications is also necessary at various stages to establish alternatives, particularly in the event of conflicts between uses. Finally, devising a management plan is essential so that the various challenges to be reconciled can be organized in a practical and sensible way.

Communication campaign explaining why old trees are uprooted and locating the future replacements (Bruges) and Information board on the ecological interest of dead wood (Lille). © M. Vansteenhuyse, P. Corens.

WHAT ABOUT THE FUTURE?

Restoration in Bergues © P. Houzé.

"Conventional" restoration work at fortified sites generally leads to the destruction of habitats* and species, such as the specific plants which grow in the walls*.

One solution consists of dividing the schedule of restoration works into phases and staggering them zone by zone, in order to preserve biodiversity. Ideally, periods of flowering should be avoided and walls* should be checked for use by certain species (bats, birds, etc.). Spreading the work over long periods of time encourages the gradual re-colonization of sites by fauna and flora, particularly in the case of walls* since it can be a fairly long process.

Although mistakes have been made in the past, more effective management actions from an ecological point of view are now designed to encourage the preservation of wildlife in fortified areas.

EXAMPLES OF GOOD PRACTICE IN ECOLOGICAL MANAGEMENT

- RESTORING WALLS

The roots of plants established on walls* can lead to moisture infiltration and damage masonry. Conventional restoration techniques involve "cleaning" the entire wall by removing all vegetation and re-pointing the joints with new mortar. Although this solution offers technical and visual advantages, it is no longer appropriate from an ecological point of view. A double inventory of the entire wall should therefore be made, mapping damage observed, as well as plant species established. The two maps can then be compared to define priority intervention areas for the restoration works, and areas of the wall that should be preserved for the associated flora and fauna species.

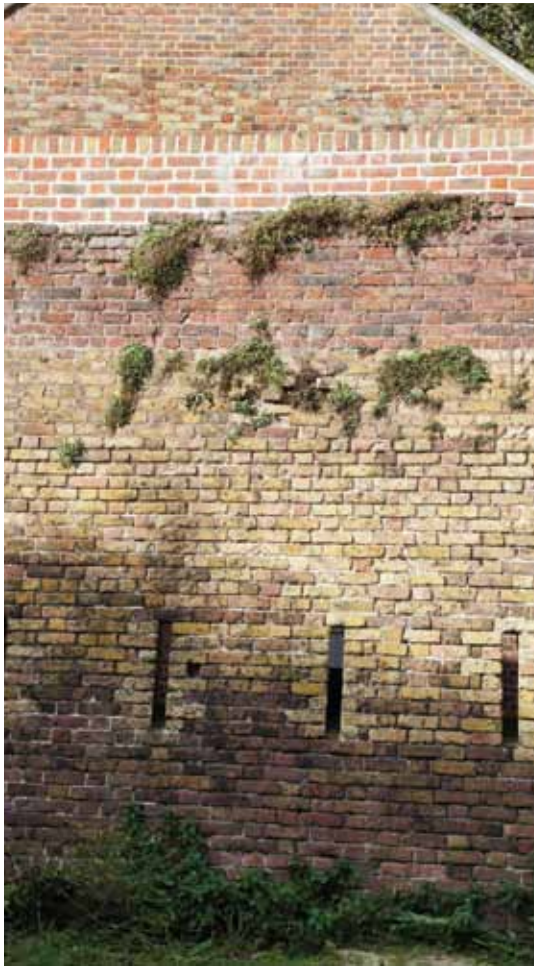
Striking the right balance between preserving plants and restoring the ramparts, Lille © droits réservés.






Materials used should be as close as possible to the original (lime mortar). A technique involving high-pressure air can be used, without any water or sand. Moreover, combining different materials and techniques enables the creation of varied and appropriate conditions to accommodate plants.

Striking the right balance between preserving plants and restoring the ramparts, Ypres © droits réservés.



Fort Amherst. Unrestored parts become resevoirs for walled plants which colonize little by little restored parts © E. Wauters.

- BANKS: A SLOPING ISSUE

Using banks as an example offers a concrete illustration of the problem studied. Ecologically speaking, gently sloping banks are particularly suited to the development of the rich flora typical of wetland habitats*. However, the banks are rather steep and smooth from a historical point of view and therefore feature fairly low levels of riparian vegetation.

