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und Fernerkundung
Professur Fernerkundung

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Edited by
Prof. Dr. habil. Elmar Csaplovics

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Editor
Prof. Dr. habil. Elmar Csaplovics
Research Group Remote Sensing
Department of Geosciences, Technische Universität Dresden
Helmholtzstraße 10, D-01062 Dresden
Tel. +49 351 463-33372
Fax +49 351 463-37266
E-Mail: elmar.csaplovics@tu-dresden.de
Homepage: https://tu-dresden.de/bu/umwelt/geo/ipf/fern

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Managing Green Infrastructure in Central European Landscapes − MaGICLandscapes

A compilation of Results and Outputs from the EU Central Europe MaGICLandscapes Project

Elmar Csaplovics / Anke Hahn / Christopher Marrs

Foreword

The European Commission defines green infrastructure (GI) as a 'strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings' (European Commission 2013).

Until recently green infrastructure, nestling amongst the more identifiable grey infrastructure of development, has rarely attracted the same level of interest or investment, at least on the strategic level, with local-level investment often concentrating on a site by site basis taking into account recreational needs or the aesthetic requirements of changing development design trends over the years. Understandably, as settlements expand and change, the strategic potential of green infrastructure has remained a secondary consideration.

The Interreg Central Europe MaGICLandscapes project worked to operationalise and promote the GI concept in Central Europe. It provided provide land-managers, policy makers and communities with the tools and the knowledge, at different spatial levels that they need to ensure the persistence of GI functionality and the consequent benefits to society. The MaGICLandscapes project created an assessment approach that deals with all spatial levels across CE landscapes types. It produced tools for GI assessment at the transnational level ensuring cross-border GI is understood in a way that reduces mismatched management approaches.

The outputs were developed, tested and implemented across nine multi-scale and multi-thematic case studies across Austria, Czech Republic, Germany, Italy and Poland. Those outputs include a suite of transferable tools: a series of technical manuals as well as partner-level evidence-based strategies and action plans to direct actions as well as investment and will enhance the capacities of institutions to better manage our natural heritage for future generations.

The first chapter of this publication provides a description of how those tools were developed and tested in those case study areas. The second chapter describes how the tools were used to develop the strategies and action plans designed to address the specific needs of those areas such as flood control, habitat connectivity and reducing soil loss for example. The final chapter is a series of articles provided by partners, associated partners and external contributors and cover a wide range of green infrastructure issues.

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Editorial / Prologue

Professor Elmar Csaplovics, Technische Universität Dresden

Ipsa quoque inmunis rastroque intacta nec ullis
saucia vomeribus per se dabat omnia tellus,
contentique cibis nullo cogente creatis
arbuteos fetus montanaque fraga legebant
cornaque et in duris haerentia mora rubetis
et quae deciderant patula Iovis arbore glandes.

The teeming Earth, yet guiltless of the plough,
And unprovok'd, did fruitful stores allow:
Content with food, which Nature freely bred,
On wildings and on strawberries they fed;
Cornels and bramble-berries gave the rest,
And falling acorns furnish'd out a feast.

Ovid's Metamorphoses, in Fifteen Books, Translated by the Most Eminent Hands [Dryden, Garth, Pope et al.], ed. Sir Samuel Garth. Tonson, London, 1717, Book I (transl. J. Dryden), pp. 101-106

“Europe’s landscapes have faced more habitat loss and fragmentation than any other continent. This is a major problem for biodiversity.” This concise statement introduces a précis of the threats to green infrastructure and of the efforts of the European Commission to “develop a strategy for an EU-wide Green Infrastructure as part of its post-2010 biodiversity policy” (European Commission 2010, p.1). Major concerns focussed on safeguarding three essential qualities of (European) green infrastructure understood in its broadest sense as the entirety of green space from core zones of national parks to patches of peri-urban ruderal areas, explicitly connectivity, (landscape) permeability and multi-functionality.

In March 2010 the European Council of Ministers agreed upon a new EU target for the protection of biodiversity in 2020, “The EU intends to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, restore them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss” (European Commission 2010, p.4).

It was and is always crucial to verify political announcements in general and in environmental and conservational issues in particular a decade or more after these statements have been published.

When taking into account that - just as an example among many others – based on numbers published by the Austrian Federal Office of Metrology and Surveying (BEV) and Statistics Austria from 1985 to 2018 a population growth of 16 % is confronted with an increase of sealed surfaces of 67 %, with an only marginal flattening of the gradient of increase in the period 2010 to 2018, it becomes evident that efforts to safeguard green infrastructure still significantly lag behind the overall pressure of environmentally-unfriendly economic development. The vulnerability of the soil-vegetation balance is underlined by the fact that the soils of the EU-27 member states store an estimated amount of between 73 and 79 billion tonnes of carbon, equivalent to about 50 times the annual greenhouse gas emissions from the EU, and that ongoing intensification of agricultural production and sealing of high-quality arable soils is inevitably leading to a continuous decline of soil organic matter (FAO and ITPS (eds.) 2015, p.340).

It is also essential to distinguish between the quantitative term “greenness” as such and the quality of the respectively related green infrastructure. Far too large is the amount of green space in urban and peri-urban areas - and increasingly in rural settlements - due to the fast-growing developing areas comprising those ugly standardised plots of monotonous “house gardens”, or “suburban lawns” in the two kinds of meanings - which are purely monocultural, dominated by all too frequently mown lawns often fenced in by uniform Thuja hedges, lacking any species-rich spots of at least some biodiversity. Also in the valuable rural cultural landscapes of Central Europe these fringes surrounding the historic hearts of the villages/towns were over centuries covered with meadow orchards and household gardens providing an exhausting biodiversity of grass species, herbs, vegetables and fruit trees and have been/are extensively destroyed by disastrous area zoning plans developed and enforced under the destructive influence of the construction industry. The same danger of misinterpretation holds true for green infrastructure related to “extensive” grazing lands in rural landscapes which are far too often degraded by additional fertilisation and sowing of fast-growing red clover and the like, thus leaving behind extremely species-poor grasslands blanketing increasingly over-fertilised soils.

It is a matter of fact that apart from the disturbing impact on open landscapes by the steady growth of transport infrastructure construction (landscape fragmentation) it is mainly urbanisation which significantly contributes to both the loss of green infrastructure and soil surfaces by a “decoupled land take”. “Since the mid-1950s, the surface area of cities in the EU has increased by 78 %, even though the population has grown by only 33 %.” (European Union (ed.) 2019, p.9).

However, positive steps have also been set. It can be argued that by all means important steps towards implementing green infrastructure in European policies have been made, efforts to stimulate programmes and projects which lead the way to a more efficient implementation into planning and management both at regional and national levels have been set, awareness for the values of unspoiled connected and permeable landscapes, of High Nature Value (HNV) areas in rural landscapes, of patchworks of local and sub-regional initiatives to provide multi-functionality in heterogeneous (agricultural and peri-urban) landscapes has been raised. In that light MaGICLandscapes plays a focal role

as its (Central) European approach is exactly covering the aforementioned portfolio of issues.

> "The main objective of MaGICLandscapes is to increase the capacities of institutions to improve the management of the green infrastructure (GI) resource and promote sustainable land-use, both in areas of high biodiversity and surrounding intensively used areas, in order to maximise its multiple socio-economic/environmental benefits and value for communities such as quality of life and environmental services and for the natural world such as ecological viability."
>
> MaGICLandscapes (application document). TUD, Dresden, 2016, p.35

It is the enhancement of "the role of (semi)natural landscapes as core areas of Green and Blue Infrastructure in Central Europe" on the one hand and the investigation of the "potential of modified landscapes to support the GI functions of core areas through enhancement of those landscapes" on the other hand which both lay the foundation for significantly increasing "the capacity of institutions to improve the functionality of GI through the provision of tools, training and information and evidence-based actions". It is obvious that besides documentation and spatial as well as thematic analysis of ecological network structures as such and green infrastructure in the overall context the subsequent valorisation of knowledge towards in-situ implementation and - consequently - towards stimulation of a new quality of understanding and appreciation of the values of green infrastructure - from the solitary tree in front of the window to the wilderness of pristine areas – represent a crucial momentum of establishing firmly rooted identification and care of/for nature in its manifold representations. It is also obvious that such holistic initiatives are still underrepresented and their impact beyond the runtime of similar projects in the real-world context is poor.

