Guidance document on buffer zone management and buffer zone zonation

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**for the UNESCO World Heritage Site
'Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe'**

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Guidance document on buffer zone management and buffer zone zonation

This guidance document aims to harmonise the management approaches in the property and the buffer zone with a view to the continued strengthening of the protection of the property over time. While the component parts of the property are under strict non-intervention management, the buffer zone management addresses the three functions of the buffer zone: protection, connection, and landscape conservation. The document points out how these functions are understood with regard to beech forest ecosystems. The complexity of the functions leads to the decision to separate two subzones within the buffer zone if needed due to different regimes in larger buffer zones with existing sustainable land use. These regulations are reflecting the minimum standards. In the many cases where component parts and their buffer zones already provide higher standards than indicated in this document, the corresponding States Parties are committed to continuously enhancing the legal protective measures beyond the baseline laid out in the guidance document in the pursuit of maximal protection of the property and the integrity of the OUV. Whenever possible, more strict regulations should be established to minimise human influence on the property.

Table 1 on page 18 of the guidance document provides a target setting on recommended minimum regulations for the property and the buffer (sub)zones.

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Introduction

The 94 component parts of the World Heritage Site "Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe" are located in 51 protected areas in eighteen European countries and ten different Beech Forest Regions under various ecological, economic, or legal conditions. This led to different designs of the property and the respective zonation of the buffer zones. In its decisions 41 COM 8B.7 and 43 COM 7b.13, the World Heritage Committee (WHC) addressed this issue with a specific focus on buffer zone management:

Decision 41 COM 8B.7 (8.): 'Further requests that special emphasis shall be given to appropriate buffer zone management in order to support undisturbed natural processes with special emphasis on dead and decaying wood, including ongoing monitoring of threats and risks, making effective use of the expertise and institutional capacity in management of the property;'

After a phase of reviewing scientific papers and expert meetings, this document was developed to come up with a proposed standardised management approach in the property, as well as the buffer zones.

The zonation process should reflect the ecological situation (location of primeval and/or ancient beech forest without forest management), the responsibility of the management organisation in place (national park, strict forest reserve,…), local and regional stakeholders (landowners, local communities, responsible authorities, and ministries, …) and legal implications of the respective protection status (status of strict protection has to be guaranteed by law or equivalent regulations).

As the property is located in 51 different protected areas within eighteen different countries, the land ownership, spatial design, legal protection status, and management regulation of the buffer zones were and are very diverse. To ensure the functionality of the buffer zone for each component part of the property and to harmonise the management approach, a process to develop a joint guidance document was started. The following activities have been met:

2018 (May-Aug.)	Literature search on threats and functionality of buffer zones (coordination office).
2018 (Aug-Sept.)	Online questionnaire on rating of threats for all component parts (clusters) by all States Parties.
2018 (Aug.-Oct.)	Development of a draft guidance document on buffer zone design and management (coordination Office).
2018 (Nov.)	Evaluation and feedback from States Parties on the draft guidance document.
2018 (Dec.)	Submission of the approved draft version of the guidance document in the States Parties Report on 1st of Dec. 2018 to UNESCO.

2019 (March)	Technical workshop on the guidance document in Sibiu (RO) (States Parties & coordination Office).
2019 (May)	Presentation of the draft regulations for buffer zones to IUCN experts in Bern in the course of the preparation of the next extension.
2019 (May)	Discussion of the current draft version of the guidance document at the Joint Committee Meeting (JMC) in Suceava (RO) (States Parties & coordination office). Another technical workshop was planned, and the final decision was postponed to the JMC-meeting in April 2020.
2019 (June-Sep.)	Online questionnaire on the current rules and regulations within all component parts (States Parties).
2019 (Oct.)	International technical workshop on buffer zone management for the beech forest WH (experts from States Parties, IUCN, coordination office).
2019 (Nov.-Dec.)	Update of the guidance document according to the workshop outcomes.
2020 (Jan.)	Submission of the updated draft guidance document for feedback to the States Parties. Inclusion of the draft document into the States Parties Report (submitted by 1st of Feb. 2020).
2020 (April)	Discussion of the current draft version of the guidance document at the Joint Committee Meeting (JMC) (online) (States Parties & coordination office).
2020 (Aug.)	Bilateral meetings with all States Parties to create a shortlist of the topics that still need further discussion among States Parties.
2020 (Oct.)	During the JMC-meeting of October 2020 the guidance document of the buffer zone management and buffer zone zonation was discussed. A shortlist of the topics that still need further discussion among States Parties was presented. The JMC decided to create 2 working groups to prepare possible solutions for these open-ended topics. (online) (States Parties & coordination office).
2020 (Nov.)	A workshop was organised with technical experts to prepare "the status of the document" and "the construction of new infrastructure and the maintenance of existing infrastructure".
2020 (Dec.)	A workshop was organised with technical experts with the aim to create a Glossary of Forest management terms to create a common language and joint understanding for the management of the property and the buffer zone of the WHS "Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe".
2021 (Feb.)	A workshop was organised with technical experts to prepare content related to forest management. For most topics, a consensus was reached during the

	workshop. There is still a very limited number of topics that need a bit of clarification.
2021 (Feb.)	Bilateral meetings with Slovakia, Romania and some experts to clarify the final open topics on forest management
2021 (March)	Update of the guidance document according to the workshop outcomes. Submission of the updated draft guidance document for feedback to the States Parties.
2021 (March)	Pre-JMC-meeting with all JMC-members to present the outcome of the workshops and to discuss the revised version of the guidance document.
2021 (April tbc)	Decision on the new updated version of the guidance document between all 12 States Parties at the JMC-meeting.
2022 (April)	Review of the updated version of the guidance document by IUCN
2023 (April)	Workshop with IUCN and the World Heritage Centre about the finalisation and implementation of the guidance document in response to Committee Decision 44 COM 7B.99.
2023 (May)	Finalisation of the guidance document at the yearly JMC meeting.

In the States Parties Report from December 2018, a draft version of the guidance document was included. The decision of the WHC 43 COM 7B.13 was based on the recommendation of IUCN:

Decision 43 COM 7B.13

6. Notes with appreciation the willingness of the States Parties to develop joint guidelines for buffer zone design and management and the progress achieved to date, but expresses concern that no progress has been made on clear guidelines regarding acceptable logging activities within the established buffer zones and reiterates the importance of good buffer zone design and effectiveness as the only feasible way to protect the integrity of the small forest remnants included in this property;
7. Considering that Decision ***41 COM 8B.7*** *requested all States Parties of this property to give special emphasis to appropriate buffer zone management in order to support undisturbed natural processes, [the World Heritage Committee] urges the States Parties to define a clear and strict approach to buffer zone design and management which will allow for the protection of the Outstanding Universal Value (OUV) of the property and to seek further guidance from the World Heritage Centre and IUCN on this issue;*

There was no negative feedback on the subzoning approach from IUCN in the SOC-Report 2019, but the report recalls “that various IUCN evaluations of this property have stressed the importance of good buffer zone design as the only feasible way to protect the integrity of the small forest remnants included in this property".

The draft guidance document developed in 2018, which was presented and discussed with IUCN experts in Bern in May 2019, was also used as the basis for the preparation process for the proposed extension process 2020 (States Parties and component parts according to the submission of tentative submission formats in Feb. 2019).

The World Heritage Centre requested additional details on the operations in the buffer zones that were met with serious concern. This request was communicated through the WHC Draft Decision 44 COM 7B.99. "Supplementary Information to the State Party Report on the State of Conservation of the Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe" was send to World Heritage Centre on 25/11/ 2021.

In response to 44 COM 7B.99, a technical workshop was organised with IUCN and the World Heritage Centre, and in conjunction with the other States Parties, to discuss how concerns over certain activities in the buffer zone could be resolved.

This current version of the guidance document includes the results of the above-listed meetings, discussions, and reviews of States Parties. It is including IUCN expertise from the workshop on the extension process in Bern in May 2019, the technical workshop in October 2019 in Vienna, the review by IUCN sent by the World Heritage Centre on the 27th of April, 2022, and the feedback received during the workshop with IUCN and the World Heritage Centre in April 2023.

This guidance document is addressed to the States Parties and responsible management authorities of the inscribed WH Property and is proposed to be approved by the Joint Management Committee (JMC).

As States Parties were using different definitions for identical forest management terminology, this created some confusion. During a workshop on December 9th, 2020, a Glossary of Forest management terms was prepared (cf. annex). This Glossary of Forest management terms is a list of definitions in order to create a common language and joint understanding for the management of the property and the buffer zone of the WHS "Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe". In an attempt to reach this common understanding, several terms are defined using easy-to-understand and metric parameters, based on international and regional forestry manuals. These definitions may diverge from legally binding definitions in the respective States Parties. In no way do the below-applied definitions and restrictions replace or abolish official definitions and restrictions included in existing national or regional legislation. The definitions will be used in the context of the WHS "Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe."

Property

The components parts of the World Heritage contain those ancient and/or primeval beech forests that have a significant contribution to the Outstanding Universal Value of the whole property. The minimum size of each separate polygon aims to be larger than 50 ha (Decision 41 COM 8B.7 (8.)) and has to be under a strict protection regime. The protection status could be a strict forest reserve, core zone of a biosphere reserve or national park or another PA categories equivalent to IUCN Category I or II. As 'non-intervention' management has no standard definition,

Table 1Table 1 on page 18 gives an overview of the recommended (target) regulations and limitations for human activities in the component parts.

Only the very best examples of ancient and/or primeval beech forests within a Beech Forest Region (BFR) have been selected. In some cases, within one protected area only a single World Heritage component part (one polygon) is located. But in those cases, where the ancient/primeval beech forest is fragmented, it was necessary to split up the property into several separated polygons that form a component cluster.