They can be reshaped, in accordance with historic profiles without using steepening measures, such as bank walls*, sheet-piling or wattle-work. Wetland works may include re-digging ditches that have been partially or totally filled.

- EROSION OF EMBANKMENTS

A high number of military embankments are still present in fortified areas. They have generally been eroded by intensive traffic in the form of walkers, joggers, mountain-bikers and other users of fortified sites. In order to protect the embankments from further erosion, an alternative consists of taking inspiration from the techniques used at the time of their construction: concentration of traffic, installation of small wooden staircases, placement of obstacles to

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block unintended routes (e.g. tree-trunks as barriers) and conserving trees. These types of installation and crossings exist for example in Bruges and Lille.

From up to down: Lille, a schematic view / Boutrange © P. Fore.

GentRozenbroeken © P. Fore.

- ECOLOGICAL IMPORTANCE OF DEAD WOOD

Old or dead trees which are still standing are deliberately left in place at Lille Citadel, Fort Duffel and Fort Rammekens. They provide valuable habitats* for fauna and flora which depend on dead wood: mosses, ferns, mushrooms and insects (especially beetles). Trunks and branches lying on the ground are soon colonized by species of mushrooms.

Moreover in Bruges, a number of chestnut trees have been cut to leave pollard or snag trees.

Bruges © M. Vansteenhuyse.

Dead tree mushrooms on a trunk left next to a path in Lille's Citadel park© P. Corens






Of the old beech, only the lower part of the trunk has been preserved for mushrooms, insects and woodpeckers © P. Corens.

An alternative to systematic tree felling, this measure increases the number of potential nesting sites for cavity-loving birds, such as woodpeckers.

Following the same principle, pockets of old wood have also been maintained at Gravelines and Ypres.

In addition to the ecological objective, there is an educational goal of demonstrating the interest, potential and importance of dead trees.

Fort Duffel © P. Corens.

Fort van Beieren à Bruges © DR

- GRAZING

Grazing management is a practice used to maintain grasslands naturally. Thus, Flemish sheep, cows and goats are a common sight in Ypres. A Highland cow keeps a flock of Soay sheep company in Lille, cows graze on the grasslands at Fort van Beieren in Bruges, while Watten is making experimental use of geese.

It is important to ensure that grazing sites are inaccessible or hidden from view to prevent visitors from feeding the animals.

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Ypres © DR

Creating pens at the top of the ramparts is also a way of keeping users at a suitable distance, thus reducing falling risks.

Lille © DR

- CREATION OF WILDLIFE SHELTERS

Different types of shelter and nesting boxes can be created to accommodate species of bats, birds and even insects. This type of shelter has been installed within the fortifications at Duffel, Ypres, Lille and Montreuil-sur-Mer. Sometimes all that is required are openings at ground level to allow access for amphibians and small mammals.

In the case of bats, entries to buildings are closed by walls*, doors or specific gratings featuring small openings (around 40 cm wide and 15 cm high).

Two examples of shelters chosen for the bats: a mini shelter made of a cinder block fixed to the ceiling, a building openings partially closed and protected

© Y. Tison.

© C. Bonamis.






© F. Freytet.

© P. Fore.

Either the openings are open at the top or the grills are wide; in both cases the bats can pass without problem. Fort Duffel.

Terracing work at Fort Duffel has enabled the construction of a tunnel which is reserved for bats: it provides them with shelter in winter and summer.

During the restoration of the King's Counterguard at Lille Citadel in 2011, nesting boxes and shelters were incorporated directly into the wall. By eliminating the visual impact of installations, the historic character of the fortification remains unimpaired.

A bat tunnel. Fort Duffel © E. Wauters.

A bat shelter integrated in masonry during the restoration of the rampart. © Y. Tison.

Visitors have not been overlooked. Certain indoor areas, at Fort Duffel for example, have been converted into exhibition spaces. To ensure adequate visitor circulation and limit disturbance to animals, a tunnel has been built on either side of the chamber for visitors.

