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STUDY ON NATURE-BASED CLIMATE SOLUTIONS IN SERBIA

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Study on Nature-Based Climate Solutions in Serbia

Study on Harnessing Nature's Potentials in Response to Climate Change Challenge

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STUDY ON NATURE-BASED CLIMATE SOLUTIONS IN SERBIA

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Table of Contents

ACRONYMS

AFOLU	Agriculture, Forestry and Other Land Use
BUR	Biennial Update Report (under the reporting requirements towards the UNFCCC)
CBD	Convention on Biological Diversity
CSA	Climate-Smart Agriculture
EbA	Ecosystem-based Approach
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GI	Green Infrastructure
GHG	Greenhouse Gasses
NAMA	Nationally Appropriate Mitigation Actions
NBS	Nature-Based Solutions
NDC	Nationally Determined Contribution
NFP	National Forest Program
NWRM	Natural Water Retention Measures
IIED	International Institute for Environment and Development
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
REDD	Reducing Emissions from Deforestation and Forest Degradation
UNEP	United Nations Environment Programme
UNFCCC	United Nation Framework Convention on Climate Change
UNDP	United Nations Development Programme
UIA	Urban Innovation Actions
WWF	World Wildlife Foundation

1. INTRODUCTION AND SUMMARY

This study is based on a comprehensive desk analysis aiming to identify and assess various Nature-Based Solutions (NBS), their links with climate change impacts and their applicability in and relevance to the Republic of Serbia. Consequently, it should feed into the Serbia's reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and to the European Union (EU) and help raise awareness of climate change impacts, thus contributing to the overall climate-related efforts of the Serbian Government.

NBS are a relatively novel concept, developed over the past 10-15 years and mainly promoted by international organizations (IUCN, WWF, UNEP, UNDP, etc.) and, more recently, by the European Commission. NBS are defined as actions which "**use ecosystems and the services they provide to address societal challenges such as climate change, food security or natural disasters**" [1].

NBS actions can contribute to addressing various societal challenges, including flood prevention and protection, managing risks of natural disasters, improving forest management, ensuring food and water security, combating climate change and contributing to the global improvement of the social, economic and health conditions, by strengthening the local communities' resilience to natural disasters.

NBS are a powerful mechanism for **climate change mitigation** due to their capacity to prevent degradation and loss of natural ecosystems, for example through sustainable forest management or improved conservation and land management actions. Moreover, natural and modified ecosystems can also extremely effectively contribute to combating climate change thanks to their function of a 'natural carbon sink', i.e. absorption and insulation of CO_2 emissions.

NBS can provide low risk, low maintenance and low-cost solutions to many climate change related disasters and impacts. In addition to protecting biodiversity and ecosystem services, NBS can also contribute to **climate change adaptation** when applied strategically and justifiably.

Numerous global and EU driven initiatives, such as the Katowice Declaration, the UN-REDD (Reducing Emissions from Deforestation and Forest Degradation) Programme, EU Research & Innovation Policy, etc., demonstrate the NBS' applicability in various fields and sectors, and a variety of approaches to their application.

Various approaches can be used to apply NBS, including **green infrastructure (GI) projects or ecosystem-based approaches (EbA)**, in different fields. Measures facilitating the practical implementation of NBS through policy development and enforcement, stakeholder involvement and building the capacity of the national institutions and/or local communities are equally important.

Cost-benefit estimates show the NBS' potential to yield cost-efficient solutions and many other benefits. In addition to mitigating climate change, GI solutions can contribute to the amelioration of temperature in urban areas, energy efficiency in buildings, etc. Application of Green Infrastructure in flood protection can substantially cut the costs of flood damage or lower flood risk management costs. On the other hand, EbAs have proven to be cost-effective alternatives to traditional solutions and capable of yielding a variety of long-term, substantial and comprehensive adaptation-related benefits, as well as social and ecosystem co-benefits.

Mainstreaming and scaling up NBS within the countries' Nationally Determined Contributions (NDCs) and/or other national and local climate public policies is one of the most

[1] https://portals.iucn.org/library/node/46191

important mechanisms that should be taken into consideration to ensure better and more efficient usage of the NBS' potentials for combating climate change.

The Republic of Serbia has drafted its first national Low Carbon Development Strategy with an Action Plan, which are to be adopted in 2020. The first draft of the National Adaptation Plan was completed back in 2015. The reports Serbia submitted pursuant to its obligations under the UNFCCC (National Communications and the First Biennial Update Report, BUR) provide an overview of and propose measures for climate change mitigation and adaptation in the relevant sectors. However, the cross-sectoral and comprehensive integration of climate change issues in other sectors in Serbia (environmental, agricultural, economic, social, etc.) is still pending.

The Serbian NDC recognizes the following areas as priorities: agriculture, hydrology, forestry, human health and biodiversity. The analysis of the available strategic, policy or program documents in Serbia in the relevant sectors (agriculture, forestry, biodiversity, environmental protection) shows that **merely marginal importance is attached to the issue of climate change within most of the valid strategic documents in Serbia, and that the adaptation measures, where proposed, have become obsolete in the meantime**. Furthermore, there is neither sufficient nor updated information on the current state of affairs in these sectors, nor can links with NBS be identified, with the exception of the forestry and, marginally, the urban development sectors. Some of the national programs and strategies (e.g. on protection of nature) recognize the values of ecosystems, and their contribution to climate change adaptation and mitigation, but they neither explicitly mention NBS nor associate them with climate change.