Mankind is corruptible if it comes to deciding between living in non-reflective irresponsibility (shaped by the misunderstanding of freedom as the "right of unlimited individual consumption") and standing against ecologically/environmentally harmful behaviours both at the level of the local/regional environment as well as of the sphere of the individual living space, thus taking self-responsibility in protecting nature in general and green infrastructure particularly.

Howsoever, a spontaneous selection of reflections of three most-famous poets and one of the most eminent environmental activists of the 20th century upon human-induced destructive impact on nature during the last two millennia proves that such (often devastating) conflicts were/are always immanent due to the intrinsic ethical and moral weakness of the human being as such. It is just the fatal misuse of tools of contemporary technologies which make the consequences at all levels much more if not deadly dangerous.

In order not to interrupt and thus disturb the connectedness of both chronological as well as contextual interrelations which span a period from the beginning of the first millennium

CE to the end of the second millennium CE the respective text excerpts are arranged consecutively:

1. Publius Ovidius Naso (43 BC - 17/18 AD), Roman Poet

Metamorphoses (3-8 AD)

[…]
communemque prius ceu lumina solis et auras
cautus humum longo signavit limite mensor.
nec tantum segetes alimentaque debita dives
poscebatur humus, sed itum est in viscera terrae,
quasque recondiderat Stygiisque admoverat umbris,
effodiuntur opes, inritamenta malorum.
iamque nocens ferrum ferroque nocentius aurum
prodierat, prodit bellum, quod pugnat utroque,
[…]

[…]
Then Land-marks limited to each his Right;
For all before was common, as the Light.
Nor was the Ground alone required to bear
Her annual Income to the crooked Share,
But greedy Mortals, rummaging her Store,
Digg'd from her Entrails first the precious Oar;
Which next to Hell, the prudent God had laid;
And that alluring Ill, to fight display'd.
Thus cursed Steel, and more accursed Gold
Gave mischief Birth, and made that mischief bold;
[…]

Ovid's Metamorphoses, in Fifteen Books, Translated by the Most Eminent Hands [Dryden, Garth, Pope et al.], ed. Sir Samuel Garth. Tonson, London, 1717, Book I (transl. J. Dryden), pp. 135-142

2. Pierre de Ronsard (1524 - 1585), French Poet

Contre les Bûcherons de la Forêt de Gâtine (1565)

[…]
Escoute, Bûcheron (arreste un peu le bras)
Ce ne sont pas des bois que tu jettes à bas,
Ne vois-tu pas le sang lequel degoute à force
Des Nymphes qui vivoyent dessous la dure escorce?
Sacrilege meurdrier, si on pend un voleur
Pour piller un butin de bien peu de valeur,
Combien de feux, de fers, de morts, et de destresses
Merites-tu, meschant, pour tuer des Déesses?
[…]

To the Woodsman of Gastine

[…]
Stay, woodsman, stay thy hand awhile, and hark,
It is not trees that thou art laying low!
Dost thou not see the dripping life-blood flow
From Nymphs that lived beneath the rigid bark?
Unholy murderer of our Goddesses,
If for some petty theft a varlet hangs,
What deaths hast thou deserved, what bitter pangs,
What brandings, burnings, tortures, dire distress!
[…]

Songs and Sonnets of Pierre de Ronsard, ed./transl. Curtis Hidden Page. Houghton Mifflin and Company, Boston, 1903, pp. 97-99 (Elegies, Mascarades et Bergerie, par P. De Ronsard Gentilhomme Vandomois. Gabriel Buon, Paris, 1565, Elegie XIV)

3. Robert Burns (1759 – 1796), Scottish Poet and Lyricist

Verses On The Destruction Of The Woods Near Drumlanrig (1791)

[…]
"Alas!" quoth I, "what ruefu' chance
Has twin'd ye o' your stately trees?
Has laid your rocky bosom bare-

Has stripped the cleeding o' your braes?
Was it the bitter eastern blast,
That scatters blight in early spring?
Or was't the wil'fire scorch'd their boughs,
Or canker-worm wi' secret sting?"

"Nae eastlin blast," the sprite replied;
"It blaws na here sae fierce and fell,
And on my dry and halesome banks
Nae canker-worms get leave to dwell:
Man! cruel man!" the genius sighed-
As through the cliffs he sank him down-
"The worm that gnaw'd my bonie trees,
That reptile wears a ducal crown[1]."
([1] The Duke of Queensbury)

William Ernest Henley, Thomas Finleyson Henderson (eds.), The Poetry of Robert Burns, Centenary Edition. Caxton, London, 1897, vol.4, p.53

4. José Lutzenberger (1926 – 2002), Brazilian agronomist and environmentalist

Acceptance Speech, Right Livelihood Award (1988)

Today, parks are often the only way of saving certain species or ecosystems. But to me the idea that we have to save parts of Nature against our own destructiveness seems obscene. It is an avowal that something is profoundly wrong with our civilisation. Shouldn't we also try to find out what is wrong with our present culture and how we can re-educate ourselves before it is too late? A healthy, sustainable civilisation can only be one that harmonises with and integrates into the totality of Life, enhancing it not demolishing it.

Modern industrial society has embarked on a course that, if allowed to continue much longer, will, in the end, destroy all higher forms of life on earth. One of the main aspects of how we wrongly deal with the world is reductionism, that is, facing only one issue at a time and thinking in straight lines. Looking for the minimum size of a certain ecosystem and then aiming at preserving only that minimum is a typical example. It completely leaves out the overall view of how those little green spots interact as parts of the whole, the biome and the ecosphere, and what will happen once they are left alone in an ocean of devastation.

José Lutzenberger, Acceptance Speech, Right Livelihood Award, 31 December 1988, Stockholm

Obviously nature as such and green infrastructure as one of its apparent manifestations were and are at the stake all through the history of mankind. But as José Lutzenberger puts it, it is the “industrial society” and the “reductionism” inherent in all kinds of purely profit-oriented and thus profit-maximising socio-economic systems which - sad to say - are rearing their ugly heads again. It is a matter of fact that celebrating the implementation of another patch of protected area under whatever status of protection and forgetting the entireness of our “biomes” and “ecospheres” is a fatal way finally leading into the “ocean of devastation”, as Lutzenberger calls it. Bearing in mind that Lutzenberger stressed these facts more than 30 years ago, and being aware that he was then the most eminent leading figure fighting for the protection of the Amazon rainforests and that he was - at least cautiously - optimistic that though “the devastation, for whatever reason, of the world’s tropical rain forests is totally irreversible we will not be able to remedy the unpleasant consequences, but we might still be able to prevent the continuation of the devastation.”

Let us have an eye-opening and thus shocking look at the actual situation with regards to large-scale forest depletion in two extremely endangered large ecosystems, the Amazon rainforest - the largest continuous rainforest ecosystem in the world - and the eastern Carpathians, including the largest primeval beech forest ecosystem in Europe.

In the Amazon basin both green and blue infrastructure are at risk. Rainfall has declined in about 70 % of the forest regions. It is estimated that in 2030 nearly 30 % of the Amazon biome will be treeless if the rate of deforestation does/will not change which - in contrary - obviously happens, though unfortunately in the wrong direction. Researchers claim that the tipping point regarding significant and irreversible change in the forest ecosystems of the Amazon lies at 20-25 % deforestation, and we have already reached 20%! A process of “savannah-isation” is activated which will turn rainforest into tropical grasslands, thus leading to a break-down of the climate-regulative function of the vast areas of rainforest, and will devastate ecosystem services related to food, water and energy supply both regionally as well as globally.