Buffer zones

The Operational Guidelines for the Implementation of the World Heritage Convention of the UNESCO deal with buffer zones as follows:

- 103. Wherever necessary for the proper protection of the property, an adequate buffer zone should be provided.
- 104. For the purposes of effective protection of the nominated property, a buffer zone is an area surrounding the nominated property, which has complementary legal and/or customary restrictions placed on its use and development to give an added layer of protection to the property. This should include the immediate setting of the nominated property, important views and other areas or attributes that are functionally important as a support to the property and its protection. The area constituting the buffer zone should be determined in each case through appropriate mechanisms. Details on the size, characteristics, and authorized uses of a buffer zone, as well as a map indicating the precise boundaries of the property and its buffer zone, should be provided in the nomination.
- 105. A clear explanation of how the buffer zone protects the property should also be provided.
- 106. Where no buffer zone is proposed, the nomination should include a statement as to why a buffer zone is not required.

The buffer zone is addressed to protect the OUV of the property and is not part of the property and is neither a contribution to the integrity of the property nor to the OUV. This was clearly stated by the IUCN Advisory Body when the design of component parts clusters connected by buffer zones and the minimum size of component parts was discussed within the extension 2016/2017.

UNESCO has published in 2009 a World Heritage Paper 25 on World Heritage and Buffer Zones (MARTIN & PIATTI (Ed.) 2009). This document includes an IUCN Position Paper (p 51-57). In this important document, IUCN considers that the following functions are required within an effective buffer zone:

1. The effective management of a buffer zone aims to maximize the protection of the values of the protected area (including the Outstanding Universal Value of a World Heritage property) and their resilience to change.
2. To maximize the connectivity of the World Heritage property/protected area with other natural lands in a landscape as a basis for responding to climate change caused biome shifts of fauna, flora and habitats – and to maximize landscape connectivity; habitat connectivity, ecological connectivity, and evolutionary process connectivity (WORBOYS et al. 2008).

3. To integrate the World Heritage property/protected area within landscape scale conservation with community initiatives for sustainable use practices including catchment protection, the conservation of healthy environments and the realization of sustainable livelihoods.

To guarantee the functionality of the buffer zone, the entire buffer zone has to be located on land that is under direct or indirect control of the management authority in charge of the component part(s) or under direct control of the State Party (e.g. state-owned forest areas). In the case that a strictly protected forest reserve is directly bordering on a private forest without legal regulation, the buffer zone needs to be located inside the strict reserve to guarantee full control of the buffer zone management. In order to avoid a reduction of the size of the component part, the better option is to find a long-lasting and binding agreement with the owner of the neighbouring forest stands about an adequate management.

Not all of the three functions mentioned above have to be realised in the buffer zones of each component part. Only the protective function of the buffer zone is obligatory and has to be implemented for all component parts.

To provide the different functions, the buffer zone might need different management approaches. To avoid confusion and to be clear about which management regulation has to be applied to which part of the buffer zone, it might be necessary to spatially separate two different subzones in one buffer zones with regard to these management approaches (see detailed description below). This zonation however is only recommended in the specific component parts where the different functions could otherwise not be provided and is limited to some component parts only.

1. Part of the buffer zone with protective function from short-distance threats (protection buffer subzone or p-buffer)
2. Part of the buffer zone with landscape conservation and connectivity function (landscape conservation buffer subzone or l-buffer)

As mentioned, the overall aim of the document is to harmonise buffer zone management in order to guarantee the conservation of the OUV and to improve the landscape context and ecological connectivity for the component parts. This can be achieved through different management options in the buffer zone: for some component parts, States Parties decided to apply a non-intervention in the buffer zone (6 States Parties). For other components, a specific sustainable management regime is permitted–that allows for certain commercial harvests, but within specific limitations to meet the overall goal of ecological connectivity (habitat features, structure, microclimate) of the buffer zone. Only for the latter, the subzoning into two different subzones makes sense.

In the nomination process, States Parties have delignated buffer zones of very different sizes and different property versus buffer zone ratios. The table in the attachment illustrates these differences (cf. annex).

It is important to understand that there is only ONE buffer zone according to the UNESCO operational guidelines and in the understanding of this guidance document. The subzoning is only necessary for these buffer zones where different management regimes are applied. Component parts or clusters with a buffer zone of sufficient size and-an adequate regulation regime according to the regulations of the protection buffer subzone shown in Table 1 on page 18 (e.g. core areas of National Parks

according to IUCN PA Category II) do not need to establish an additional landscape conservation subzone. It is not intended to apply the internal zoning scheme to additional component parts nor should this result in any lowering of the actual protection standards.

While the protection buffer subzone serves mainly the protective function, the landscape conservation buffer subzone serves both the connectivity function as well as the landscape conservation and sustainable use function. As different management approaches need to be applied, these functional buffer subzones may need individual zonation and clear delineation in the field, so that rangers, site managers and land users can realise the borders of each subzone in the field.
An analysis of threats (see State Party Report on the State of Conservation 2018, chapter 3.3.1 Monitoring of threats) shows that not all of them can be avoided or reduced by buffer zones. Climate change or negative impacts through human-made emissions are beyond the protective function of buffer zones. However, buffer zones and adequate management of these buffer zones can mitigate negative impacts caused by human land use practices in adjacent areas. Therefore, the buffer zone should be as large as possible and should have adequate protective management.

Sustainable livelihood and buffer zones

In line with the mentioned UNESCO World Heritage Paper 25 on World Heritage and Buffer Zones (MARTIN & PIATTI (Ed.) 2009) the guidance document supports community initiatives for sustainable use practices and the realisation of sustainable livelihoods. Since some properties have huge buffer zones including settlements, Table 1 indicates how the realisation of sustainable livelihoods is dealt with in the buffer zone.

Protection buffer subzone

The protection buffer subzone has a rather strict protection regime and is located directly around the component part. The protective function of this subzone is closely related to the threats that have local origins and short-distance effects.

If the component parts are located close to agricultural land, a buffer zone can protect them from the impact of pesticides or fertilisers. In cases where the property is bordering on economically managed forests, the most likely negative impacts on the property are caused by forestry, leading to a significant reduction of the canopy of adjacent forest stands. Clear-cuts and shelterwood cutting may cause these reductions of the canopy, which have an impact on the microclimatic regime in a forest stand. The opening of the canopy of adjacent stands leads to a change in light regime, microclimate, and wind exposure. This might have direct negative impacts on trees on the property by sunburn, windthrows or unnatural changes in regeneration, as well as in the herb layer.

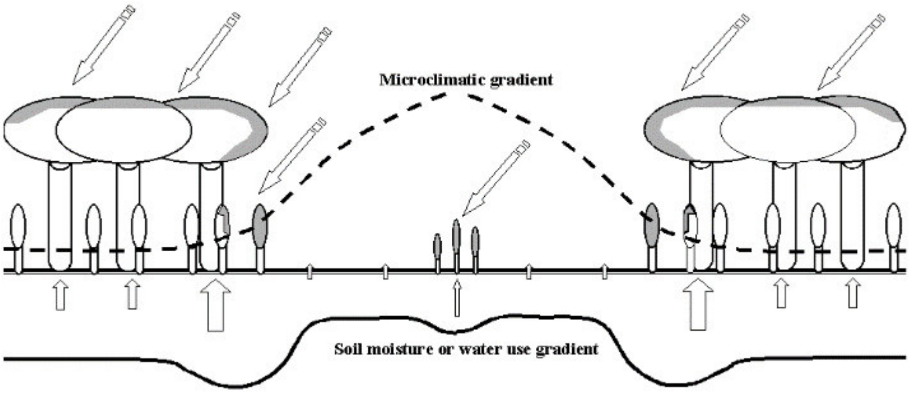

Figure 1: Opening the canopy has effects on microclimate and soil moisture (source: R. Sluiter & N. Smit 2001).

This microclimatic impact is well documented by several studies: MATLACK (1993) described microclimatic effects up to 50 m from the forest edge. JEMALI et al. (2017) documented the impact on temperature up to 50 m and humidity 40-60 m. SCHMIDT et al. 2017 expected altered conditions in soils of transition zones from the forest edge to be 10–20 m with a maximum of 50 m, and 25–50 m for aboveground space with a maximum of 125 m. DAVIES-COLLEY et al. (2000) have observed changes in temperature up to 50 m inside the forest stand. GEHLAHUSEN et al. (2000) documented edge effects on microclimate 40-80 m into the forest stand and observed invasion of exotic species up to 25 m into the forest. These studies give important information on the minimum distance between the property and human-made canopy openings.

SPITTLEHOUSE et al. (2004) demonstrated that openings of less than one tree height in diameter have no significant impact on the microclimate of the surrounding forest stands.

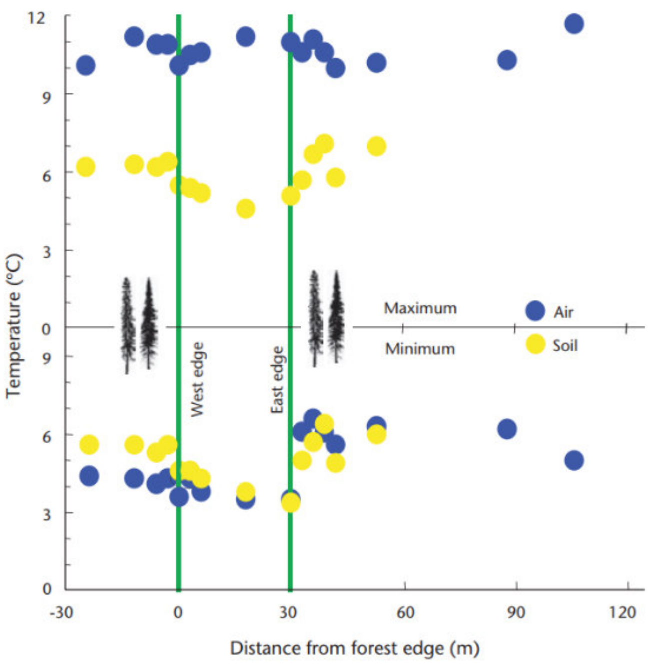

Figure 2: Small forest gaps do not show severe impact on stand climate in neighbouring stands (source Spittelhouse et al. 2004)

This provides important information on the maximum size of human-made gaps in buffer zones near the property to avoid negative microclimatic effects.