On the other hand, the potential for NBS is clearly recognized in the new National Forestry Program (still under development), which clearly identifies and incorporates the links and synergies between forest planning and management, on the one hand, and climate change mitigation interventions, on the other.

Given that NBS are a relatively novel concept, it was not easy to identify case studies and projects applying NBS in Serbia. However, the analysis of examples of application of NBS in other countries indicates that the **challenges that can be addressed by NBS across the world are very similar to those faced by and identified in Serbia**. The greatest similarities have been identified in the policy planning processes at the national level and in the need to improve institutional capacity to apply NBS, as well as in the lack of a systemic approach to utilizing the potential of the existing ecosystems and natural solutions for climate change mitigation and adaptation.

In order to derive maximum benefits from the existing natural phenomena and ecosystems in Serbia, NBS need to be mainstreamed and their application strongly linked with other sectoral measures and plans. In that sense, the next step in combating climate change should include a thorough exploration of the NBS' potential to tackle some of the challenges identified in urban development, agricultural production, preservation of biodiversity or flood prevention and protection in Serbia.

Given the overarching and cross-sectoral character of Serbia's Low Carbon Development Strategy and the relevant reports under the UNFCCC, as well as the fact that NBS should permeate many other sectors, **NBS should be mainstreamed in national climate policies, and, above all, incorporated in Serbia's NDC**. Ongoing policy development and review processes in Serbia, notably, the development of the Low Carbon Development Strategy and its Action Plan and the National Forestry Program (NFP), as well as the preparation of the Third National Communication and Second Biennial Update Report under the UNFCCC, are an excellent

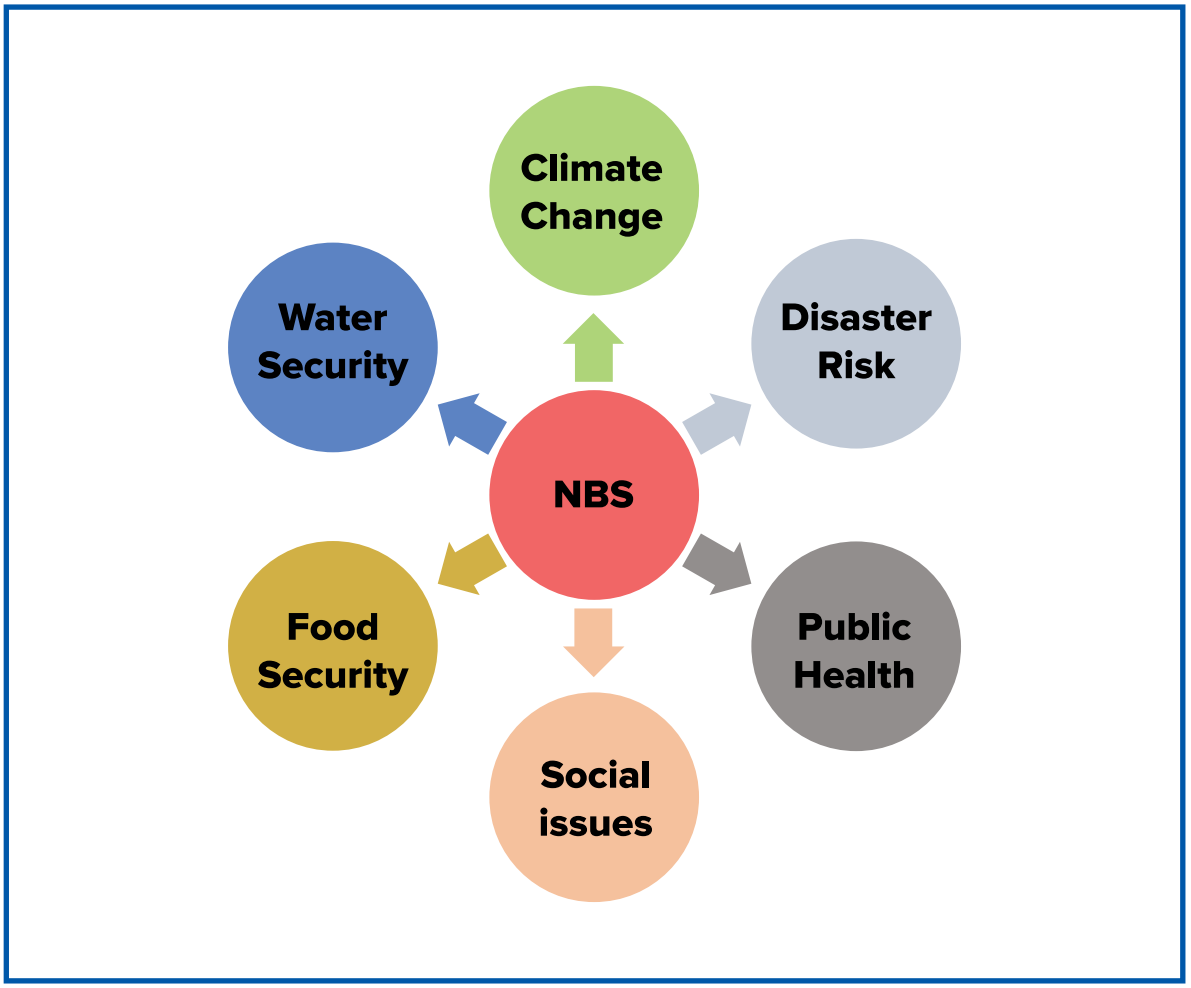
opportunity to ensure that measures involving the application of NBS or similar concepts are taken into consideration and mainstreamed in these documents.