Since the outbreak of the COVID-19 virus pandemic and its spread into the Amazon rainforest it is to be feared that the impact on the vulnerable indigenous tribes will be the worst. However, at the same time the protection of reserves in Brazil is weakened and environmentalists and indigenous leaders expect that the pandemic is being used as a pretence for a tremendous increase of illegal logging and mining. Recent numbers refer to more than 6,800 wildfires in the Brazilian Amazon region detected in August 2020 which is the highest number for 13 years. The amount of burnt area has increased for about 50 % compared to the same month last year. To make things even worse dubious interest groups go so far to assassinate indigenous activists opposing their illegal intentions. It is reported that from November 2019 to March 2020 five leaders from the Araribóia Indigenous Territory in Brazil's Amazonian state of Maranhão were purposely killed, all of them somehow involved in the defence of the Araribóia territory against illegal logging (Amazon Watch 2020).

It is disturbing and embarrassing that similar events happen right on our doorstep, explicitly in the remote parts of the last large areas of primeval beech forests in Central Europe, in the easternmost parts of the Carpathians. In 2013 an official investigation In Romania revealed that during the previous ten years about 80 million cubic metres of wood were illegally logged, corresponding to a worth of about 5 billion euros. In 2018, after Romania's second National Forest Inventory had been published, the Romanian NGO Agent Green referred to unpublished information which states that logging per year in the period from 2013 to 2018 amounted to more than double of the legally allowed logging. Based on the forest management plans, the maximum volume of logging in Romania is 18 million cubic metres per year, but the true amount of logging was 38 million cubic metres per year. It is thus obvious that illegal logging in Romania was exploding during the second decade of the 21st century (EuroNature and Agent Green (eds.) 2019, p.22)

These developments are also - like in the Brazil Amazon rainforests - closely correlated with a significant increase of violence, in this case against forest rangers. In September/October 2019 two forest rangers were killed by lumber thieves in Northern Romania (Romanian Insider 2019).

Indeed, green infrastructure encompasses wilderness areas, semi-natural and cultural landscapes, High Nature Value (HNV) areas in rural landscapes as well as meadow orchards around villages, peri-urban and urban green space from parks to single trees in intra-urban backyards.

> "Rewilding is the passive management of ecological succession with the goal of restoring natural ecosystem processes and reducing the human control of landscapes. The opportunity for large-scale rewilding in Europe has been developing over the last few decades through the process of land abandonment, particularly of farmland. Some projections estimate that between 2000 and 2030 as much as 20 million hectares may be released from agricultural use in Europe, an area twice as large as Portugal."
>
> Pereira H.M. and Navarro LM (2015) Rewilding European Landscapes. Springer, Berlin Heidelberg, pp.V-VI.

It seems to be obvious that besides traditional conservation schemes thinking in terms of rewilding European landscapes is a concept worthwhile to be given a serious consideration. However, the concept of ecological rewilding has to take into account that especially in Europe there are complex socio-ecological systems with a continuously increasing impact of human interaction which have to be managed. The focus therefore lies upon ecosystems where it is possible to reduce human impact on ecological processes as much as possible and where non-extractive ecosystem services, e.g. carbon sequestration and recreation potential, the latter providing additional sources of

income for the local people, can be provided. This can - at least in the medium term - only be secured under the assumption that the issue is à la longue understood and advocated by the local people themselves!

But is wilderness - in spite of all these constraints - a focal concept which will significantly support the protection and conservation of green infrastructure both globally as well as regionally in the long run? Or does the key for a long-term safeguarding of green infrastructure lie rather in series of small steps towards maintaining and additionally creating patches of green infrastructure in (peri-) urban and rural environments? Evidently both approaches and many more in between these two extrema are needed to ensure for the protection, creation and management of sufficient valuable green infrastructure at all levels of scale.

Taking into account that our societies are facing something like an “environmental generational amnesia” i.e. that each generation - and within it also each specific *Kulturkreis* - has a different understanding and perception of the term “nature”, also depending on the environment shaping the specific living space, however degraded or polluted it may be. It seems to be vital that in the light of a degrading perception of qualitative standards of a healthy environment the people concerned should not only be motivated to get involved in supporting protection, conservation and/or sustainable management of their landscapes but should also be actively engaged in interacting in and within nature. Urban and peri-urban spaces grow and open spaces shrink and despite that evidence it is “environmental generational amnesia” which allows for an overall unchecked destructive socio-economic development. The increasingly degraded standards of what “nature is” are shaped by the milieu and the age-set of the people concerned. Suggesting the development of a “nature language” which enables the establishment of a relationship with the environment at local to global scales based upon sensitiveness, empathy and appreciation might support a reversal of that “environmental generational amnesia” towards an urgently needed new interpretation of the implications and values of promoting individual self-determination and proactive involvement in safeguarding green infrastructure, from patches of ruderal “weeds” in intra-urban backyards to pristine forests in the last remaining outbacks of wilderness in Europe and worldwide (Kahn and Weiss 2017, pp. 7-24).

Actually perception of and interaction with “nature” in our societies fluctuate between ignorance and deep involvement. There is on the one hand an alarming indifference manifested by an ever-growing misunderstanding of what “nature is” - in suburban and rural settlements people compete for the most monotonous front lawn of their equally looking “little boxes on the hillside” (Seeger 1963) by high-frequency mowing of their putting-green-like treeless Thuja-framed garden plots, thus carefully preventing any possible emergence of spots of potential biodiversity. On the other hand an increasing process of awareness-building and re-interpretation of living in and with nature, mainly carried by urban out-migration but also by local people, takes place - people get involved in organic farming, restoring extensive grazing of semi-natural grasslands and are ready to stand for a proactive involvement in protecting and developing green infrastructure on

their doorsteps. Indeed, some of the new settlers in the “lost landscapes” of Central Europe and beyond are even crossing the line and try to resettle under Thoreau-like wilderness conditions (Csaplovics 2012).

MaGICLandscapes has successfully involved the whole potential of people living and working in favour and supportive of maintaining, extending and re-creating green infrastructure in Central European environments. May their impetus and inspiring example steadily grow and embrace an ever-increasing number of people ready to support strategies and action plans for the establishment of green infrastructure as a key indicator in planning guides in order to counteract immanent and even rekindling political and socio-economic interests favouring unrestrained exploitation of resources by purely economically-driven infrastructure.

> “Deprived of their usual car-washing and lawn-mowing pursuits, the inhabitants of Privet Drive had retreated into the shade of their cool houses. […]”
>
> JK Rowling, Harry Potter and the Order of the Phoenix. Bloomsbury, London, 2003, p.7

> “I would say that landscape and democracy are very strongly related. Because who can resist the logic of capitalist development for the sake of the landscape? Only the people living in the landscape can defend it.”
>
> Gianni Vattimo, in: In armonia con la natura interiore e exteriore/In harmony with the inner and outer nature, a documentary by Lenka Ovcackova. MaGICLandscapes 2020, 5:20-5:25

> “There are those who cling to the world and never break free;
> there are those who enter the wilds and never come back.”
>
> Xi Kang (223-262AD), Letter to Shan Tao, cp. Hightower, James Robert (transl.) "Hsi K'ang's Letter to Shan T'ao.", in: Cyril Birch, Donald Keene (eds), Anthology of Chinese Literature, Vol.1: From Early Times to the Fourteenth Century. Grove Press, New York, 1965, pp.162-166 (UNESCO collection of representative works: Chinese series)

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MaGICLandscapes, Green Infrastructure and a Viral Interruption

Christopher Marrs, Project Manager MaGICLandscapes

Technische Universität Dresden

The protection of our environment has become one of the key themes towards the end of the last century and will certainly continue to be so as we embark on this century. This isn't to say that environmental protection wasn't practiced in earlier years, but its importance for us, as a society, has become a pressing issue as populations increase and resource management becomes more and more critical.