Based on these scientific studies, recommendations for the management of the protection buffer subzone were developed.

Figure 3: Clear-cuts closer to the property than 50-80 m can have effects on the microclimate of the property.

To protect the beech forest in the component parts from these negative, man-made influences by forest management, generally, a buffer zone with a protective function with a minimum width of 100 m was or will be established beside economically managed forests and agricultural lands. To protect the forest from other threats, larger buffer zones have been or will be established depending on the requirements.

The management in the protection buffer subzone is limited to very small-scale interventions. Single trees might be removed for phytosanitary purposes to protect the property from invasions of foreign pests. These activities are allowed only with special permission and in restricted areas. Gaps created by human management activities must not exceed the size of the height of a tree in diameter. Human activities must not bring the crown cover below the minimum of 80 % compared to the natural tree cover.

Unless no subzoning takes place because of the choice for a non-intervention regime, a protection buffer subzone is obligatory for each component part. When a river/lake or a steep mountain ridge forms the border and there is no evidence of potential negative impacts across the river, protection buffer subzones might not need to be established.

The geomorphology must be taken into consideration in the design of the protective buffer subzone. Disturbances have a wider reach in the downhill direction of a slope (release of nutrients, human-induced avalanches caused by removing forest stands etc.). Therefore, the protective buffer subzone on the uphill side of the property should be wider than on the downhill side.

Landscape conservation buffer subzone

While the protection buffer subzone is designed to protect from direct local threats like microclimatic impacts, pesticides, or fertilisers, the landscape conservation buffer subzone is addressed to protect the forest landscape of the surrounding area, as an important buffer of the meso-climatic situation and to provide good connectivity between component parts included in the same buffer zone, as well as to the surrounding ecosystems.

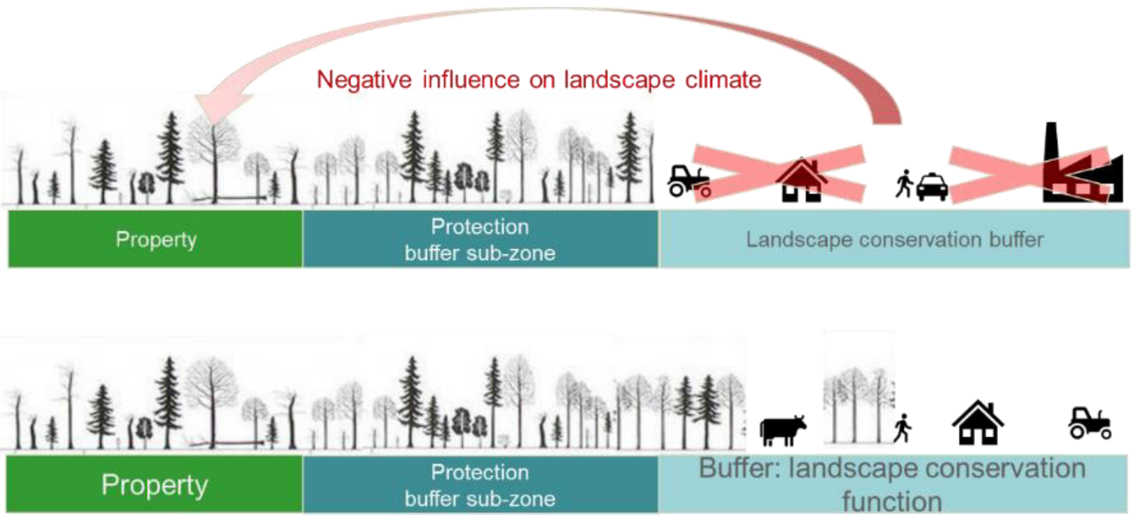

Figure 4: The Landscape conservation buffer subzone should protect the wider landscape from negative developments.

Details on the regulations of land use are found in Table 1.

It is recommended to integrate this subzone into the legal framework of spatial planning on national and local levels.

It is not obligatory for a component part to have a landscape conservation buffer subzone.

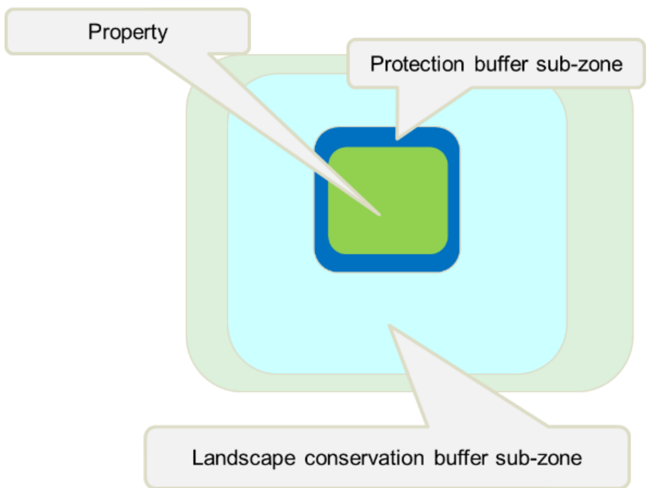

Figure 5: Schematic design of a world heritage component part with two buffer subzones

Landscape conservation function

The more forest cover that can be found in the surroundings of the component parts and the higher the biomass of these forests is, the higher the buffer capacity will be against climatic changes inside the forest and at landscape level. The management needs to ensure that the micro- and meso-climate in the forests of the component parts are not disturbed by human activities outside the component part.

To enhance this meso-climatic buffer function, it is important to protect the adjacent landscapes from negative developments. This includes:

- increasing protected areas and protection status;
- conserving or decreasing the extent of settlements, industrial zones, tourism, and traffic infrastructure;
- conserving or decreasing the extent of extraction of minerals or infrastructure of the energy sector (wind farms, dams, power lines, pipelines etc.);
- decreasing the intensive industrial agricultural land use and replacing it with organic agriculture;
- replacing possible intensive forest management[1] by close to nature, extensive forest management (e.g. selective logging) or new forest reserves.

Connective function

In many cases, the buffer zone covers the entire protected area in which the component parts are located. It connects the undisturbed beech forest stands with other forests or natural ecosystems within the protected area. To ensure connectivity between component parts within the cluster, the connective function of the buffer zone is of high importance. In the case of a continuous natural forest, under non-intervention management of the entire cluster, the connectivity is realised by itself.

Whenever a landscape conservation buffer subzone is relevant, the connective functions require specific management regulations in order to establish a consistent and functional ecological network. The network focuses on conserving and fostering late-successional structural elements and late forest development phases (terminal phase, disintegration phase) in order to provide connectivity and continuity of such natural forest elements. The functional network thus consists of set-aside and senescent patches, habitat trees and a higher amount of dead wood (coarse woody debris). The old-growth patches are functioning as stepping stones for the old-growth forest habitat species, while coarse woody debris and habitat trees guarantee a minimal ecological matrix connecting the forest reserves (component parts) and the old-growth patches. This conceptual model is shown in the scheme of Lachat & Bütler (2007) further on (blue = components, green = set-aside patches, red = habitat trees)

[1] The term „intensive forest management " is used for age-class structured forest management with clear-cut or shelterwood harvesting units larger than 0.5 ha or creating gaps larger than 2x heights of trees. The distance between gaps must be at least 2x the height of trees to be regarded as separate gaps.

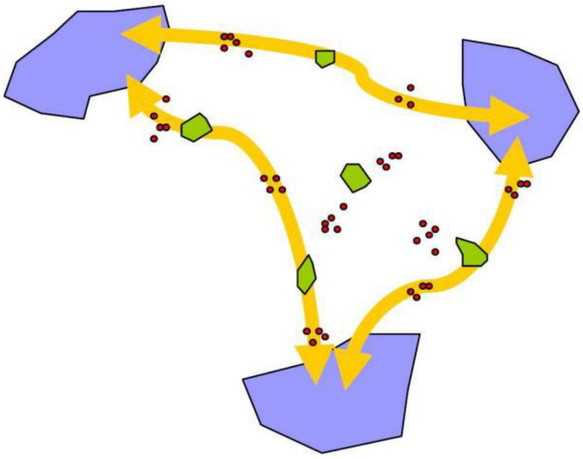

Figure 6: Schematic representation of a functional network of old-growth elements: larger set-asides are interconnected through set-aside patches and individual habitat trees. Source: Lachat and Bütler 2007

To enhance the connective function in the landscape conservation buffer subzone, the forest habitats shall be managed to preserve and promote the natural structure and tree composition of forest ecosystems specific to the local site conditions. The management should strive to preserve and increase the quantity of dead wood, preserve or develop uneven-aged stands, maintain natural gap structure or disturbance dynamic, as well as natural regeneration of all tree species of the potential natural forest type. In the case of managed forests, the average biomass (living and dead) should be increased to approach natural biomass levels.

Management regulations

In Table 1 an overview of the proposed regulations for the property (component part) and the two subzones of the buffer zone are given.