A **paradigm shift in the relevant actors' perceptions of NBS'** potentials that exist in Serbia needs to occur in order to ensure that this untapped potential is clearly recognized and properly utilized in the context of climate change mitigation and adaptation. This process definitely calls for a systemic and cross-sectoral approach, which must be overseen by the state authority charged with climate policy (the Nature Protection and Climate Change Department of the Serbian Ministry for Environmental Protection) and thus linked with other climate policy planning processes (above all the development of the National Low Carbon Development Strategy and reports under the UNFCCC).

2. OVERVIEW OF THE NATURE-BASED SOLUTIONS CONCEPT AND APPLICATION

NBS are a relatively novel concept, developed over the past 10-15 years and mainly promoted by international organizations (IUCN, WWF, UNEP, UNDP, etc.) and, more recently, by the European Commission. Despite several interpretations of the concept, NBS are commonly defined as actions which "**use ecosystems and the services they provide to address societal challenges such as climate change, food security or natural disasters**"[2].

NBS actions can contribute to addressing various societal challenges, including flood prevention and protection, managing risks of natural disasters, improving forest management, ensuring food and water security, combating climate change and contributing to the global improvement of the social, economic and health conditions, by strengthening the local communities' resilience to natural disasters, as illustrated in the following Picture.



Picture No.1 NBS' Contribution to Addressing Various Societal Challenges

The International Union for Conservation of Nature (IUCN) defines NBS as "*actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*" [3].

[2] https://portals.iucn.org/library/node/46191
[3] https://www.iucn.org/commissions/commission-ecosystem-management/our-work/nature-based-solutions

Some of the many examples of applying NBS in addressing various societal challenges:

- **Reduction of risks of flooding** and simultaneous provision of recreational and tourism benefits through restoring and sustainably managing wetlands and rivers to maintain or boost fish stocks and fisheries-based livelihoods
- **Conservation of forests** to support food and energy security, local incomes, climate change adaption and mitigation, and biodiversity
- **Restoring drylands** to strengthen water security, local livelihoods and resilience to climate change impacts
- **Development of green infrastructure in urban environments** (e.g. green walls, roof gardens, street trees, vegetated drainage basins) to improve air quality, support wastewater treatment, and reduce stormwater runoff and water pollution, as well as to improve the quality of life for residents
- **Usage of natural coastal infrastructure** such as barrier islands, mangrove forests, to protect shorelines and communities from coastal flooding and reduce the impacts of sea-level rise

based on IUCN's report
"Nature Based Solutions to Address Global Societal Challenges"
https://portals.iucn.org/library/node/46191

Even though all the above-mentioned NBS increase resilience to climate change impacts, only forest conservation has been recognized as a measure that can have direct impact on reducing GHG emissions.

2.1 Nature-Based Solutions Aimed at Climate Mitigation and Adaptation

The Nature-Based Solutions for Climate Manifesto, presented at the UN Climate Action Summit 2019[4] on September 23, recognizes NBS as "*a fundamental part of action for climate and biodiversity*".

In its Special Report,[5] the Intergovernmental Panel on Climate Change (IPCC) estimates that 23% of total net anthropogenic GHG emissions (2007-2016) derive from Agriculture, Forestry and Other Land Use (AFOLU).

Authoritative research[6] shows that **NBS can provide over one-third of the cost-effective climate mitigation needed between now and 2030** to stabilize warming below 2°C, achieving

[4] https://www.unenvironment.org/engaging-nature-based-solutions-coalition-climate-action-summit
[5] https://www.ipcc.ch/site/assets/uploads/2019/08/Edited-SPM_Approved_Microsite_FINAL.pdf
[6] https://www.pnas.org/content/114/44/11645

nature's mitigation potential of 10-12 gigatons of CO_2 per year. Adequate investments in NBS will help reduce financial consequences of climate change, and contribute to the creation of new jobs, to livelihood resilience and to reducing people's poverty.