In terms of land management, environmental protection has, in the past and rightly so, concentrated on the preservation of wildlife and natural/semi-natural habitats and preserving natural and cultural landscapes often on a site by site basis and, equally as often, in isolation from other important habitats.

Societies and economies have invested heavily in transport infrastructure, industry and housing, all of which are essential in the modern world and vital to economic and societal stability. Whilst these investments in 'grey' infrastructure provide tangible benefits to society they have somewhat overshadowed the less-tangible, though equally, actually more, important benefits that the environment provides to humans.

In the past this 'other' infrastructure, nestling amongst the more identifiable grey infrastructure of development, has rarely attracted the same level of interest or investment, at least on the strategic level, with local-level investment often concentrating on a site by site basis taking into account recreational needs or the aesthetic requirements of changing development design trends over the years. Understandably, as settlements expand and change, the strategic potential of this 'other' infrastructure has remained a secondary consideration.

Today, our interdependence with the environment is better understood and its value and the benefits it provides for society are the subject of much research and debate. What has become clear is that those spaces or areas outside of protected areas can, and do, provide us with vital services, essential to our health and well-being, economies and cultural identity and indeed also support those protected natural areas by providing connective networks.

The science of ecosystem services brings with it an opportunity to maximise the benefits that the 'other' infrastructure can provide and adds an extra, more tangible value to our green spaces. However, application of ecosystem services does not necessarily address the strategic imbalance or how or where to plan green and open spaces at the city or regional scale. So we have an inherited situation where our important natural areas are not planned strategically and our urban and peri-urban spaces are rarely planned on a strategic or multifunctional basis.

This ‘other’ infrastructure is Green Infrastructure. Green Infrastructure is an approach that brings together both the need for strategic planning of green and open spaces and the science of ecosystem services. It promotes the multifunctional nature of space and the benefits that appropriate management approaches can deliver. It recognises the need to plan land use for specific purposes such as farming, nature protection and development but also provides the tool and methods to identify needs and opportunities to enhance the environment and its functions.

Green Infrastructure (GI) is a key strategy in the European landscape policies aimed at reconnecting vital natural areas to urban hubs as well as restoring and improving their functional roles. Thus, GI is an essential planning concept towards protecting Natural Capital and simultaneously enhancing quality of life. This approach needs to be urgently implemented in Central European (CE) landscape planning policies, which seldom consider the ability of land to deliver multiple benefits.

The Interreg Central Europe project Managing Green Infrastructure in Central European Landscapes - MaGICLandscapes worked to operationalise and promote the GI concept in Central Europe. It provides land-managers, policy makers and communities with the tools and the knowledge, at different spatial levels that they need to ensure the persistence of GI functionality and the consequent benefits to society. The MaGICLandscapes project created an assessment approach that deals with all spatial levels across CE landscapes types. It produced tools for GI assessment at the transnational level ensuring cross-border GI is understood in a way that reduces mismatched management approaches.

Nine multi-scale and multi-thematic case studies across Austria, Czech Republic, Germany, Italy and Poland provided the testing ground for the trans-disciplinary partner consortium to identify and feedback best practice for assessment, thus creating transnational added value. Outputs include a suite of transferable tools: a series of technical manuals as well as partner-level evidence-based strategies and action plans to direct future actions as well as investment and will enhance the capacities of institutions to better manage our Natural Heritage.

In its final stages the MaGICLandscapes project, along with other Interreg Central Europe projects and the daily life of literally billions of people across the planet was affected by the COVID-19 virus and the restrictive, yet necessary, measures required to control it. Within a very short time MaGICLandscapes’ project partners and stakeholders were compelled to work from home, juggling family and professional responsibilities and personal interaction with one another was severely restricted, and at the global level the consequences of this enforced isolation to personal and societal health will likely be the subject of discussion for years to come.

It is interesting that just as our personal interactions with one another had reduced somewhat due to the pandemic, our interaction with the world that surrounds us became more important and its value more apparent. During the lockdowns seen across Europe

when people were unable to travel around freely, our local green spaces became oases, places where human interaction could be carried out safely at a distance.

Those interactions weren't only those between people, they were also between people and nature. The open spaces were a theatre of birdsong, of emerging leaves and flowers, the spectacle of spring itself and thus a stark and welcome contrast to the confines of houses and flats. We walked, we ran, we sat and we enjoyed these spaces with our close families, perhaps more than we would have done under normal circumstances when we had the 'freedom' to spend the day at work. The outdoors was in itself a distraction from the pandemic and in some respects a cure, not to the virus itself, but perhaps to the secondary symptoms of confinement.

It is certainly no great leap of faith, nor cause for in-depth academic research, to suggest that people with access to green spaces were better off physically, mentally and perhaps spiritually during those times than those with limited access. Sadly, it is also reasonable to assume that when this pandemic has passed and, if the green space distribution remains the same, those with limited access will continue to be worse off.

A wealth of research and evidence already exists demonstrating the clear benefits of green and open spaces to human health. The associated problems of limited access unfortunately are not just confined to health, there is evidence aplenty that societal and economic deprivation are closely associated with environmental deprivation. Meaning vulnerability can no longer be simply a measure of economic or societal standing, our surrounding environments and lack of green space also makes us vulnerable, and not only to a virus.

The COVID-19 pandemic will not be the last, increasing stress on ecosystems caused by exploitation of natural resources has been responsible for almost half of the emerging zoonoses, pathogens that 'jump' from one species to another. It is safe to assume that continuation along our current and unsustainable trajectory will likely increase the chances of further pandemics. So we have a situation where the destruction of core wilderness areas of green infrastructure is also leaving us vulnerable to further pandemics as well as indiscriminate loss of biodiversity and ecosystem services.

It would appear that the protection we need from future pandemics will need to be more than just wearing a mask and washing hands, relying on a vaccine or having to sit at either end of a garden simply to talk to each other. We also need to reduce the opportunities for those pandemics to appear and be better prepared to live with them when they do. We need to recognise that protecting and increasing our green infrastructure resources and enabling access for all will have to be an essential and undeniable part of planning for the future and increasing both our resilience as a society and that of the natural world.

During the pandemic and lockdowns there were hopeful glimpses of what could be with stories from across the world about wildlife reclaiming its rightful realm. Stories such as the return of dolphins in Venice's lagoons and Hong Kong's harbour and the return of

Dugongs to Hat Chao Mai National Park in Thailand and even the Kashmiri wild goats on the streets of Llandudno in North Wales. It demonstrated that perhaps all is not lost and we do have a chance to improve upon what we still have or could have. However, it might be possible the good gardeners of Llandudno may hold a slightly different point of view regarding the goats.

Seizing this chance in a post-COVID world, whenever that is, is surely the challenge we must rise to, it's no longer a question of whether we should or should not, simply a question of how. How to ensure that we commit to an equitable world for people and wildlife, how to learn the lessons of the past and finally how to avoid the compounding destruction and plunder of natural resources as nations, in competition with each other, scramble to rebuild economies and make up for lost time…

It would be folly to over-ride the need to protect the environment for the sake of the rampant capitalism and consumerism that will undoubtedly race to fill the void in economies caused by the pandemic. That our economies were so easily damaged by the pandemic was a clear indication that they were far too fragile in the first place. Not only were they fragile, they were destructive at the local, regional and global levels, and undoubtedly and sadly at the personal level for many.

It should therefore be seen with some optimism and a positive move, that here in Europe this has been recognised as unsustainable and a return to business as usual is not an option, that a reset is needed and new innovative approaches are necessary. With its Green Deal the European Union is fostering a green, digital and resilient Europe.

Pandemics will come and go, but our need for a healthy and functioning environment will remain, the ensuing threat of climate change is still with us and will be for generations. We have no choice but to ensure resilience of our environment as we are wholly dependent upon it and we have no other.