All eighteen States Parties are committed to applying the guidance document in favour of the continued strengthening of the property's protection and hereby ensuring the integrity of the OUV. Commitment to the guidance document justifies by no means the relaxation of legal, national protection measures where these are more ambitious than the baseline laid out in the guidance document. All States Parties strive for a strengthening of the legal protection of the property and will push this forward with reference to the guidance document where needed, in the pursuit of maximal protection for the property.

The regulations are seen as target setting for a minimum requirement and the national regulations can be more restrictive based on the national policy or regulations. In many cases the protection buffer subzone is part of the strict forest reserve and has the same strict protection status as the component part(s) – it is imperative that these strict regimes are not downgraded to less strict protection regimes. It is also noted that not all component parts might need a landscape conservation protection subzone.

The process to establish the spatial division into subzones (if needed) and the adaptation of the rules and regulations from the existing legal framework and management plan towards the new target settings given in the following table is a long-term process which needs intensive involvement of stakeholders and site managers. This only applies to component parts for which States Parties need to adjust the management planning.

After the approval of this guidance document, we assume a period of 5 years to map the spatial boundaries of the subzones for those component parts for which States Parties need to adjust the management planning. Considering the longer time frames needed for the renewal of the management plans, a time period of 10 is allowed to integrate the management targets into the management plan. In a few cases, the traditional land use practices (e.g., shelterwood cuttings) must be shifted step by step into new selective logging schemata, which might take longer, and which should be implemented within 2-3 decades~~.~~

Although the implementation has already started in almost all SPs, all the timelines for implementation are initiated at the moment the guidance document has been finalised and agreed upon by the JMC (May 2023).

The implication of this is, that if a State Party needs 5 years to map the boundaries of the buffer subzones, this will reduce the time available to change the management plans. Of course, the individual State Party can decide to speed up the process of the mapping of the boundaries of the subzones to gain some time to adapt the management plans.

With regard to forest management practises related to the cutting of trees, preference should always be given to less intrusive management systems (e.g. selective cutting).

In the following table, the proposed regulation for each land use and each (sub)zone is classified. In most cases, the regulation is either ‘not allowed’ or ‘possible’. In some cases, there are additional specifications, such as ‘with special permission’ or ‘on restricted areas’.

The specification ‘with special permission’ allows a land use in the given (sub)zone only with permission from a nature conservation authority. This permission can be explicit for each intervention or might be regulated in a management plan.

An official forest management plan (MP) is only valid if it was endorsed/approved by a nature conservation authority.

In the case no approved MP is available yet (e.g. if the MP is under revision), intervention in protection buffer subzones and landscape conservation buffer subzones is only allowed in restricted areas and with special permission, issued by the qualified authority, and endorsed/approved by a nature conservation authority**.**

For some permissions, also other responsible authorities might have to be integrated in the approval process.

The specification ‘only on restricted areas’ allows a land use only on specified sections of the zone. These areas need to be delineated on a map and can be part of a management plan document.

If development proposals near the component parts of the WHS would potentially impact the OUV, an Environmental and Social Impact Assessment (ESIA)2, tailored to the level of the corresponding potentially impacting proposal, is required to identify, evaluate, avoid, and mitigate environmental and

[2] Guidance and toolkit for impact assessments in a World Heritage context | IUCN Library System

social impacts. This is definitely needed for infrastructure development in the buffer zone (but also outside the buffer zone if a potential impact on the OUV cannot be excluded). If the ESIA was positive (no negative impact on the OUV is to be expected) the proposed project (e.g. infrastructure development) might be implemented. In the case of a positive ESIA, a "not allowed" might be overruled.

Table 1: Target settings for minimum management regulations for different (sub)zones.

<table>
<tr><th>Land use</th><th>Property (WH component part)</th><th>Protection buffer subzone</th><th>Landscape conservation buffer subzone</th></tr>
<tr><td colspan="4">AGRICULTURE</td></tr>
<tr><td>Maintenance of existing agricultural land present at the time of inscription</td><td>Not allowed</td><td>Not allowed</td><td>Possible</td></tr>
<tr><td>Land use change from forest to agriculture land (arable fields, meadows, pastures and cattle grazing)</td><td>Not allowed</td><td>Not allowed</td><td>Not allowed</td></tr>
<tr><td colspan="4">In the property and protection buffer subzone: existing agricultural land should be phased out in 2 to 3 decades. Exception is possible in the case of implementation of NATURA 2000 goals within a NATURA 2000 management plan. "If grazing takes place and in order to prevent the forest from grazing the application of adequate methods is necessary (e.g. use of sheepdogs, fencing, etc.) in the property and in the protective buffer subzone."

In Landscape conservation subzone: an exception on land use change is possible in the case of the implementation of NATURA 2000 goals.

All agricultural land use (if existing) should not harm the OUV of the property and agricultural land should be managed according to the principles of high nature-value farming.</td></tr>
<tr><td colspan="4">FORESTRY</td></tr>
<tr><td>Tending operations in young stands</td><td>Not allowed</td><td>Not allowed</td><td>Only allowed within the legally approved Management Plan (MP).</td></tr>
<tr><td colspan="4">Exception for the protection buffer subzone: with special permission, it is possible in restricted areas for 2 – 3 decades to restore natural vegetation types or to create stable forest stands that were planted before time of inscription. If non-native tree species occur they should be reduced through tending operations.</td></tr>
<tr><td>Phytosanitary cuts (pest control)</td><td>Not allowed</td><td>Only allowed for conifer tree species within the legally approved Management Plan (MP) or with special permission.</td><td>Only allowed with special permission or within the legally approved Management Plan (MP).</td></tr>
<tr><td colspan="4">Gaps created by human management activities must not exceed the size of the height of a tree in diameter. Human activities must not bring the crown cover below the minimum of 80 % compared to the natural tree cover.</td></tr>
<tr><td>Cuttings due to extreme events or Salvation harvest</td><td>Not allowed</td><td>Not allowed</td><td>Only allowed within the legally approved Management Plan (MP) or with special permission.</td></tr>
</table>

Land use	Property (WH component part)	Protection buffer subzone	Landscape conservation buffer subzone
			Remaining dead wood volumes should be at least 30 m3/ha in average
Only windthrown and damaged trees are considered for salvation harvest.			
Clear-cuts	Not allowed	Not allowed	Not allowed
If the landscape conservation buffer subzone is > 5 times the area of the property an exception for landscape conservation buffer subzone is exceptionally possible, only in accordance with the management plans approved for Natura 2000, namely restoration towards natural habitats of non-native forest stands or maintenance of light-demanding native species such as *Pinus sylvestris*. The surface area where that silvicultural system may be applied annually will never be bigger than 1% of the total buffer area at the time. This management practice can be applied in maximally 10 % of the landscape conservation buffer subzone and should be described in an approved MP.			
Shelterwood cutting	Not allowed	Not allowed	Not allowed
If the landscape conservation buffer subzone is > 5 times the area of the property an exception for landscape conservation buffer subzone is exceptionally possible only in accordance with the approved management plans for Natura 2000. The surface area where that silvicultural system may be applied annually will never be bigger than 1% of the total buffer area. The remaining trees after the final intervention should be at least 8 to 10 trees per hectare. Special conservation measures should be evaluated periodically to assure conservation of the beech ecosystem.			
Group selection or femel cutting	Not allowed	Not allowed	Allowed within the legally approved Management Plan (MP)
If non-native tree species occur they should be reduced through group selection. The total amount of harvested volume, for all exploitation measures including firewood for local communities, in 10 years is < 10% of standing trees volume at a scale of a forest unit of 50 to 150 hectares.			
Individual tree selection or plenter cutting.	Not allowed	Not allowed	Allowed within the legally approved Management Plan (MP)
Artificial regeneration	Not allowed	Not allowed	Allowed within the legally approved Management Plan (MP) with genetic material from same or adjacent beech forest region.
If natural regeneration is not possible because of the negative consequences of climate change/game browsing and/or grazing these negative impacts have to be solved (as a negative impact of game/livestock on the			

<table>
<tr><th>Land use</th><th>Property (WH component part)</th><th>Protection buffer subzone</th><th>Landscape conservation buffer subzone</th></tr>
<tr><td colspan="4">property is very likely). Artificial regeneration will be used only in cases where, despite efforts, natural regeneration could not be achieved. Seedlings from tree nursery risk to bring pests into the protection buffer subzone.</td></tr>
<tr><td>Assisted natural regeneration</td><td>Not allowed</td><td>Not allowed</td><td>Allowed within the legally approved Management Plan (MP) from same or adjacent beech forest region.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Old-growth patches (set-aside and extended rotation patches)</td><td>Non-intervention~~s~~ zone</td><td>Non-intervention zone</td><td>If surface of the buffer zone < 5x surface of the property = 10 % old-growth patches

If the surface of the buffer zone > 5x surface of the property = 3 % old-growth patches</td></tr>
<tr><td colspan="4">Old-growth patches are equally divided between set-aside patches and senescence patches. The surface and configuration in the area is based on the forest characteristics.