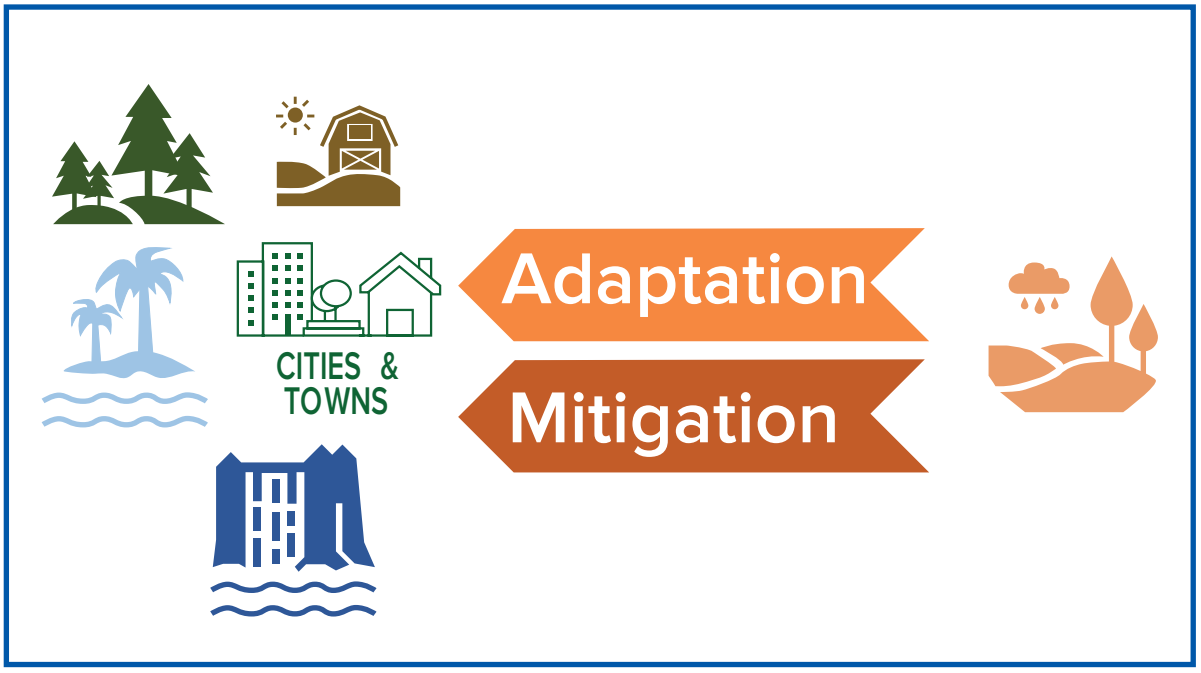
NBS are a powerful mechanism for **climate change mitigation** due to their capacity to prevent degradation and loss of natural ecosystems, for example through sustainable forest management or improved conservation and land management actions. Moreover, natural and modified ecosystems can also extremely effectively contribute to combating climate change thanks to their function of a 'natural carbon sink', i.e. absorption and insulation of CO_2 emissions.

Furthermore, deforestation and forest degradation have a significant impact on climate change. Consequently, reducing forest loss could have multiple benefits for ecosystems and people, including cutting greenhouse gas emissions, sequestering carbon, providing other ecosystems services, and maintaining intact, functioning forests that have the best chance of withstanding climate change.

The NBS can provide low risk, low maintenance and low-cost solutions to many climate change related disasters and impacts. In addition to protecting biodiversity and ecosystem services, NBS can also contribute to **climate change adaptation** when applied strategically and justifiably.

NBS are fundamentally important for global efforts on climate change as a long-term solution that can restore and sustain ecosystems and can also help vulnerable communities, especially those dependent on natural resources, to better adapt and become more resilient to the adverse effects of climate change, including extreme weather events or climate-related disasters.

The following picture illustrates the NBS' potential contribution to both mitigation and adaptation efforts and combating climate change.



Picture No. 2 NBS' Contribution

2.2 Mainstreaming Nature-Based Solutions in NDCs

Mainstreaming and scaling up NBS within the countries' NDCs and/or other national and local climate public policies is one of the most important mechanisms that should be taken into consideration to ensure better and more efficient usage of the NBS' potentials for combating climate change.[7]

The Paris Agreement requests of all Parties to undertake and communicate ambitious efforts in their NDCs with a view to achieving the purpose of this Agreement.

According to UNEP's Gap Report 2018[8], the current commitments expressed in the NDCs are inadequate to bridge the emissions gap by 2030. Technically, it is still possible to bridge the gap to ensure that global warming stays well below 2°C and 1.5°C, but if NDC ambitions are not increased before 2030, exceeding the 1.5°C goal can no longer be avoided.

Sixty-six percent of State Parties to the Paris Agreement have committed to restoring or protecting ecosystems in their NDCs. Of 168 NDCs, 104 include commitments to working with natural ecosystems in their adaptation plans, while an additional 27 describe NBS actions in their mitigation plans (76 nations include NBS actions in both their adaptation and mitigation plans). NBS were particularly prominent in the adaptation plans of low or lower-middle income tropical and subtropical nations.[9]

The UNDP developed a seven-step approach for national governments to integrate or enhance nature-based solutions in their NDCs[10], with a view to helping them identify and use the potential of NBS and to enhance their climate mitigation and adaptation actions. The approach suggests that this can be achieved by better integration, mainstreaming and scaling up of NBS in the NDCs.