Green infrastructure, nature-based solutions and promoting the multiple benefits of our green spaces and wilderness areas are key actors in creating a resilient environment, society and economy. It is hoped that in some way the MaGICLandscapes project has contributed to the concept of green infrastructure and that the seeds it has sown in the nine case study areas will provide a catalyst for a sustainable and positive change to the environments we depend upon.

In the following chapters the results of the project, broken down into the three essentially spatially specific work packages and subsequently how the outputs of those work packages were employed to create green infrastructure strategies and action plans in the project's nine case study areas. The remainder of the book consists of a series of thought-provoking articles which were contributed by authors associated with the project or themselves involved in improving our green infrastructure resource

Green Infrastructure and MaGICLandscapes

Background, Objectives, Actors and Regions

Christopher Marrs, Technische Universität Dresden

The MaGICLandscapes project focussed on the improvement of green infrastructure in the Central European space, within the framework of transboundary cooperation. This cooperation was both at the political boundary level i.e. working across shared borders and working together to address issues that were, and still are, found in those regions. A case of sharing knowledge, learning together and at the border level ensuring a consistent approach to landscape management to the benefit of society, the environment and the economies of those areas.

In order to protect and enhance our green infrastructure resource it is essential we understand its location, structure and connectivity, spatial relationship to surrounding land-use, its function(s), issues affecting it, the benefits it provides and conversely where new or additional green infrastructure is needed to address specific needs, to reduce flooding or to provide recreational space for example.

These informational needs and issues provided the following specific objectives of the project.

- Enhance the role of (semi)natural landscapes as core areas of green, and blue, infrastructure in Central Europe and for the improvement of transnational green infrastructure.
- Investigate the potential of modified landscapes to support the green infrastructure functions of core areas through the enhancement of the landscapes that deliver multiple benefits and support sustainable development.
- To increase the capacity of institutions to improve the functionality of green infrastructure through the provision of tools, training and information and evidence-based actions that have the support of stakeholders.

The project consisted of three thematic work packages designed to meet the above specific objectives.

Work Package 1 – Concepts and Framework for Green Infrastructure Assessment

The first objective of WP1 was to design a framework for green infrastructure assessment that identified the specific informational needs regarding green infrastructure at the European, regional and local level and how adopting green infrastructure management approaches support European, territorial and local policies and objectives.

This was achieved by investigating theoretical approaches of GI assessment towards their success in practical application (state of art) and the analysis of best-practice examples. Transnational cooperation in the definition of types of GI assessment ensured it met the informational needs of the partner countries. The first output from this WP was the Handbook of Conceptual and Theoretical Background, Terms and Definitions.

The second objective was to identify the green infrastructure resource at the transnational scale. The partnership developed a remote-sensing methodology for transnational assessment of GI and ground-truth the methodology in selected case study areas across the partnership. The re-integration of experiences and empirical findings delivered iterative improvement, ensuring validity and that territorially specific needs were recognised in the development process of the transnational assessment methodology.

The second output was the Manual for Transnational GI Assessment, which includes a collection of best-practice examples, digital maps and data of GI at the transnational scale. The result of which was a CE-wide standard approach to defining GI and its constituent elements and improved capacities for institutes for conducting GI assessments and monitoring across borders.

Work Package 2 – GI Functionality Assessment at European and Regional Scale

Work Package 2 concentrated on assessing the functional values of GI in the landscape; including protected and non-protected areas. Its objective was to develop and demonstrate GI assessment methods that gauge connectivity, functionality (in terms of landscape ecology i.e. cores, nodes, stepping stones etc.), and functionality in terms of ecosystem services and to communicate, and facilitate the adoption of those assessment methods by institutions through participatory approaches and training. Previously assessments methodologies for functionality had not brought together landscape ecological functions and ecosystem services.

Understanding how the management of areas high in biodiversity affects the surrounding productive/cultural landscapes and vice-versa is vital in prescribing landscape management guidelines. Transnational cooperation between partners worked in tandem on specific themes such as fragmentation, user pressure, and invasive species and explored and demonstrated the use of GI as a landscape planning concept and role in landscape-scale ecological systems through developing and then applying GI-functionality assessment in their case study areas and feeding back into the assessment development. The output was the Manual for Regional GI Functionality Assessment. In addition to this digital maps and databases that illustrate landscape ecological functions and ecosystem services were produced for the case study areas. The resulting outputs provided institutes with information and methods with which planning policies and strategies can be produced that recognise landscape ecological functions and ecosystem services and identify opportunities for enhanced multifunctionality.

Work Package 3: Strategies for Intervention

The objective of Work Package 3 was to show how transnational (Work Package 1), regional (Work Package 2) and local (Work Package 3) green infrastructure assessment can be used to develop strategies and action plans that fit strategically, improve functionality of green infrastructure and meet specific local needs. In this work package a third, local, level of assessment was developed, one that takes into account specific local needs and maximises the public benefit from green infrastructure intervention and identifies threats, strengths, weaknesses and opportunities related to the green infrastructure resource.

By developing together and testing the public benefit assessment in their case study areas, in conjunction with local stakeholders, the partners identified priority areas and actions and produce green infrastructure strategies and action plans. All of these green infrastructure strategies/action plans were informed by the assessments methods and evidence gained in Work Package 1/Work Package 2 thus ensuring a strategic fit within the wider green infrastructure network and that recognise the functionality of green infrastructure and provide a sound case for investment in green infrastructure enhancement. The case study areas that were a constant throughout the work packages covered a variety of scales and different landscape types and uses. The developed strategies and action plans reflected the differing needs and opportunities within those case study areas.

This work package had three key outputs, firstly the evidence-based and stakeholder-supported strategies and action plans for each of the nine partner case study area, secondly the Manual for Developing Evidence-Based green infrastructure Strategies and Action Plans using transnational, regional and local green infrastructure assessment based on the experiences and lessons learnt in developing the strategies/action plans and thirdly it provided training in the green infrastructure transnational/functional and local assessment approaches and the Manual for Developing Evidence-Based green infrastructure Strategies and Action Plans.

Case Study Areas and Partners

Ten partners from Austria, Czech Republic, Germany, Italy and Poland cooperated in the project. They included national parks, research institutions and a municipal authority. The Table 1 overleaf provides an overview of the partner consortium.

The partners cooperated with local, regional and national stakeholders in the production of nine evidence-based green infrastructure strategies and action plans in nine different case study areas a summary of each follows Table 1.

PP No.	Institution	Country
1	Lead Partner: Technische Universität Dresden, Department of Geosciences, Chair of Remote Sensing	Germany
2	Silva Tarouca Research Institute for Landscape and Ornamental Gardening	Czech Republic
3	The Saxony Foundation for Nature and Environment	Germany
4	The Karkonosze National Park	Poland
5	Work Package 1 Leader: Leibniz Institute of Ecological Urban and Regional Development	Germany
6	The Krkonoše Mountains National Park	Czech Republic
7	Work Package 2 Leader: University of Vienna, Department of Botany and Biodiversity research	Austria
8	Thayatal National Park	Austria
9	Metropolitan City of Turin	Italy
10	Work Package 3 Leader: Italian National Agency for New Technologies, Energy and Sustainable Economic Development	Italy

Table 1: MaGICLandscapes Partners

Case Study Area Descriptions

Kyjovsko, Czech Republic

Responsible Partner: Silva Tarouca Research Institute for Landscape and Ornamental Gardening

The Kyjovsko region is a diversified lowland region situated in the south-east part of the Czech Republic in South Moravia. Most of the area lies at an altitude of between 200m-300m with a few peaks over 400m. More than half of the region is intensively used, especially for agriculture with 61% of the area for this purpose only. This means there are some large continuous cultivated areas in which arable land is dominate, though to a lesser extent, vineyards or orchards can also be found. Forest areas are mainly concentrated in the northern and southern parts of the region and represent 29 % of the area. The forests are mostly deciduous dominated by oak, but there are also many coniferous trees on sandy soil in the southern parts as well. From a nature conservation point of view, there are many small protected areas, several NATURA 2000 sites (from both bird and habitat directive) and two nature parks (significant from the perspective of landscape character) there as well.