- MANAGING WATER LEVELS

Managing water levels provides favourable conditions for plant species to establish themselves in areas of wetland. With the exception of strictly aquatic species (such as water lilies, pondweed, etc.), the majority of wetland plants require much drier conditions by late summer. This allows the oxygenation of root systems and enables germination of seeds (which will not germinate when submerged): water-crowfoot, iris, reeds, arrowhead and purple loosestrife will only germinate effectively in waterlogged mud. Varying water levels therefore allow for the survival of plant communities which are sometimes very rare.

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These conditions are also favourable to animal species: the reproduction of pike, for example, requires herbaceous plants that are submerged from late February to early May.

The temporary drying out of organic mud allows for mineralization, which reduces the need for dredging and gradually improves the quality of the water and associated plants.

Dedicated structures can be installed to allow site managers to control seasonal variations by raising and lowering water levels.

- (RE)PLANTING

Particular attention should be paid to the genetic origin of species for planting. Ideally, indigenous* shrubs and herbaceous plants should be selected for planting. During 'greening' works for new ditches in Lille, purple loosestrife was sown using seeds harvested from the site. Particular attention is also paid to young seedlings from elms, ash and oak trees, since some individuals are nearly 200 years old. Replanting of indigenous* shrubs and trees is carried out using plants grown artificially from populations growing in the wild within the region.

During operations to restore the walls* (in Ypres, Lille and Fort Rammekens near Vlissingen for example), an experiment was conducted to remove plants growing within the wall, relocate them temporarily and then replant them back into the wall. It was not an easy operation, however, and survival rates for a number of fragile plants were low.

- MANAGING INVASIVE EXOTIC SPECIES

Special floating traps are recommended to deal with red-eared terrapins, whose presence is an issue at several sites. Meat is placed inside the trap to serve as bait. Once the terrapin enters the trap above the tube, it cannot get out again since the water-level (inside the trap) is lower than outside. Barriers and filters have been installed in Lille to tackle problems caused by duckweed. They have allowed for an initial improvement in water quality, followed by a high diversification of plant species.

Muskrats have caused damage at the Bruges, Gravelines and Lille sites. To resolve the issue, the Gravelines authorities have opted to catch the animals using traps. In Lille, the strategy chosen involved temporarily raising the water level to flood burrows. Faced with inadequate ecological conditions, the animals abandon the site. ■

Duckweed filter, Lille © Y. Tison.

Temporary rise in water level floods muskrat burrows (Lille) © Y. Tison.

Picture on the right:
Vulpia sp. grows spontaneously between the paving stones of Tilbury Fort. © V. Levive .

CONCLUSION

Fortified areas in North-West Europe are a heritage shared by all Europeans. Created through human endeavour, they have involuntarily given way to a wealth of animal and plant biodiversity that is often common to the different sites, always unexpected and sometimes endangered.

These nature areas have often been abandoned or sacrificed to leisure activities as urban expansion gained ground.

Having made mistakes in the past, the managers of these sites have since taken steps to help nature withstand the various forms of site-use. Moreover, they have implemented appropriate site management practice to give due consideration to this biodiversity - which is frequently ignored since unexpected - and enhance its potential to thrive.

Considerable efforts should be devoted to implementing contemporary, innovative and effective management of fortified sites. The coexistence of history, biodiversity and human activities is not always free of conflict. It is therefore important to apply an overall strategic vision, underpinned by scientific knowledge of these environments. Having raised public awareness of the use and preservation of these sites, their involvement is also crucial. Development responses are required that capture the spirit of the sites and are supported by appropriate communication methods.

The all-important balance between rich heritage, contemporary site use and nature conservation relies on knowledge, raising awareness and respect.

Thanks to the European Union, the Walls and Gardens project has succeeded in establishing this dynamic by placing the combined expertise and commitment of the project partners in the service of fortified sites and their natural heritage which is now fully recognized. ■

GLOSSARY

BIOCENOSIS:

all forms of animal and plant life coexisting in a defined area.

BIOTOPE:

biological environment presenting defined ecological factors (stable chemical and physical characteristics), required for the existence of a given biological community, and for which it constitutes their usual habitat.