In its "Pathway for Increasing Nature-Based Solutions in NDCs"[11], the UNDP recognizes that "scaling-up "Nature-Based Solutions" (NBS) – the protection, restoration and sustainable use of forests, grasslands and wetlands – within the AFOLU sector, can represent a cost-effective opportunity for countries to enhance their NDC ambition. Globally, **NBS alone can deliver approximately a third of the cost-effective CO_2 mitigation needed through 2030 while supporting more productive and resilient communities with social, economic and environmental returns**." Furthermore, "increasing nature-based solutions in the NDCs is an opportunity to utilize an essential component of a comprehensive climate strategy and scale NDC ambition. Incorporating nature-based actions can contribute to improving livelihoods and reducing inequality, securing food and water, improved resilience and disaster risk reduction (and therefore directly relevant to climate adaptation), and biodiversity conservation, in addition to the established climate mitigation benefits."

[7] https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs
[8] https://wedocs.unep.org/bitstream/handle/20.500.11822/26895/EGR2018_FullReport_EN.pdf?sequence=1&isAllowed=y
[9] https://www.nbspolicyplatform.org/adaptation-planning/adaptation-action-types/nature-based-actions/
[10] https://www.ndcs.undp.org/content/dam/LECB/docs/pubs-tools-facts/undp-ndcsp-pathway-for-increasing-nbs-in-ndcs-final.pdf
[11] https://www.undp.org/content/dam/LECB/docs/pubs-tools-facts/undp-ndcsp-pathway-for-increasing-nbs-in-ndcs-final.pdf

The UNDP goes on to say that the “idea behind compiling existing NBS action in national legal and institutional frameworks is not only to make it evident to policymakers, but also to showcase the potential “low hanging fruits” available to countries to enhance their NDCs, which may not yet reflect the richness of the NBS goals that the country already has.”

3. NATURE-BASED SOLUTIONS IN THE SERBIAN CONTEXT

As noted above, scaling up NBS in Serbia's NDC is crucial for utilizing their potential benefits in climate adaptation and mitigation.

This process is undoubtedly overarching, demanding and complex, requiring the involvement of many stakeholders, state and policy actors and experts. The initial steps, described in the UNDP guidelines in the Pathway, have been taken to launch the process of scaling up NBS in the NDC and to conduct basic mapping of NBS potential in the Serbian context. They, notably, include establishing an understanding of the national greenhouse gas accounting context, and identification of NBS in the legal and institutional framework and of nature-based actions in Serbia's NDC and other climate policies.

3.1 Nature-Based Solutions and GHG emissions

The first step in identifying NBS (mitigation) potential in Serbia involved the review of the official Serbian documents developed under the UNFCCC requirements in order to examine the existing GHG emission data and identify potential structures by sources and removals by sink with regard to the AFOLU sector and other sectors.

Serbia's goal, presented in its Intended NDC (2015), is to reduce GHG emissions by 9.8% by 2030 compared with the 1990 levels. As it stated in its Intended NDC, **"the greatest impact of climate change has been observed within agriculture, hydrology, forestry, human health and biodiversity sectors."**[12]

The projected removals by sink in the AFOLU sector are also being considered within the ongoing update of the Serbian GHG inventory. These data should serve as input for mainstreaming NBS into both the NDC and other national sectoral and/or climate policies and strategies.

According to the First Biennial Update Report[13] which the Republic of Serbia submitted under the UNFCCC in 2016, the AFOLU sector participated with 9,116.10 Gg CO_2 eq (10.9%) in total GHG emissions in 2013. Removals by sink in forestry in 2013 stood at -15,737.06 Gg CO_2 eq.

In its Second National Communication under the UNFCCC submitted in 2017, Serbia reported that estimated total net removals[14] from the AFOLU sector stood at -11,111.69 Gg CO_2 eq in 2014 and that total net removal had increased by 46.8% since 2000. Removals by sinks in forestry in 2014 stood at -17,848.99 Gg CO_2 eq, marking an increase of 26% over removals by sink in 2000.

[12] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Serbia%20First/Republic_of_Serbia.pdf
[13] http://www.klimatskepromene.rs/wp-content/uploads/2017/04/E-version_FBUR-srpski-2016.pdf
[14] Net removals are calculated as the difference between removals from sinks and emissions by source in the AFOLU sector.

The data collection system was not complete due to the lack of data for 2014 caused by the devastating floods.[15]

According to the Second Biennial Update Report[16], which is in the final phase of development, an overall GHG emissions during the 2016, excluding removals, were set at 60,917.27 Gg CO_2 eq. More precisely, from 2010 onwards, the overall GHG emissions, excluding removals were reduced for 2.8%.

It is expected that the GHG inventory will be further updated within the finalization of development of the Second Biennial Update Report and development of the Third National Communication to the UNFCCC.

3.2 Identification of existing Nature-Based Solutions and Their Potential in Serbian Strategies and Policies

The analysis of the concepts, approaches, examples and lessons learnt from the application of NBS shows that policy enforcement, stakeholder engagement and involvement, and a multi-sectoral approach are just as important for the applicability of NBS as their recognition in the national strategic and policy framework.