Over the last two centuries, the region was known for lignite mining and at the beginning of the 20th century, extraction of oil and natural gas commenced. However, the volume of the extracted oil corresponds to only 1 % of national consumption.

From a cultural point of view, the Kyjovsko region is well known for its traditional folklore, historical monuments and viticulture. Tourists also appreciate the extensive cycling network in the region.

Despite all the benefits that the region offers, the large continuous areas of arable land mentioned above and the lack of green infrastructure represent a considerable risk of soil erosion, reducing permeability of the landscape for living organisms, reducing biodiversity etc. That is why researchers from Silva Tarouca Research Institute chose this region as an area of interest. They worked in cooperation with Department of Environment and Territorial Planning of Municipal Authority Kyjov.

Dübener Heide Nature Park, Germany

Responsible Partner: The Saxony Foundation for Nature and Environment

The Dübener Heide is located between the two German states of Saxony and Saxony-Anhalt. Working together with associated partners Naturpark Dübener Heide and stakeholders from the planning and nature conservation sectors, professional and voluntary, the Saxony Foundation for Nature and Environment (LaNU) and the Leibniz Institute of Ecological Urban and Regional Development (IOER) used the Dübener Heide as a case study area during the MaGICLandscapes project.

The Dübener Heide is cherished and highly valued by the local communities and their contribution to its conservation is both impressive and considerable. With almost 400 members the Verein Dübener Heide e.V. (Dübener Heide Association) is organised into nine local groups. The association has demonstrated the effectiveness of community involvement and ownership of conservation activities in the park and is the perfect example of professional bottom up conservation efforts supported by established and effective funding mechanisms. The Dübener Heide is a significant part of the area's green infrastructure and the surrounding communities work hard to ensure that the multiple benefits achieved through sound management, promotion and respectful use will endure. With such effective community action, the park provides the learning platform from which those successful approaches and lessons learnt can be transferred to other areas and thus made it a perfect case study for the project.

Close to the cities of Leipzig, Halle, Wittenberg and Dessau the Dübener Heide attracts numerous visitors during the weekends and holidays. It's tranquil landscape of lakes and ponds, heath-land, swamp and Germany's largest mixed woodland provide the opportunity for a number of recreational activities such as hiking and cycling. Cultural events promoting local traditions also add to the parks popularity.

The landscapes and physical activities are not the only attraction for visitors, in the peace of the natural park, between the River Elbe and River Mulde, visitors can relax amongst the park's unique flora and fauna. It is home to cranes, the threatened Black stork, osprey, beavers, otters and red deer among many other species of animal. The south of

the park is especially noted for its high biodiversity with 114 bird species recorded as breeding there.

Karkonosze National Park and surrounding area, Poland

Responsible Partner: The Karkonosze National Park

The Karkonosze National Park in south eastern Poland covers the northern slopes of the Karkonosze Mountains, the largest range of the Sudetes, a mountain system shared by the Czech Republic and Poland with its highest peak Śnieżka (1,603 m). It belongs among the most valuable landscapes and natural regions in Central Europe. The area is known for its high biodiversity in four altitudinal vegetation belts, from sub-montane to alpine. The mountains constitute a kind of ecological island of arctic and alpine ecosystems whose counterparts are found in the Alps and north and north-west Scandinavia. In Karkonosze National Park the highest mountain belts: sub-alpine and alpine are especially valuable and are under strict protection.

Some of the most interesting areas include: the highest peat bogs in Europe (designated under the Ramsar Convention), post-glacial cirques, block fields, ponds, granite rocks and dwarf pine shrubs. The area is especially important for biodiversity with many endemic and relic species of fauna such as *Campanula bohemica, Saxifraga moschata ssb. basaltica, Pado sorbetum, Saliceti lapponum, Pendicularis sudetica, Saxifraga nivalis.*

The Karkonosze region has a very rich history of human activity the remnants of which can be found across the area including medieval castles, chapels and charming mountain hostels. There are also some relics of industrial development in the past such as loom houses and glass-works.

Today the Karkonosze Mountains are a popular tourist destination for hikers and skiers with around 2 million visitors per year just on the Polish side. The high number of mountain hostels and tourist trails mainly situated within the strict protection zone contributes to the increasing tourist pressure, one of the biggest threats for the Park's nature and landscapes.

On both sides of the border there are National Parks: in Poland Karkonosze NP cat. II of IUCN was established in 1959 and in the Czech Republic the Krkonoše National Park (IUCN Category V) was established in 1963. They have a combined area of around 425 km^2.

In 1993 and in order to provide a forum of communication between the decision-makers of the cross-border region, local stakeholders and experts, both National Parks were officially recognised by UNESCO as the Bilateral Biosphere Reserve Krkonoše/Karkonosze, the Park area and its buffer zone are also designated as Natura 2000 sites (Bird and Habitats).

Krkonoše National Park and surroundings, Czech Republic

Responsible Partner: The Krkonoše Mountains National Park

The unique natural, cultural and historical value of the Krkonoše Mountains has been known for centuries. They are the highest mountains in the Czech Republic and its highest peak is the Sněžka at 1,603m. The bio-geographical location of the Krkonoše Mts. gives these middle-mountains a varied mosaic of montane spruce and mixed forests, tall herb meadows, dwarf pine communities, *Nardus* grasslands, sub-arctic peat bogs and lichen tundra. Arcto-alpine tundra covers 4 % of the territory.

Despite its relatively small area, the Krkonoše Mts. harbour many rare and endemic plants, such as *Sorbus sudetica, Campanula bohemica, Viola lutea* subsp. *sudetica, Pedicularis sudetica*. The high level of species diversity in plant communities and the presence of different types of vegetation dependant on altitude from sub-montane to alpine also determine the composition of fauna. Of particular interest is the occurrence of glacial relicts (*Vertigo arctica, Luscinia svecica*) and endemics (*Cochlodina dubiosa corcontica, Psodos quadrifaria sudetica*).

Human impact on the Krkonoše‘s environment dates back to 13th century (settlement, mining, natural resources industry, livestock grazing). The threat to the area's natural assets perceived by wise and far-sighted individuals led to protection measures being introduced over time.

In 1959, the Karkonosze National Park on the Polish side of the mountains was established with an area of 55 km^2. The Krkonoše National Park (KRNAP) was established in 1963 as the first national park in the Czech Republic. Its present area comprises almost 370 km^2. The Krkonoše Mts. are visited by 6 million people a year on the Czech side, there are facilities for year-round recreation. However, the impact of tourism poses a serious threat to the unique environment of the national park.

Krkonoše became a member of European protected areas (EUROPARC) in 1990. Since 1992, the Krkonoše Mts. have been included into the World Network of UNESCO Biosphere Reserves within Man and Biosphere Programme (MaB). KRNAP is also involved in NATURA 2000, Ramsar Convention, LTER (The Long Term Ecological Research Network) and EUROSITE network.

Tri-border region Czech Republic, Germany, Poland

Responsible Partner: Leibniz Institute of Ecological Urban and Regional Development

Within the Czech-German-Polish case study area the Leibniz Institute of Ecological Urban and Regional Development (IOER) worked together with LaNU Saxony Foundation for Nature and Environment and associated partners such as universities, regional planning and nature conservation authorities and NGO's.

The region is formed by a mountain range stretching from the Ore Mountains and the Saxon-Bohemian Switzerland in the west via the Lusatian Mountains (Zittau Mountains)

and the Jizera Mountains to the Giant Mountains in the east. The region is an important ecological corridor connecting the two national park regions of Saxon-Bohemian Switzerland and the Giant Mountains.