CAVE-DWELLING:

describes animals that favour the darkness and shelter or live in caves. In ornithological terms, describes birds that shelter or reproduce in cavities.

CHASMOPHYTES:

range of plant species which grow on rock and cliff-faces.

DARK CORRIDOR:

series of light-free spaces to encourage the mobility of nocturnal species (bats, insects, etc.).

ECOLOGICAL CORRIDOR:

links between reservoirs of biodiversity, offering species favourable conditions for moving around and successfully completing their lifecycle. They may be linear, discontinuous or landscape.

ECOLOGICAL NICHE:

corresponds to a comprehensive set of environmental factors (physical, chemical, climate, edaphic, biotic) upon which a given species depends and which distinguish it from other species occupying the same habitat.

ECOLOGICAL RESTORATION:

all the natural and intervention-assisted processes used to initiate, accompany, encourage and facilitate the recovery of an ecosystem* which has been degraded, damaged or destroyed.

ECOSYSTEM:

dynamic complex formed by the interactions of living organisms (plants, animals and microorganisms) with one another and with the environment (soil, climate, water, light) in which they live. In other words, the ecosystem* is the sum total of the biotope* and biocenosis*.

EMBANKMENT:

very steep ground, built during terracing works.

HABITAT:

describes the place, or more precisely the characteristics of the "environment", featuring the usual conditions required for a population of individuals from a given species to live and thrive. A natural habitat is a natural entity mainly characterised by its vegetation, climate, exposure, altitude, geology, pedology and the human activities which take place there.

HERITAGE INTEREST (SPECIES OF):

a species is said to be of heritage interest on a regional scale when at least one of the following conditions is satisfied:

- it is a legally protected species at an international, national or regional level;

- its status is either 'threatened' in the region or at a higher geographic level (minimum 'near-threatened' status), or 'rare' in the region in question (minimum 'rare' status).

INDIGENOUS:

refers to a species originating in the territory where it lives.

IUCN:

established in 1948, the International Union for the Conservation of Nature was the first worldwide environmental organisation.

NATURA 2000:

Europe-wide ecological network of protected areas for the conservation of species and habitats identified on the basis of two directives.

PEDIMENTS:

structure on the outside of the fortification consisting of a low and gently sloping embankment.

RED LIST:

list of species classified according to their endangered status.

ROCK-CREVICE SPECIES:

species specific to rock-faces.

TURF-STRIPPING:

ecological restoration* technique consisting of removing the top layer of the soil surface in order to reduce the level of organic matter and encourage the establishment of pioneer plant and animal species.

TVB ECOLOGICAL NETWORK (TRAME VERTE ET BLEUE):

town and country planning tool aiming to (re)constitute a coherent network of land and water-based ecological continuity, throughout France, to enable plant and animal species to travel and safeguard their lifecycle (feeding, reproduction, rest, etc.).

WALL:

within the framework of this project, walls are defined as visible masonry structures which may or may not be part of a building (free-standing walls, masonry structures alongside earth banks, walls forming part of buildings).