Old-growth patches cover individually 0.5 to 5 ha. Set-aside patches have a non-intervention management, while senescence patches have a temporary period of non-intervention of a rotation of minimal 20 years in order to create more biomass and older trees.</td></tr>
<tr><td>Dead wood volumes</td><td>Non-intervention zone</td><td>Non-intervention zone</td><td>Average dead wood volumes of > = 30 m3/ha or 10 % of the standing volume of the growing stock excluding old-growth patches</td></tr>
<tr><td colspan="4">Dead wood is defined as coarse woody debris with DBH (Diameter at breast height) at least 15 cm diameter. The dead wood fraction should cover both standing and lying dead wood in all decay stages and species composition in line with the growing stock. In general, large dead trees present are to be left unharvested in the forest. Young stands do not have a dead wood volume target. The pace required to reach the dead wood target depends on the biogeographical conditions, development stage of the forest stand and the tree species composition in landscape conservation buffer subzone.</td></tr>
<tr><td>Habitat trees</td><td>Non-intervention zone</td><td>Non-intervention zone</td><td>Minimal **5** habitat trees/ha</td></tr>
<tr><td colspan="4">Habitat trees should be spared during forest interventions, also in young stands habitat trees might occur.</td></tr>
<tr><td>Collecting mushrooms, berries, and medical herbs (only for personal use)</td><td>Not allowed</td><td>Not allowed</td><td>Possible</td></tr>
</table>

Land use	Property (WH component part)	Protection buffer subzone	Landscape conservation buffer subzone
The long-term target is to avoid the collection of mushrooms, berries, and medical herbs in the property and protection buffer subzone. Exception is allowed for the collection by owners for personal use only and if it is allowed by the legislation of the State Party. Commercial use is not allowed.			
Security management along hiking trails	Possible with special permission, wood remains on site	Possible with special permission, wood remains on site	Allowed according to national legislation
Trees that are obviously endangering passengers of hiking/riding/biking trails can be cut for safety reasons. Trees crossing the path can be cut and put aside.			
HUNTING AND FISHING			
Game management controlled by protected area management (to safeguard OUV)	Possible, but reduced to non or minimum intervention	Possible	Possible
Main activities for regulation of game (if needed) should be applied in the landscape conservation buffer subzone. Monitoring of game impact is strongly recommended. Game management should only be applied if game density is increased by anthropogenic factors like feeding, nearby agricultural areas etc. or because of the presence of invasive alien species.			
HUNTING AND FISHING			
Fishing	not of significant relevance to the OUV		
MANAGEMENT OF INVASIVE SPECIES AND PESTS			
Active management (e.g., removal) of invasive species and human-introduced pests to protect the OUV and integrity of the property	Only with special permission and in restricted areas	Only with special permission and in restricted areas	Possible
CONSTRUCTION OF **NEW** INFRASTRUCTURE			
Local supply of electricity (< 20KV) and water, landlines,	Not allowed	Not allowed	Allowed with positive ESIA and special permission
Large infrastructure (power lines > 20KV, cellular phone towers)	Not allowed	Not allowed	Allowed with positive ESIA and special permission
Forest huts, shelters	Not allowed	Not allowed	Allowed with positive ESIA and special permission

Land use	Property (WH component part)	Protection buffer subzone	Landscape conservation buffer subzone
Visitor/information centre	Not allowed	Not allowed,	Allowed with positive ESIA and special permission
Trails (hiking, riding, biking, Nordic skiing)	Not allowed (only with special permission if integrity of the site can be improved by redesign of trails)	Only with special permission if integrity of the site can be improved by redesign of trails and in restricted areas	Only with special permission
Border control infrastructure	Only with special permission (only in few cases relevant)	Only with special permission (only in few cases relevant)	Only with special permission and in restricted areas
Hunting infrastructure	Not allowed	Not allowed	Possible
Hotels, motels, guest houses, restaurants	Not allowed	Not allowed	Allowed with positive ESIA and special permission
The amount of area used by hard touristic infrastructure should not increase significantly compared to the state at the time of inscription (e.g. not more than 10 %)			
Industrial buildings	Not allowed	Not allowed	Allowed with positive ESIA and special permission
The amount of area used by industrial infrastructure should not increase significantly compared to the state at the time of inscription (e.g. not more than 10 %). Industrial buildings should be located in the landscape conservation buffer subzone. Only small-scale artisanal industry with a direct connection to the forest is accepted (e.g. small-scale processing of fruits, vegetables, mushrooms…)			
Forest roads	Not allowed	Not allowed,	Only with special permission
Areas that need new forest roads should be placed in the landscape conservation buffer subzone. Construction of new forest roads in protection buffer sub-ones should only be possible when redirecting existing roads to new corridors to improve the conservation status of the property			
Public roads, railway	Not allowed	Not allowed	Allowed with positive ESIA and special permission
The total number, width and length of roads should not increase significantly in comparison to the amount at the time of inscription.			
Settlements/dwellings in building areas	Not allowed	Not allowed	Only allowed with special permission and restricted to building areas

Land use	Property (WH component part)	Protection buffer subzone	Landscape conservation buffer subzone
The settlement area in the landscape conservation buffer sub-zone should not increase significantly (e.g. not more than 10 % compared to the time of inscription			
Ski slopes, cable cars, snow machines	Not allowed	Not allowed	Not allowed
Watchtowers, look-outs	Not allowed	Not allowed	Only with special permission
Natural hazard management (water management, protection from avalanches, rock fall…)	Only with special permission possible as long as natural processes in the beech forest are not disturbed	Only with special permission possible as long as natural processes in the beech forest of the component part are not disturbed	Possible, as long as natural processes in the beech forest of the component part are not disturbed
Whenever possible, tourism infrastructure and natural hazard management should be located outside the property and the protection buffer subzone.			
MAINTENANCE OF EXISTING INFRASTRUCTURE			
Besides hiking trails, there is hardly any significant infrastructure in the component parts. If possible, existing infrastructure should be moved outside the component part and the protection buffer subzone in the long-term perspective. If it is not possible to remove all existing infrastructure in the property and in the protection buffer subzone, maintenance is allowed by national legislation. Visitor infrastructure (e.g. trails, information boards, cultural heritage) or natural hazard management infrastructure can be maintained in line with the national legislation in the property or protection buffer subzone. In the landscape conservation buffer subzone, the maintenance of existing infrastructure is allowed by national legislation. Maintenance of visitor infrastructure in this subzone is generally allowed. Removal of dead trees from the path (or parts of these) is possible inside the property as long the timber stays on the site.			
SCIENTIFIC RESEARCH			
Destructive scientific research (e.g. removing trees for measures)	Not allowed	Not allowed	Possible
Non-destructive research	With special permission possible	With special permission possible	Possible
Taking a core for age/growth analysis or collecting small samples for genetic assessment is not regarded as destructive.			
TOURISM AND RECREATION			
Expedition to caves	Not allowed	Not allowed	Possible

Land use	Property (WH component part)	Protection buffer subzone	Landscape conservation buffer subzone
Extreme sports (paragliding, climbing, rafting)	Not allowed	Not allowed	Possible
Paragliding, climbing, and rafting are unlikely to have a negative impact on the integrity of the beech forest ecosystem, especially when it is conducted outside the property and the protection buffer subzone.			
Hiking on trails (including Nordic skiing)	Possible	Possible	Possible
Off-trail hiking	Not allowed	Not allowed	Possible
Riding, biking on trails	Not allowed	Not allowed	Possible
It is proved that legal restrictions are not as successful as visitor guidance by means of a proper and attractive trail system and awareness-raising measures (information boards, leaflets, explanations by rangers …)			
MILITARY ACTIVITY AND (MOUNTAIN) RESCUE SERVICE			
Non-destructive military practices (e.g. survival training, fighting in mountains and wooded terrain, etc.), as well as rescue services, are allowed if they do not exceed the amount of practice before the inscription.			

Annex

References on buffer zone management, threats, and connectivity

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Literature review on microclimate and edge effects in forest ecosystems

The impact on the microclimate was addressed in several scientific papers. A review is summarized in Table 2 and in the following graphs (Figure 1, Figure 2, Figure 3, Figure 4).

Table 2: Overview on selected papers dealing with microclimatic edge effect of forest ecosystems.

Paper	Spatial microclimatic impact	Forest ecosystem
DAVIES-COLLEY et al., 2000	Up to 50 m into the forest	Native broadleaf rainforest, New Zealand
DIDHAM & EWERS, 2014	Vertical impact (experimental setup 16 m inside the forest)	Temperate rainforest, New Zealand
SPITTLEHOUSE et al., 2004	No significant impact of openings of less than one tree height in diameter	Spruce-fire forest, British Columbia
JEMALI et al., 2017	Temperature effect up to 50 m, relative humidity 40-60 m	Tropical forest Malaysia
GEHLAHUSEN et al., 2000	Microclimatic effects disappear in 40-80 m. Exotic species mainly in the first 25 m.	Oak-Acer mixed forest, Illinoi, US
MATLACK, 1993	Microclimatic effects up to 50 m from the edge.	South-eastern Pennsylvania and northern Delaware, US
SLUITER & SMIT	Gap size effects on microclimate and soil moisture – Gaps from 40 to 3200 m²	Undisturbed forest: 13 experimental gaps of the Pibiri Gap Experiment (PGE)
GRAY et al., 2002	Effect of gap size on solar radiation and soil and air temperatures, response of water content in soil and common forest-floor substrates to gap formation and trends in soil moisture over several years	Douglas-fir forests of the Pacific Northwest, U.S. A
RITTER et al., 2003	Temporal and small-scale spatial variation in microclimate and soil moisture levels on gradients along the forest-gap continuum in irregularly shaped gap with a diameter of 24 m	Semi-natural beech dominated forest in Denmark.
DIDHAM & EWERS, 2014	Edge influence on vertical stratification of microclimate across the full vertical profile from ground level to upper canopy	Temperate rain forest, New Zealand

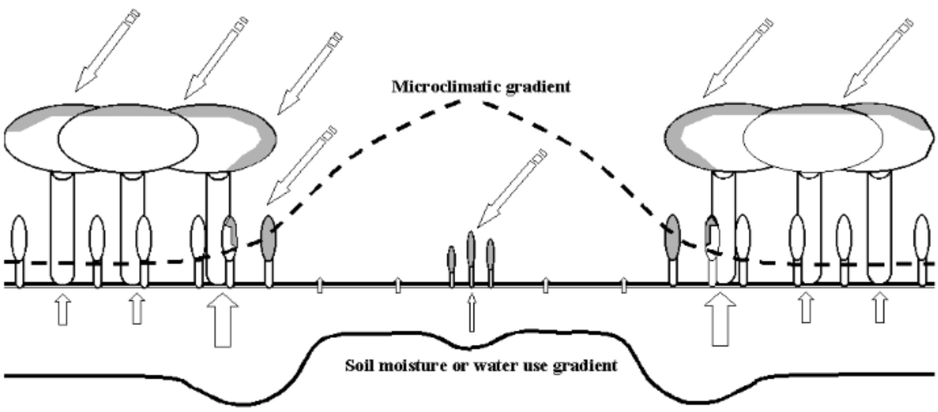

Figure 3.1 Gradients of microclimatic conditions (dashed line) and soil moisture or soil water consumption (solid line and solid arrows) in gaps. The gray areas on the vegetation are parts of the crowns that receive direct solar radiation (dashed arrows) and the small arrows in the gap represent direct soil evaporation. (see text for further explanation)

Figure 6 - R. Sluiter & N. Smit 2001: Gap size effects on microclimate and soil moisture.