The region is an old cultural landscape and was used for forestry, mining (i.e. lignite), as well as glass and textile production. A historic regional feature is the so-called '*Umgebindehaus*' (semi-timbered house). The ecosystem was badly affected by emissions, produced by lignite-fired power plants. Thus, the region was also called Black Triangle. The higher parts of the range, once densely wooded, became largely treeless, in part also because of excessive deforestation. Today nature is recovering and is turning into a Green Triangle. The region is of high interest for tourism, especially for hiking, skiing and climbing. Tourism and traffic are at the same time major threats for nature.

The often spruce-dominated forests bogs and mountain pastures are important habitats for several important species of flora and fauna (e.g. orchids, globeflower, arnica, cottongrass, sundew, alpine shrew, blackcock, black stork and eagle owl). Protected areas on the German side of the border are the landscape protected areas Oberlausitzer Bergland, Mandautal and Zittauer Gebirge and the Naturpark Zittauer Gebirge. The border area on the Czech side is dedicated as landscape protected area CHKO Lužické hory.

Eastern Waldviertel & Western Weinviertel, Austria

Responsible Partner: University of Vienna

The case study area is covering the districts of Horn and Hollabrunn located in Lower Austria on the border with the Czech Republic: The Eastern Waldviertel is shaped by the highlands of a shallow gneiss landscape and the River Thaya, which has carved the characteristic valleys found there. Due to the combination of loamy, clay sediments and loess deposits this region is more fertile than other parts of the area and is therefore characterized by agriculture (mainly wheat, rye, triticale and barley). The previously predominant wet meadows were drained and improved a long time ago, so that they are almost nonexistent nowadays. The remaining meadow lands are mainly improved meadows dominated by foxtail grass, tall oatgrass or golden oatgrass.

In this agricultural landscape forests and copses with red pines, pioneer plants (birch, aspen, sweet cherry) and common oak form important centres of biodiversity and provide habitats for plants and numerous animal groups (e.g. as refugium for amphibians and reptiles or breeding areas for birds including birds of prey such as Montagu's harrier (*Circus pygargus*), great grey shrike (*Lanius excubitor*), western marsh harrier (*Circus aeruginosus)* or the grey partridge (*Perdix perdix*)).

From a conservation point of view it is a big advantage that the Eastern Waldviertel does not have any highly developed infrastructure (e.g. there is neither a motorway nor a single high-voltage line nor any wind farms) and only a few tourist attractions.

The Western Weinviertel is characterized by wide open valleys and molasse sediments with rolling hills. To the west, the Manhartsberg – a gneissic rock ridge - represents the border between the Western Weinviertel and the Eastern Waldviertel and is highest hill in the Western Weinviertel. Due to the lack of rainfall there are no distinctive stream networks in the region. With a total annual precipitation between 450 and 600 mm, the Western Weinviertel represents one of the driest parts of Austria.

Here you can find more meadows and less wetlands when compared to the Eastern Waldviertel. Due to the Pannonian climate and the loess soil this region was predestined for viticulture and the area is Austria's biggest wine growing region. The Western Weinviertel is dominated by intense agricultural use. River regulation and drainage associated with arable farming has meant that much of the previously widespread wet meadows and waterlogged habitats have been lost.

On steeper hillsides and knolls the landscape becomes more structured with viticulture interspersed by patches of dry and xeric grassland as well as heath land. At slightly higher elevations warm temperate oak forest can be found.

The vegetation in this area is unique and differs from the more westerly parts of Austria. Here you can not only find Pannonian species but also species normally found much further to the east and here are at the limit of their western distribution. This includes species such as Adriatic lizard orchid (*Himantoglossum adriaticum*), Tuberous Jerusalem sage (*Phlomoides tuberosa*), small absinthe (*Artemisia pontica*), the southern globethistle (*Echinops ritro*).

Due to the high biodiversity large areas of the case study area are part of the Natura 2000 Network, listed both under the EU Birds Directive (16,904 ha) and the EU Habitats Directive (2,982 ha).

The area is home to the great bustard (*Otis tarda*) – and the huge adult male great bustard is one of the heaviest flying birds. The Western Weinviertel is also home for several other endangered bird species such as Montagu's harrier (*Circus pygargus*), red-backed shrike (*Lanius collurio*), barred warbler (*Sylvia nisoria*), Syrian woodpecker (*Dendrocopos syriacus*), European honey buzzard (*Pernis apivorus*) and the western marsh harrier (*Circus aeruginosus*).

Thayatal National Park, Austria

Responsible Partner: Thayatal National Park

The Thayatal National Park and its neighbour, the Podyjí National Park in the Czech Republic, contain some of the most biodiverse areas to be found in Central Europe's protected areas. It is a steep valley embedded in natural forests located at the border of northern Lower Austria and the Czech Republic. The combination of diverse geology, river morphology and the valley's location on the intersection of two climate zones created the conditions for this high biodiversity.

The River Thaya carved its way 150 m deep into the geological formations of the Bohemian Massif creating the characteristic valley meanders. Along these river bends an intertwined mesh of various habitats can be found: natural forests, dry grasslands, meadows and cliffs and rock faces. It provides habitat for numerous rare animals such as the Black stork and the European Wildcat and plants such as the Siberian melic grass.

Its central position in the otherwise very fractured and intensively used landscapes of the Waldviertel, the Weinviertel and South Moravia make it very precious in terms of wildlife in Central Europe and worthy of protection. Despite its relatively small expanse of 7,660 ha (NP Thayatal 1,360 ha, NP Podyjí 6,300 ha) the area has great potential as a stepping stone for migrating wildlife, such as the European Wildcat, Lynx, Wolf or other species that require interconnected movement corridors for migration and dispersion.

In addition to the impressive natural landscape the area has a rich cultural history, such as the castles and ruins along the river or the famous wineries, which are of interest for visitors and scientists alike.

The Thayatal National Park is situated within the case study area Eastern Waldviertel & Western Weinviertel and they worked closely together with the University of Vienna and its associated partners, the Podyjí National Park Administration.

Po Hills around Chieri, Italy

Responsible Partner: Metropolitan City of Turin

The Po Hill and Chieri case study area is characterised by both hilly and flat lowland territory and contains many opportunities in terms of natural and cultural resources protection but also many different threats.

On the Turin hill you can find the Site of Community Importance (SCI) named Superga Hill and Bosco del Vaj and Bosc Grand established for the presence of its characteristic chestnut and oak woods. In 2016 the Turin's hill area and the Po river protected area were recognised as “Collina Po Man and Biosphere Reserve” the first recognition of an Urban MAB in Italy. It is an area of 171,233 ha which includes over 80 municipalities and sectors characterised by both natural and human influence. The Chieri case study area is within the MAB UNESCO Reserve.

In the lowland parts of the study are there are many other Sites of Community Importance (SCI) and natural reserve areas along the River Po such as the Le Vallere natural reserve, Arrivore e Colletta natural reserve, Meisino and Bertolla Isolone natural reserve, Tangenziale verde and Laghetti Falchera natural safeguard area; Meisino Special Protection Area, confluence of the Rivers Po and Stura.

Despite the high number of protected areas and a good natural environment there are a number of pressing issues that threaten these sites and the non-protected land in-between. The landscape is deteriorating with problems such as habitat isolation, loss of connectivity, soil loss, and poor or inappropriate forestry techniques and in common with many European landscapes the spread of exotic and invasive species.

In cooperation with local communities in the pilot area of the Po Hill, the Metropolitan City of Turin, along with Regione Piemonte, Parco del Po and Comune di Chieri as associated partners, developed a Green Infrastructure Strategy based on local community and environmental needs as well as those of a strategic nature.

Upper Po Plain, Italy

Responsible Partner: Italian National Agency for New Technologies, Energy and Sustainable Economic Development

The River Po case study area corresponds to the system of the Vercellese-Alessandrino River Po protected areas lying along the River Po. The area ranges for nearly 90 kilometres along the River Po's banks in the Piedmont region, North-western Italy, with a succession of different environments linked by the course of the river. A total of 24 municipalities are included in the case study area, distributed among the provinces of Alessandria, Torino and Vercelli.