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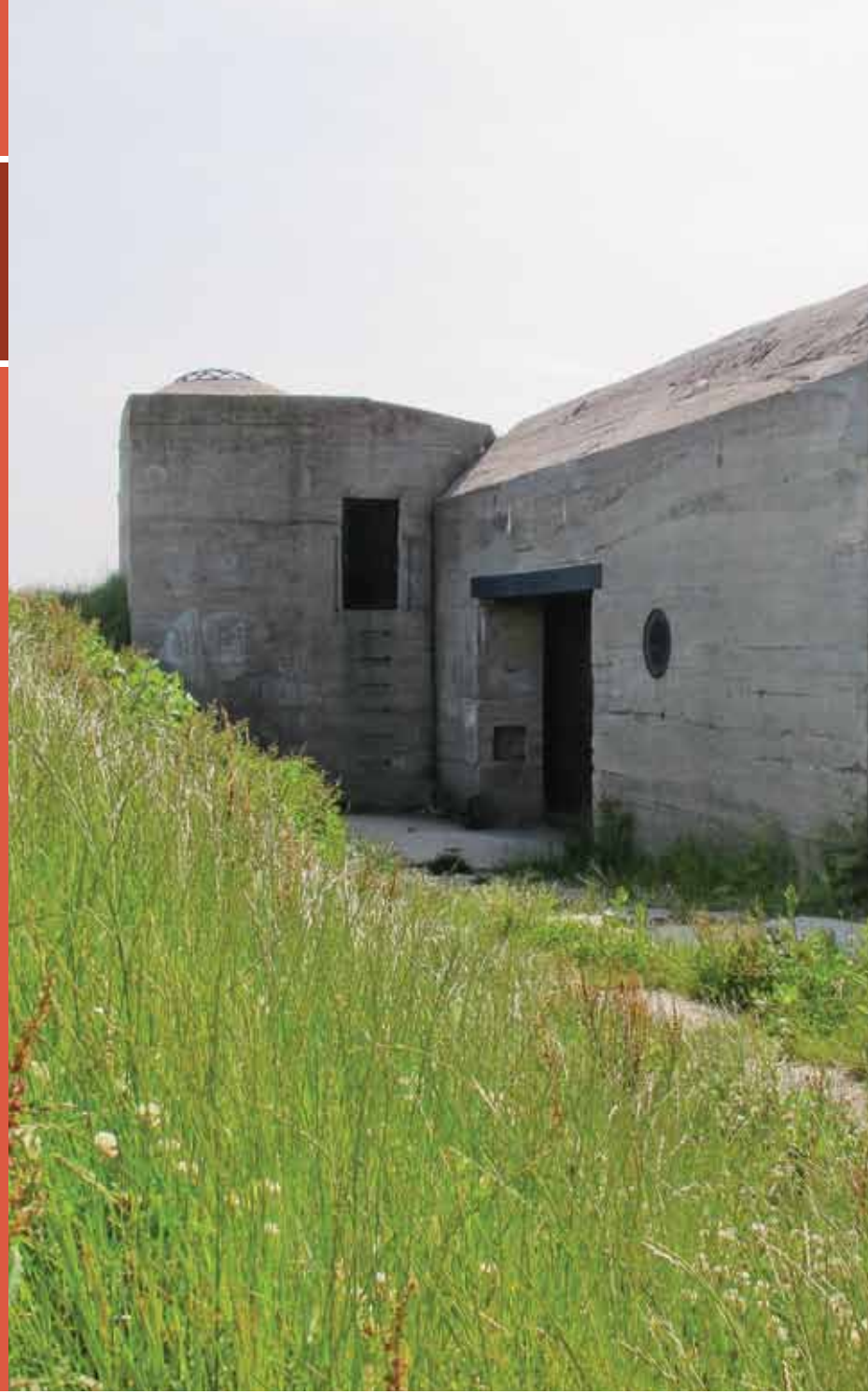

Hellevoetsluis © DR

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WALLS AND GARDENS

A DEDICATED MOBILE APP

'Walls and Gardens', a new mobile application in three languages developed specially for the project, provides assistance to the local population and visitors in understanding the history and the exceptional value of the fortified sites. For the four countries involved in the project, the application proposes tours.

Find them all in the trilingual leaflet published !

EDUCATIONAL GUIDES

Several guides aimed at visitors were created as part of the project. As part of the Euro-regional fortified site open days, a guide of the North European sites was produced in collaboration with the Association for the promotion of the fortified areas of the Nord-Pas de Calais region. Themed tours, hidden riches and unusual visits, green hikes: The guide proposes numerous tours and ideas of walks for all ages.

An e-book entitled All you ever wanted to know about fortifications... was put together with the aim of providing an simplified description of the military heritage and its history.

AN ALMANAC THROUGHOUT THE YEAR

The 'into nature's secret' almanac offers an alternative perspective on the fortified heritage: Using several typical examples, this calendar illustrates the biological rhythms of the fortifications by encouraging the reader to understand and respect the wild flora and fauna. What do plant and animal species do during each different season? Which maintenance and management activities are required in nature areas? Every month, this information is given along with recommendations for the visitors.

Walls and Gardens
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