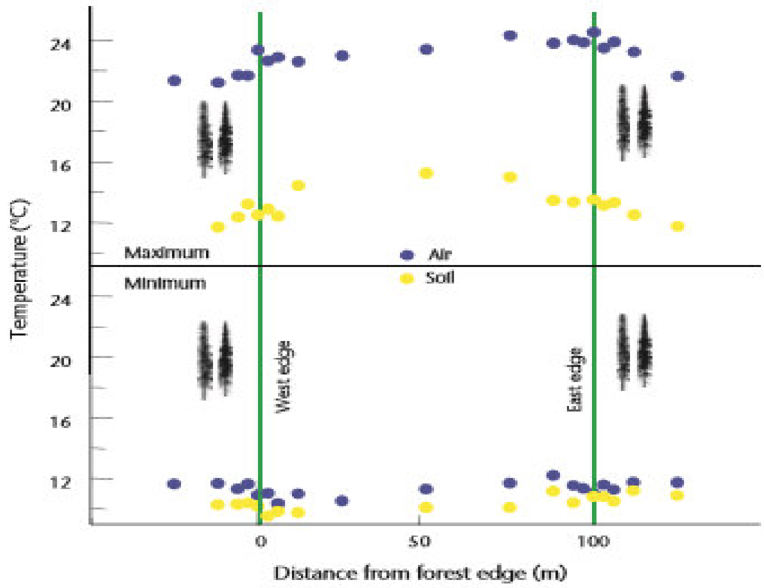

FIGURE 10 *Daily maximum and minimum air and soil temperature on a west–east transect from the forest through the 1-ha opening, August 9, 1997.*

Figure 7 - D.L. Spittlehouse, R.S. Adams, and R.D. Winkler, 2004: Forest, Edge, and Opening Microclimate at Sicamous Creek - Research Report 24

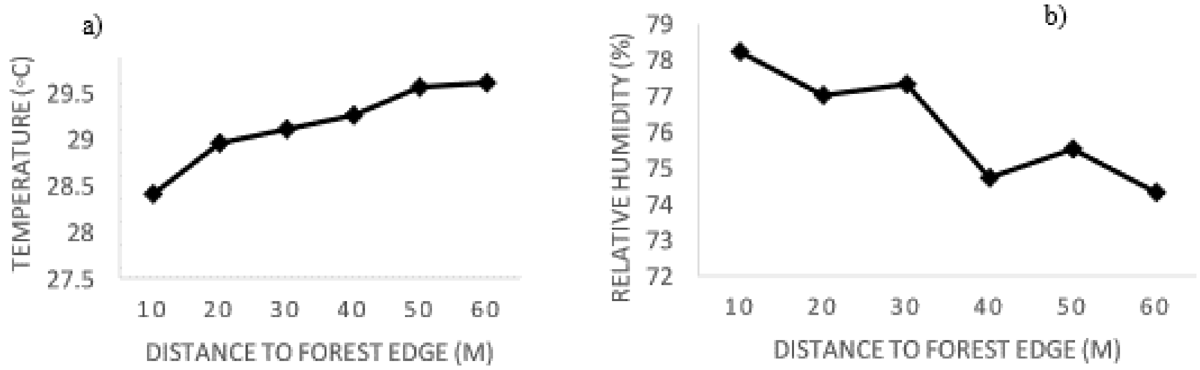

Figure 1 a) Relaive humidity and b) temperature pattern in study area

Figure 8 - Noor Jemali, Syafinie Abdul Majid, Saiful Sulaiman, Sadam KAHAR, Muhamad Faiz Arif, 2017. Microclimate and vegetation edge effects of Jeli forest in Kelantan

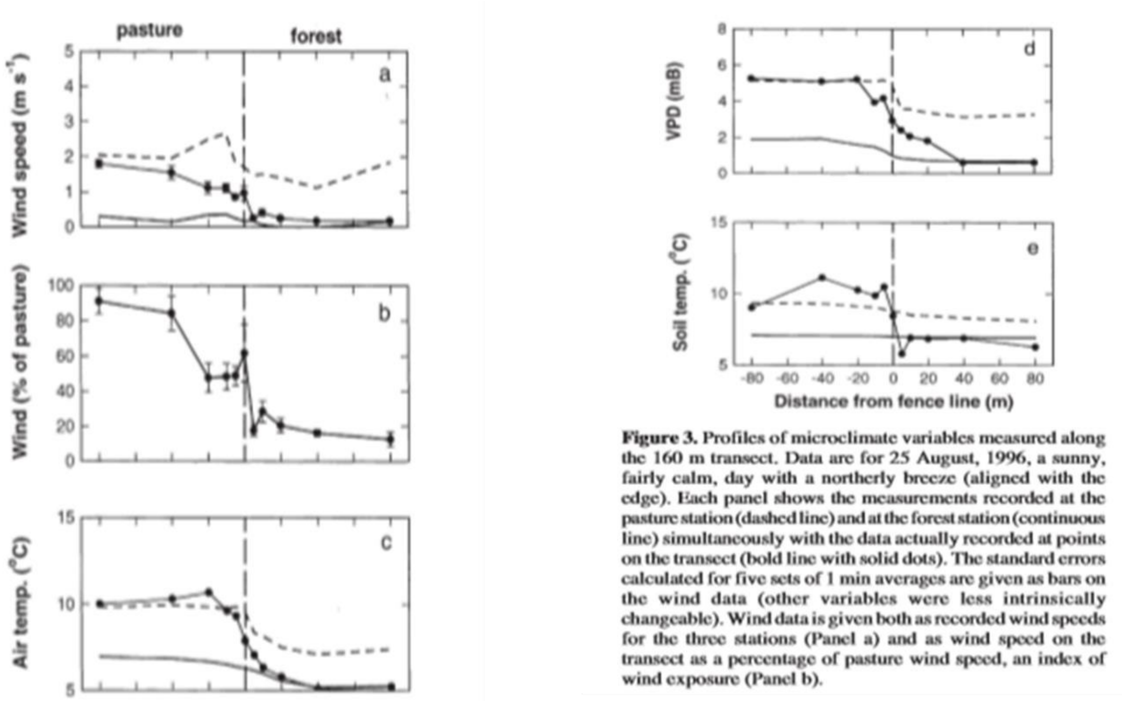

Figure 3. Profiles of microclimate variables measured along the 160 m transect. Data are for 25 August, 1996, a sunny, fairly calm, day with a northerly breeze (aligned with the edge). Each panel shows the measurements recorded at the pasture station (dashed line) and at the forest station (continuous line) simultaneously with the data actually recorded at points on the transect (bold line with solid dots). The standard errors calculated for five sets of 1 min averages are given as bars on the wind data (other variables were less intrinsically changeable). Wind data is given both as recorded wind speeds for the three stations (Panel a) and as wind speed on the transect as a percentage of pasture wind speed, an index of wind exposure (Panel b).

Figure 9 - R. J. Davies-Colley, G. W. PAYNE, and M. van Elswijk. Microclimate gradients across a forest edge. New Zealand Journal of Ecology · January 2000.

The results of the papers listed in Table 2 and of the graphs show impacts of openings on the microclimate up to 50 m(average) into the forest.

The depth of impact depends on the orientation of the forest edge. On edges exposed by sun and wind (in Europe mainly south and west) the impact is larger than on the opposite edges. Low impact is measured on the northernedges.

SPITTLEHAUSE et al. (2004) measured the impact of openings of different sizes on the microclimate. They documented that openings of less than one tree height in diameter have no significant impact on the microclimate.

According to SLUITER & SMIT, microclimate conditions were strongly influenced by gap size and the effect of the gap on the microclimate was noticeable beyond the perpendicular projection of the canopy opening. Gap size had the strongest influence on solar radiation and air temperature, which increased according to the increase of the gap size up to approximately 600 m² after which no increase was found. The effect of a gap on the air temperature decreased over time, as the vegetation in the gap was regenerating. Soil temperature was probably likewise, or even more, affected by soil cover and soil moisture. The extent of the gap on microclimatic variables was noticeable up to 10 m from the gap edge.

DAVIES-COLLEY et al. (2000) found that the edge effects on microclimate extend at least 40 m into native New Zealand rainforest. This result is also consistent with that of YOUNG & MITCHELL (1994) who discussed ramifications for terrestrial ecology and indigenous species conservation in New Zealand of the 50 m wide edge zone that they inferred from their microclimate data. They suggested that native forest remnants < 9 ha in area are dominated by edge microclimate conditions, and that remnants < 1 ha lack interior forest conditions.

Based on these results, a minimum distance of artificial openings larger than the height of one tree in diameter should be over 50 m from the property border to avoid negative long-term effects on the forest stands inside the property.