Many protected areas can be found within the case study area. Some are natural reserves belonging to the System of protected areas of the River Po: "Isola Santa Maria", "Ghiaia Grande", "Confluence of the Rivers Sesia and Grana and Garzaia di Valenza", "River banks of Casale Monferrato", "Bric Montariolo", "Boscone", "Confluence of Tanaro river"; three other protected areas are located in the mosaic of the Vercelli rice fields: the natural reserves "Palude di San Genuario" and "Fontana Gigante" and the natural park "Bosco delle Sorti della Partecipanza di Trino". The listed protected areas are associated to an external contiguous area which links the areas with the surrounding territory.

Several Sites of Community Importance (SCI) and Special Protection Areas (SPA), belonging to the Natura 2000 Network, can be found in the area and largely overlap with the above mentioned protected and contiguous areas. They are designated to protect habitats and species typical of lowland and fluvial environments, some of which are severely threatened at the European level: habitat 91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae);* 9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli*; habitat 3270 Rivers with muddy banks with *Chenopodion rubri* pp and *Bidention* pp vegetation; the largest Italian nesting sites of several heron species such as purple heron (*Ardea purpurea), black-crowned night heron (Nycticorax nycticorax)* and Eurasian bittern (*Botaurus stellaris)*.

Despite this area being characterised by strong human activities, this reach of the lowland River Po still retains many natural elements. In the upstream section of the area, the landscape is characterised by the contrast between the Monferrato hills and Vercelli's rice plain. Rice fields, in particular, represent the dominant farming activity in lowland sections, together with large forestry activities (poplar). Some energy plants and other industrial facilities are also present.

People have a lesser presence in the Monferrato hills leaving space for wooded areas and meadows though some extensive cultivation does exist in the form of the area's vineyards. The landscapes created where these hills meet the River Po are called 'Rocche' and have sharply eroded cliffs and are sparsely vegetated.
Downstream the town of Casale Monferrato the River Po is enlarged by the waters of the Rivers Sesia and Tanaro and it acquires the morphology typical of large lowland rivers, shaping large gravel beds, islands and lateral wetlands.

List of Contributors

ALBERICO, Simonetta
Metropolitan City of Turin, 10138, Corso Inghilterra 7, Turin, Italy

BOVO, Gabriele
Metropolitan City of Turin, Corso Inghilterra 7, Turin, Italy

CIADAMIDARO, Simone
Italian National Agency for New Technologies, Energy and Sustainable Economic Development, I-13040, strada per Crescentino, Saluggia, Italy

CSAPLOVICS, Elmar
Department of Geosciences, Technische Universität Dresden, Helmholtz Str. 10, 01062, Dresden, Germany

DANZINGER, Florian
University of Vienna Division of Conservation Biology, Vegetation Ecology and Landscape Ecology, Rennweg 14, A-1030, Vienna, Austria

D'AMBROGI, Serena
Italian Institute for Environmental Protection and Research (ISPRA), Via Vitaliano Brancati 48 – 00144, Rome, Italy

DRIUS, Mita
Formally of University of Vienna Division of Conservation Biology, Vegetation Ecology and Landscape Ecology, Rennweg 14, A-1030, Vienna, Austria

EBERTS, Christiane
Rehwaldt Landscape Architects, Bautzner Str. 133, 01099, Dresden, Germany

ERLEBACH, Martin
Krkonoše National Park Administration, Dobrovského 3, 543 01 Vrchlabí, Czech Republic

FREUDL, David
Nationalpark Thayatal GmbH, 2082, Hardegg, Merkersdorf 90, Austria

FUCHS, Stefan
University of Vienna Division of Conservation Biology, Vegetation Ecology and Landscape Ecology, Rennweg 14, A-1030, Vienna, Austria

GRASSO, Stephanie
Metropolitan City of Turin, Corso Inghilterra 7, Turin, Italy

HAHN, Anke
Formerly of Department of Geosciences, Technische Universität Dresden, Helmholtz Str. 10, 01062, Dresden, Germany

HAVLÍČEK, Marek
Silva Tarouca Research Institute for Landscape and Horticulture, Lidická 25/27, 602 00, Brno, Czech Republic

HOSEK, Michael
DHP Conservation, Sudoměřská 1243/25, 130 00 Praha 3, Czech Republic

JAŁA, Zygmunt
Karkonosze National Park, str. Chałubińskiego 23, 58-570 Jelenia Góra, Poland

JOHN, Henriette
Leibniz Institute of Ecological Urban and Regional Development, 01217, Weberplatz 1, Dresden, Germany

KORZEŃ, Janusz,
(retired) architect and town planner, Karpniki, Poland

MANOUTSCHEHRI, Anja
University of Vienna Division of Conservation Biology, Vegetation Ecology and Landscape Ecology, Rennweg 14, A-1030, Vienna, Austria

MARRS, Christopher
Department of Geosciences, Technische Universität Dresden, Helmholtz Str. 10, 01062, Dresden, Germany

MINCIARDI, Maria-Rita
Italian National Agency for New Technologies, Energy and Sustainable Economic Development, I-13040, strada per Crescentino, Saluggia, Italy

NEUBERT, Marco
Leibniz Institute of Ecological Urban and Regional Development, 01217, Weberplatz 1, Dresden, Germany

POKORNÁ, Pavla
Silva Tarouca Research Institute for Landscape and Horticulture, Lidická 25/27, 602 00 Brno, Czech Republic

QUARTA, Maria
Piedmont Region, Palazzo Lascaris, via Alfieri 15, 10121, Turin, Italy

RIEDL, Sven
Academy of the Saxony State Foundation for Nature and the Environment, Riesaer Str. 7, 01129, Dresden, Germany

ROSSI, Gianluigi
Italian National Agency for New Technologies, Energy and Sustainable Economic Development, I-13040, strada per Crescentino, Saluggia, Italy

SCHERRER, Judith
University of Vienna Division of Conservation Biology, Vegetation Ecology and Landscape Ecology, Rennweg 14, A-1030, Vienna, Austria

SEILERN, Jacob
University of Vienna Division of Conservation Biology, Vegetation Ecology and Landscape Ecology, Rennweg 14, A-1030, Vienna, Austria

SKOKANOVÁ, Hana
Silva Tarouca Research Institute for Landscape and Horticulture, Lidická 25/27, 602 00 Brno, Czech Republic

SLACH, Tomáš
Silva Tarouca Research Institute for Landscape and Horticulture, Lidická 25/27, 602 00 Brno, Czech Republic

VAYR, Paola
Metropolitan City of Turin, Corso Inghilterra 7, Turin, Italy

WOJNAROWICZ, Dorota
Karkonosze National Park, str.Chałubińskiego 23, 58-570 Jelenia Góra, Poland

WRBKA, Thomas
University of Vienna Division of Conservation Biology, Vegetation Ecology and Landscape Ecology, Rennweg 14, A-1030, Vienna, Austria

Chapter 1 – Analysing the functions, services and benefits of green infrastructure for improved landscape management in Central Europe

In the following chapter the three main thematic work packages of the project are described, including an introduction to the objectives and basis for each work package. Each section will give examples of how the tools were applied in at least one of the case study areas. More in-depth and detailed explanations of how the tools were applied in the case study areas will follow in Chapter 2.

Transnational Framework of Green Infrastructure Assessment (Work Package 1)

Marco Neubert and Henriette John, Leibniz Institute for Ecological Urban and Regional Development, Dresden, Germany

Assessing green infrastructure functionality at European, regional and local scale (Work Package 2)

Florian Danzinger, Mita Drius, Stefan Fuchs, and Thomas Wrbka, University of Vienna, Vienna, Austria

Strategies for intervention at European, regional and local level (Work Package 3)

Gian Luigi Rossi, Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)