The Serbian NDC recognizes the following areas as priorities: agriculture, hydrology, forestry, human health and biodiversity. Nature-based concepts (e.g. green infrastructure or specific ecosystem-based approaches) were sporadically identified among recommended actions during the perusal of the available national strategic and policy documents in these fields.

3.2.1 Reporting Requirements under the UNFCCC

The **Second National Communication** proposes a set of climate change mitigation measures within the so-called "strategic sectors". For example, "change of forest management practices and promotion of the "close-to-nature" forest management concept" is proposed as a long-term measure for reducing risks from climate change in the forestry sector.[17] Unfortunately, the report unfortunately does not elaborate in greater detail either the concept or the implementation measures. Although not explicitly defined as "nature-based solutions", the terms "nature-based silviculture" or "close-to-nature management" are commonly used for silvicultural or forest management strategies that are required to develop economically productive[18].

Some of the measures proposed in the water sector can also be recognized as NBS actions to an extent. They include preservation of the existing natural flood zones, construction of green areas along the river flows and formation of protective forest vegetation and grass communities along important "torrential streams" (Table 6.2, page 89 of the Second National Communication).

[15] http://www.klimatskepromene.rs/wp-content/uploads/2017/09/SNC_eng.pdf
[16] http://www.klimatskepromene.rs/wp-content/uploads/2019/11/DAY-1-1.-A.-Jovovic-Prvi-nacrt-2BUR-19-11-2019.pdf
[17] Table 6.3: Proposed climate adaptation measures for the forestry sector (Second National Communication of the Republic of Serbia under the UNFCCC)
[18] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.663.6809&rep=rep1&type=pdf

The document also provides an estimate of funds required for the implementation of activities that will lead to total and GHG emission reduction by 2030 (projected in scenarios), and sets out the following measures for the forestry sector (page 16):

- Afforestation
- Regeneration of even-aged high forests
- Reconstruction of devastated forests
- Indirect and direct conversion of coppice forests
- Rehabilitation of stands damaged by abiotic and biotic factors and of fire-damaged stands
- Forest certification
- Development of strategic documents for the forestry sector
- National forest inventory

Research (capacity-building and project implementation)

Several conclusions can be drawn from these documents:

1. **The potential for NBS exists in the forestry and partly water management sectors in Serbia and has been recognized as such in some of the proposed measures for climate change adaptation/risk reduction.**

2. **There are still no indicators that would enable monitoring of progress or the effects of those measures or estimation of the climate impacts triggered by these actions.**

3. **NBS should be further explored during the development of the future reports under the UNFCCC, as well as during a review of the NDC. Particular attention should be paid to the AFOLU sector, in which NBS can achieve their full potential in terms of both mitigation and adaptation.**

Although most of the listed measures should clearly be considered NBS, pursuant to the new transparency requirements under the Paris Agreement, more needs to be done to identify indicators to assess progress or the effects of those measures or to estimate the climate impact and co-benefits (climate change adaptation and GHG emissions reduction) of these actions in the national context.

The First Biennial Update Report proposes specific mitigation measures for reducing GHG emissions in the energy, industry and waste management sectors, but no specific mitigation/adaptation actions in the AFOLU sector.

The Report, however, notes that specific actions ensuring GHG emissions reduction were identified in the 12 Nationally Appropriate Mitigation Actions (NAMA) Serbia submitted to the NAMA Registry[19] in 2012. These actions mainly regarded the energy supply sector (65%), construction (29%) and transport (6%), but did not envisage any NBS or compatible measures.

NBS and/or similar concepts capable of offering solutions for managing the "conflicting" needs in agriculture i.e. for combating climate change effects whilst ensuring food security, were not considered in the Strategy. Exploring the potential for NBS and suggesting such actions might be the next step in tackling some of the expected agricultural challenges associated with climate change.

3.2.2 Other National Strategic Documents

Other national documents were also perused in order to further assess the level of recognition of NBS, their mitigation potential and, more broadly, ecosystem protection potential that can be utilized within climate change mitigation and adaptation measures.

A rapid screening of the strategic documents shows that the issue of climate change is recognized merely as one of several important factors in most sectoral and/or national strategies developed over the past two decades in Serbia, but that no special attention has been paid to planning specific measures for climate change mitigation or sectoral adaptation to the changed climate conditions (forestry, biodiversity).

Some of the strategic documents, such as the National Strategy for Sustainable Development, the National Environmental Protection Program and the 2011-2018 Biodiversity Strategy, have devoted special attention to the climate change, but it is important to work on including the issue of climate change within the sectoral policies and programs as well as on updating the already established measures. The public discussion on Draft Low-carbon development Strategy of the Republic of Serbia is finished and its adoption is expected during the 2020. The Strategy provides a comprehensive and realistic climate change effects assessment by sectors (environment, agriculture, economy, social protection, etc.)[20].

The **2014-2024 Agriculture and Rural Development Strategy**[21] mentions sustainable management of natural resources among its strategic development objectives and emphasizes, inter alia, the "necessity of responding to climate change" (p. 62).