Especially alongside roads, railroads, and industrial sites there is an increased risk of emissions of gas, chemicals, noise, and light. Depending on the geomorphological situation and wind directions, the risk has different effective distances. The factor most difficult to assess is spatial distribution of air pollution. There is a short-distance buffer effect on dust and air pollution alongside roads, but in Europe we are facing long-distance distribution of air pollutants as well, which cannot be managed by buffer zones.

Transport infrastructure like roads and railroads are known as corridors of foreign species and pests. They were considered to have a medium to high impact on the forests inside the property in the future by several protected areas participating in the online survey. Depending on the individual ecology of invasive species and pests a buffer zone can help to increase protection. Only few of the invasive species known in Europe today have the capacity to alter beech forest ecosystems significantly. Pests like fungi affecting the beech tree itself pose the highest risk. The risk of invasive pathogens and species might change radically due to climate change.

SLUITER R. & SMIT N. 2001. Gap size effect on microclimate and soil moisture. In: Effects of gap size on water and nutrient cycling in tropical rain forest, a study in Guyana (O. van Dam, PhD. Thesis). Utrecht University, Faculty of Geographical Sciences, 49–66.

Literature review on climate change and beech forest ecosystems

European beech is known to respond more significantly to drought than numerous other broadleaved tree species in Central Europe (e.g., LEUSCHNER et al. 2001, BRÉDA et al. 2006).

The climate response and future distribution of *F. agus sylvatica* to global warming is controversially discussed (e.g., KÖLLING et al. 2007, KRAMER et al. 2010). RENNENBERG et al. (2004) assumed that by the end of the present century beech will no longer be in its optimum range in numerous locations where it is dominating nowadays. PEUKE et al. (2002) presumed that beech will be impaired in its physiological capacity, its growth, and competitiveness.

Beech trees have a notable potential to recover after drought periods (van der WERF et al. 2007) and show a high drought tolerance through a strong allocational plasticity (SCHALL et al. 2012, MÜLLER-HAUBOLD et al. 2013).

Besides the competition for light, competition for water plays another key role between F*agus sylvatica* seedlings and other competitors in the forest understory (FOTELLI et al. 2002, 2004, ROBSON et al. 2009). Therefore, increased frequency and duration of summer droughts will possibly harm the natural regeneration of this forest tree (GESSLER et al. 2007).

Some studies on the drought tolerance of *Fagus sylvatica* detected better adaptation of trees originating from drier than of moister origins in significant traits. Meanwhile, other studies detected only weak significant differences in the drought adaption of beech genotypes (e.g., ROSE et al. 2009, ROBSON et al. 2012, THIEL et al. 2014). It may be possible that provenances from the southern margin of the distribution can cope better with predicted climate warming in Central Europe (RENNENBERG et al. 2004, EILMANN et al. 2014).

F. KNUTZEN (2016) in his study concludes that global warming is already acting as a major stressor in F. sylvatica forest stands even in the centre of the species' distribution range. Current growth-reductions were detected in regions where precipitation in summer is below 200 mm. In future, growth reductions will also occur in today's moderately moist habitats. But it is not clear if growth limitations are contributing to investments into safety mechanisms or should be seen as loss of vitality. Beech showed high plasticity in most of the investigated morphological, physiological, and growth-related traits. Changes in vessel diameter, hydraulic properties and embolism resistance in mature beech trees and adjustment of cell wall elasticity in beech saplings show that beech has a substantial adaptive potential to respond to environmental climatic conditions. Also, the high trait variability within populations could represent a valuable source for adaptation in *Fagus sylvatica*. All this can be advantageous for the future well-being of *Fagus sylvatica* in Central Europe. However, it is doubtful whether these careful and slow evolving drought adaptions are enough to safeguard growth and vitality of *Fagus sylvatica* against the challenges by a rapidly warming and drying climate.

Climate change cannot be directly and significantly influenced, but locally and regionally the buffer and cooling capacity will depend on the wider landscape quality. Large, forested landscapes can help reduce maximum temperatures and fluctuations as well as wind speeds and evapotranspiration. It is of equal importance to manage the water retention capacity of the forest ecosystems within and around the component parts. This can be done by appropriate strategies of landscape conservation and the sustainable development function of the buffer zone and surrounding landscapes.

Glossary of forest management terms

Glossary of Forest management terms used by the Unesco WHS "Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe"

- This Glossary of Forest management terms is a list of definitions in order to create a common language and joint understanding for the management of the property and the buffer zone of the WHS "Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe".
- In an attempt to reach this common understanding, several terms are defined using easy to understand and metric parameters, based on international and regional forestry manuals. We are aware that these definitions may diverge from legally binding definitions in the respective States Parties. In no way do the below applied definitions and restrictions replace or abolish official definitions and restrictions included in existing national or regional legislation.
- The definitions will be used in the context of the WHS Beech "Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe."

A) Silvicultural system[3]

A silvicultural system	A planned series of treatments for tending, harvesting, and re-establishing a stand. The silvicultural system is applied in the forest stand or forest management unit. The forest stand is a homogeneous unit within the forest that has a certain structure and tree species composition and is managed in the same way, areas can differ from very small (< 1 ha) to very large (up to 50 ha).

Most of the management treatments being used can be assigned to following management options:

1. Even-aged silvicultural system	A planned sequence of treatments designed to create or maintain a stand with predominantly one age class. The range of tree ages for an even aged forest is generally assumed to be 20 % or less of the rotation age.
2. Uneven-aged silvicultural system	A planned sequence of treatments designed to create or maintain a stand with three or more age classes. These silvicultural systems include cutting methods designed to obtain regeneration (regeneration cutting methods), and a variety of cultural practices for modifying tree density and otherwise contributing to the development of an immature stand (intermediate cutting methods) but is especially the result of single tree or group selection systems. In the single tree selection (plentering) (natural) regeneration is not an aim but has to be considered because of harvesting a single mature tree.

3 https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5413732.pdf

3. Non-intervention forest	is characterized by the lack in formal management, e.g. in the preference of natural development of forests for nature conservation purposes. As the lack of formal management measures is a consequence of a management vision it should be viewed as a management regime. In some forests a non-intervention regime is the only management measure applied. Areas in the forest with explicit and deliberate choice of non-intervention can be larger (10-1000 ha, often defined as 'forest reserve') or smaller areas (0.5-10 ha), embedded in a matrix of managed forests (often called 'set-aside islands').

A 1) Even-Aged Management

Even-aged management involves application of regeneration and intermediate cutting methods to create and maintain an even-aged stand. The even-aged regeneration cutting methods are clearcutting, seed-tree cutting, and shelterwood cutting. The even-aged silvicultural system also includes thinning, improvement cutting, release, and other intermediate cutting methods.

Clearcutting system	The harvesting in one operation of (almost) all trees with the expectation that a new, even-aged stand will be established. In the context of this document, we define a minimum surface of 0.5 ha. Intervention areas smaller than that are covered as 'group fellings' or 'femel cutting'. (The size limit of the intervention area is related to the circular area with a diameter between 2 and 3 times the tree height of mature trees*). There are many variants of clearcutting (a common variant is strip clearcutting): nevertheless, independent of form the same rule on the intervention area can be applied. In modern clear-cut areas, some trees may be spared from felling (tree retention, e.g. habitat trees). The remaining canopy cover after clearcutting is below 30 % of the initial cover. * in some countries, lower surface minima are applied; local legal restrictions off course always apply.
Shelterwood cuttings system	The shelterwood regeneration method involves a series of entries designed to improve the vigour and seed production potential of residual trees, and to provide suitable conditions for seedling establishment. To be considered the shelterwood method, the prescription must include an explicit regeneration objective. Generally, the shelterwood cutting method is used to create an even-aged or two-aged stand, the regeneration period is about 20 to 30 years. Theoretically a shelterwood cutting could involve from two to four steps. A four-step shelterwood includes a preparatory cut, a seed cut, first removal and final removal cut. A two-step shelterwood includes a seed cut and a removal or final cut. We distinguish a uniform shelterwood and a group shelterwood. Uniform shelterwood means that the seed cut and removal cut are applied to the entire stand area. In a group shelterwood system, cuttings are limited to smaller plots. In the context of this WHS we refer to a group shelterwood system whenever the

	plots or groups are smaller than 0.5 ha. Regulations for group shelterwood systems are mentioned together with femel cutting.

A 2) Uneven-Aged Management

Uneven-aged management uses regeneration and intermediate cutting methods to create and maintain an uneven-aged stand. The uneven-aged regeneration methods are individual tree and group selection cutting. Regeneration period is continuous.

Individual Tree Selection or plenter cutting.	This silvicultural system involves removing selected trees from specific size or age classes over an entire stand area. Removing single trees creates small openings so this method favours the regeneration of species that can tolerate shade. Individual tree selection is used to create or maintain an uneven-aged stand, reflecting a predefined (semi-)natural age or size distribution. It involves periodic selective harvests (final harvest and thinnings combined), and no rotation period and continuous regeneration.
Group Selection or femel cutting	This silvicultural method involves final felling of small groups of trees[4]. The resulting openings permit more sunlight to reach the forest floor than with individual tree selection, and some regeneration of shade intolerant species is possible. Planned repeated application of group final fellings result in small groups or clumps dispersed through a stand, with each group containing trees of similar age and size classes. We refer to group selection whenever the intervention area is smaller than 0.5 ha.

Non-native tree species	is a tree species living outside its historical or actual native distributional range, but which has arrived there by human activity, directly or indirectly, and either deliberately or accidentally.