This Strategy proposes several mitigation and adaptation interventions to operationalize the strategic objectives. They include climate change monitoring, planning of adaptation

[19] https://www4.unfccc.int/sites/publicnama/SitePages/SearchResults.aspx?k=serbia&cs=This%20Site&u=https%3A%2F%2Fwww4.unfccc.int%2Fsites%2FPublicNAMA

[20] https://www.ekologija.gov.rs/wp-content/uploads/javne_rasprave/Strategija%20niskougljeni%C4%8Dnog%20razvoja%20sa%20akcionim%20planom_za%20javnu%20raspravu.pdf

[21] http://uap.gov.rs/wp-content/uploads/2016/05/STRATEGIJA-2014-2020-.pdf

measures focus on reduction of GHG emissions from agricultural production, as well as raising the farmers' awareness of climate change, its effects and the need to mitigate them. It emphasizes the challenge agricultural policy will face: to identify adequate mechanisms that will simultaneously "prevent or reduce the effects of climate change" and "respond to the need to increase food production" (pp. 68, 69).

Sustainable Urban Development Strategy[22]

The Sustainable Urban Development Strategy of the Republic of Serbia was adopted in July 2019. The Strategy relies, inter alia, on the EU Urban Agenda[23] (one of whose thematic partnerships is devoted to sustainable use of land and nature-based solutions).

The Strategy recognizes among the key challenges for urban development the uneven quality of the environment, health care and safety of the citizens, as well as the urban settlements' non-adaptation to climate change. Consequently, one of the five objectives of the Strategy is dedicated to the quality of the environment with a view to "improving the quality of the environment, health and safety of citizens and adaptability of the urban areas to climate change".

The Strategy sets out a comprehensive set of measures under Strategic Goal No. 4 related to the quality of the environment. Several of them can be construed as application of the NBS principle. For example:

- Mitigation of climate change by improving the quality of the environmental parameters, inter alia, through green infrastructure measures and green roofing, and
- Adaptation to climate change and establishment of a system of rapid response to risks and hazards in urban settlements, inter alia, through the conservation of biodiversity of urban areas (green surfaces, green infrastructure, protected areas, landscape, water surfaces, etc.)

Serbia's new National Forest Program, although still under construction, demonstrates clear links and synergies between forest planning, forest management and climate change mitigation interventions.

3.2.3 Serbian Policies and Programs under Development

The **National Forest Program (NFP)** is under development, with the support of the GEF-funded project "Contribution of Sustainable Forest Management to a Low Emission

[22] https://www.mgsi.gov.rs/cir/dokumenti/urbani-razvoj
[23] https://ec.europa.eu/regional_policy/en/policy/themes/urban-development/agenda/

and Resilient Development"[24]. Although the draft is not available, several project-related outputs[25] provide insight in the main postulates and approaches promoted through the NFP.

The new Urban Development Strategy commendably takes into account the cross-sectoral approach, recognizes the importance of climate change, considers the latest developments in urbanization, and includes some, albeit marginal, measures for applying NBS in urban settlements.

The concept of improving forest and forestry in Serbia envisages the contribution of the forestry sector to economic, environmental and social development through the synergy of the effects of carbon storage, conservation of biodiversity and economic benefits; coppice conversion, i.e. carbon storage through conversion of coppice to high-forest, and promotion of multifunctional sustainable forest management (biodiversity, carbon storage, ecosystem services in economically sustainable areas).

The **Draft Nature Protection Program of the Republic of Serbia for the 2020 - 2022 Period**[26] devotes a lot of room to the links between climate change and biodiversity, emphasizing that the "preservation of natural ecosystems and restauration of the degraded ecosystems (including their biodiversity and genetic diversity) are of major importance for achieving the goals of both the UN Convention on Biological Diversity (CBD) and UNFCCC, due to the key roles ecosystems play in the global carbon cycle and climate change adaptation, providing, at the same time, extensive ecosystem services crucial to human well-being and development. Therefore, preservation of biodiversity can substantially facilitate the mitigation of the adverse effects of climate change."

One of the measures defined within this goal includes monitoring the effects of climate change on biodiversity and vice versa – the effects of biodiversity on mitigation of climate change effects.

Finally, during the January of 2020 the public discussion was held on Draft Low Carbon Development Strategy with Action Plan and after inter-ministerial consultations its adoption is expected. This document will enable Serbia to implement a comprehensive national strategic and legal framework for climate action (mitigation and adaptation) in compliance with its international obligations and GHG reduction.