[4] One to two tree heights are the rule (Leibundgut, 1981; Runkle, Brokaw). This results in a canopy gap of max. 0.1 to 0.5 ha)

B) Silviculture terminology

Tending operations in young stands	In even-aged stands, between the period when a tree stand is established and the first commercial harvesting operation~~,~~ there are a number of tasks that are carried out to allow access to the stand and improve survival rate, tree form, and wood quality of young trees. In Europe we normally distinguish tending and thinning: Tending (pre-commercial thinning): operations to improve the tree shape and spacing and tree species composition, but with no financial revenue, only investment in increased survival of trees (suppression of competing vegetation) and tree shape and quality. Thinning: selective removal of trees, if the felled trees can be sold we refer to commercial thinning.
Cuttings due to extreme events or Salvation harvests:	Salvation harvest is the harvest of trees that were affected by a disturbance event, leading to considerable amounts of dying trees. Trees are removed to recuperate some financial revenue, or for accessibility, or to prevent further spread of pests and diseases (= sanitary cutting).
Phytosanitary cuts (pest control)	Sanitary cutting[5] - extraction of dead, damaged, broken and fallen trees etc. to improve the phytosanitary condition of the forest stand. It is applied in the situation where the stand is affected by biotic factors (pest attacks) and the extraction of the affected trees is not part of the regular management but is necessary in order to prevent further spread of a biotic disturbance agent (e.g. insect or fungal infection) to the remaining forest stand or adjacent unaffected forest stands = a specific situation of 'salvation harvest'.
Artificial regeneration	Active planting of trees, grown in nurseries. Often applied if the natural regeneration is not sufficient or does not include specific target tree species.
Natural regeneration	Regeneration from seed or vegetative parts originating from trees in situ.
Assisted natural regeneration	Natural regeneration of forest/other wooded land with deliberate human intervention aimed at enhancing the ability of desired species to regenerate. Works to help natural regeneration establishment and growth (age of the trees: 0 - 5 years, approximately): Examples: Scarification of the soil to create good germination conditions for seeds.

[5] Information Romania

C) Additional measures of integrative management (cfr. Kraus & Krumm, 2013).

Functional network of old-growth elements	This contains: conservation and development of old-growth patches (set-aside and extended rotation patches), habitat trees (individual trees or clusters) and large dead wood.
Set-aside patches	Areas that are deliberately delineated to conserve or develop to old-growth stages through non-intervention = biologische Altholzinseln (îlots de sénescence).
Extended rotation patches/ senescence patches	Areas that remain managed but are deliberately delineated to develop old stands by significantly extending the rotation period or excluding final harvest (only selective thinning). (wirtschaftliche Altholzinseln (îlots de viellissement).
Corridors	Connecting areas between the component parts of the functional network of old-growth elements and other biodiversity hotspots, containing a high concentration of old-growth features.
Habitat tree[6]	Tree containing Tree Related Microhabitats (TReM's - Larrieu et al): they are preferably (or wherever possible) large and old trees (mature or overmature).
Tree related Microhabitat	A distinct, well delineated structure occurring on living or standing dead trees, that constitutes a particular and essential substrate or life site for species or species communities during at least a part of their life cycle to develop, feed, shelter, or breed. TreMs are specific aboveground tree morphological singularities that are not to be found on every tree. TreMs encompass both tree-originating modifications caused by biotic and abiotic impacts, such as intrusions, lesions, and breakages, which expose sap and heartwood and initialize outgrowth structures and wood decay (saproxylic TreM), as well as elements of external origin that are physically linked to the tree (epixylic TreM).

[6] Tree related microhabitats in temperate and Mediterranean European forests: A hierarchical typology for inventory standardization

Size of components and buffer zone

	Component part/cluster	State Party	Component (ha)	Bufferzone (ha)
1	Lumi i gashit	Albania	1.261,52	8.977,48
2	Rrajca	Albania	2.129,45	2.569,75
3	Durrenstein	Austria	1.867,45	1.545,05
4	Kalkalpen-Bodinggraben	Austria	890,89	
5	Kalkalpen-Hintergebirge	Austria	2.946,20	
6	Kalkalpen-Uriach	Austria	264,82	
7	Kalkalpen-Wilder Graben	Austria	1.149,75	14.197,24
8	Sonian Forest – Forest Reserve “Joseph Zwaenepoel	Belgium	187,34	
9	Sonian Forest – Grippensdelle A	Belgium	24,11	
10	Sonian Forest - Grippensdelle B	Belgium	37,38	
11	Sonian Forest - Réserve forestière du Ticton A	Belgium	13,98	
12	Sonian Forest - Réserve forestière du Ticton B	Belgium	6,50	4.650,86
13	Central Balkan - Dzhendema Reserve	Bulgaria	1.774,12	2.576,63
14	Central Balkan - Kozya stena Reserve	Bulgaria	644,43	289,82
15	Central Balkan - Peeshti skali Reserve	Bulgaria	1.049,10	968,14
16	Central Balkan - Severen Dzhendem Reserve	Bulgaria	926,37	1.066,47
17	Central Balkan - Sokolna Reserve	Bulgaria	824,90	780,55
18	Central Balkan - Stara reka Reserve	Bulgaria	591,20	1.480,04
19	Central Balkan - Steneto Reserve	Bulgaria	2.466,10	1.762,01
20	Central Balkan- Boatin Reserve	Bulgaria	1.226,88	851,22
21	Central Balkan- Tsarichina Reserve	Bulgaria	1.485,81	1.945,99
22	Hajdučki i Rožanski kukovi	Croatia	1.289,11	9.869,25
23	Paklenica National Park - Oglavinovac-Javornik	Croatia	790,74	395,35
24	Paklenica National Park - Suva draga-Klimenta	Croatia	1.241,04	414,76
25	Grumsin	Germany	590,1	274,30
26	Hainich	Germany	1.573	4.085,40
27	Jasmund	Germany	492,5	2.510,50
28	Kellerwald	Germany	1.467	4.085,40
29	Serrahn	Germany	268,1	2.568,00
30	Abruzzo, Lazio & Molise - Coppo del Morto	Italy	104,71	415,51
31	Abruzzo, Lazio & Molise - Coppo del Principe	Italy	194,49	446,62
32	Abruzzo, Lazio & Molise - Selva Moricento	Italy	192,70	
33	Abruzzo, Lazio & Molise - Valle Cervara	Italy	119,70	751,61
34	Abruzzo, Lazio & Molise - Val Fondillo	Italy	325,03	700,95
35	Cozzo Ferriero	Italy	92,53	
36	Pollino National Park	Italy	477,94	2.771,08
37	Foresta Umbra	Italy	182,23	1.752,54
38	Monte Cimino	Italy	57,54	87,96
39	Monte Raschio	Italy	73,73	54,75
40	Sasso Fratino	Italy	781,43	6.936,64
41	Valle Infernale	Italy	320,79	2.191,36

42	Cheile Nerei-Beușnița	Romania	4.292,27	5.959,87
43	Codrul secular Șinca	Romania	338,24	445,76
44	Codrul Secular Slătioara	Romania	609,12	429,43
45	Cozia – Lotrisor	Romania	1.103,30	
46	Cozia - Masivul Cozia	Romania	2.285,86	2.408,83
47	Domogled - Valea Cernei - Ciucevele Cernei	Romania	1.104,27	
48	Domogled - Valea Cernei - Domogled-CoroniniBedina	Romania	5.110,63	
49	Domogled - Valea Cernei - Iauna Craiovei	Romania	3.517,36	51.461,28
50	Groșii Țibleșului - Izvorul Șurii	Romania	210,55	
51	Groșii Țibleșului – Preluci	Romania	135,82	563,57
52	Izvoarele Nerei	Romania	4.677,21	2.494,83
53	Strîmbu Băiuț	Romania	598,14	713,09
54	Havesova	Slovakia	167,87	
55	Stuzica-Bukovske vrchy	Slovakia	1.742,33	
56	Rozok	Slovakia	74,55	
57	Udava	Slovakia	453,75	14.123,93
58	Vihorlat	Slovakia	1.559,41	847,54
59	Kyjovsky-prales	Slovakia	289,39	104,46
60	Krokar	Slovenia	74,50	47,90
61	Snežnik-Ždrocle	Slovenia	720,24	128,60
62	Hayedos de Ayllón – Montejo	Spain	71,79	
63	Hayedos de Ayllón - Tejera Negra	Spain	255,52	13.880,86
64	Hayedos de Navarra - Aztaparreta	Spain	171,06	
65	Hayedos de Navarra - Lizardoia	Spain	63,97	24.494,52
66	Hayedos de Picos de Europa - Canal de Asotin	Spain	109,58	
67	Hayedos de Picos de Europa - Cuesta Fría	Spain	213,65	14.253,00
68	Chornohora	Ukraine	753,48	4.637,59
69	Gorgany	Ukraine	2.476,80	12.925,00
70	Kuzi-Trybushany	Ukraine	1.369,60	3.163,40
71	Maramosh	Ukraine	2.243,60	6.230,40
72	Roztochya	Ukraine	348,81	598,21
73	Satanivska Dacha	Ukraine	212,01	558,37
74	Stuzhytsia- Uzhok	Ukraine	2.532,00	3.615,00
75	Svydovets	Ukraine	3.030,50	5.639,50
76	Synevyr – Darvaika	Ukraine	1.588,46	312,32
77	Synevyr – Kvasovets	Ukraine	561,62	333,63
78	Synevyr – Strymba	Ukraine	260,65	191,14
79	Synevyr – Vilshany	Ukraine	454,31	253,85
80	Uholka-Shyrokhyi Luh	Ukraine	11.860,00	3.301,00
81	Zacharovanyi Krai – Irshavka	Ukraine	93,97	
82	Zacharovanyi Krai - Velykyi Dil	Ukraine	1.164,16	1.275,44
		Total	**91.303,16**	**259.365,55**