The Strategy will identify priority GHG emission reduction measures, designate the institutions charged with specific options, and specify implementation timeframes and over-

[24] https://www.thegef.org/project/contribution-sustainable-forest-management-low-emission-and-resilient-development
[25] https://upravazasume.gov.rs/medjunarodni-projekti/
[26] https://www.ekologija.gov.rs/wp-content/uploads/razno/PredlogProgramaZastitePrirodeRS2020-2022.pdf

all financial requirements. It will also provide an adaptation planning framework addressing the priority sectors: agriculture, forestry and water management.[27]

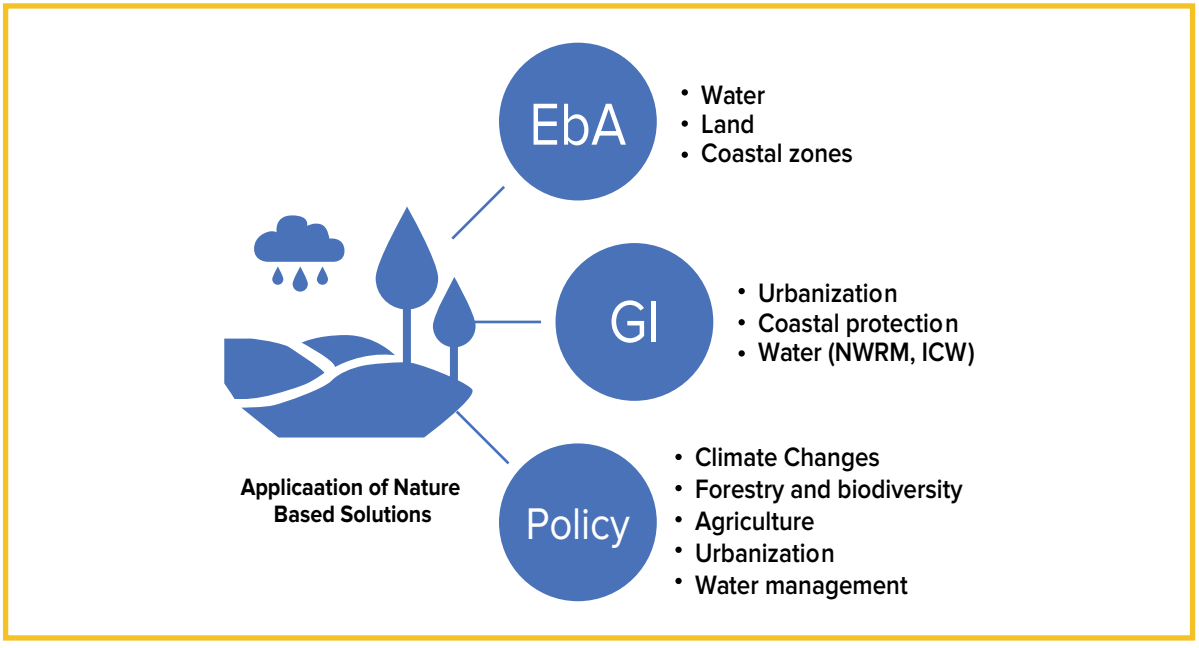
Based on Strategies draft, it is expected that this document will provide a cross-sectoral, comprehensive and realistic estimation of the climate change effects on various sectors (environmental, agricultural, economic, social, etc.), and set out the most suitable measures for climate change mitigation and adaptation, including application of NBS.

[27] http://www.klimatskepromene.rs/projekti/strategija-u-oblasti-klimatskih-promena/

4. APPROACHES TO AND EXAMPLES OF NATURE-BASED SOLUTIONS IMPLEMENTATION

There are many examples across the world of the application and implementation of NBS for climate change mitigation or adaptation. International organizations, development agencies national governments, community initiatives and other stakeholders have over the past decade been intensively documenting evidence of implemented initiatives, aimed at promoting and demonstrating the advantages of nature-based solutions.

Different approaches can be used to apply NBS, including green infrastructure projects (GI) and ecosystem-based approaches (EbA). The third significant group of examples relates to policy and strategic improvements and changes, enabling the practical implementation of NBS. These examples include policy development and enforcement facilitating the mainstreaming of NBS, building governance potential and institutional capacity, local community empowerment, awareness raising, etc.



Picture No. 3: Application of the NBS Concept

4.1 Policy Mainstreaming and Development

4.1.1. Global Initiatives for Mainstreaming Nature-Based Solutions in Various Policies

The global and EU initiatives presented below illustrate the applicability of NBS within various policies and initiatives and the variety of approaches and fields of intervention:

The Katowice Declaration "Forest for Climate" highlights the role of carbon sinks and reservoirs in climate change mitigation and the need for them to simultaneously adapt to climate change; emphasizes the need to conserve terrestrial ecosystems, including forests as great GHG sinks and reservoirs and raises awareness of the role of forest ecosystems in the accumulation of carbon in the soil, trees and other vegetation.

https://cop24.gov.pl/presidency/initiatives/declaration-forests-for-climate/

The **UN REDD Program** supports nationally led REDD+ processes and promotes the informed and meaningful involvement of all stakeholders in the implementation of national and international REDD+.

The REDD+ refers to "reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks".

https://www.un-redd.org/

NBS for Water were the sole focus of the UN World Water Development Report 2018. As this report points out, the "NBS for water are central for achieving the 2030 Agenda for Sustainable Development because they generate social, economic and environmental co-benefits, including the fields of human health and livelihoods, food and energy security, sustainable economic growth, decent jobs, ecosystem rehabilitation and maintenance, and biodiversity.

https://www.unwater.org/publications/world-water-development-report-2018/

There are growing tendencies towards **applying NBS in towns and cities** in order to enhance sustainable urbanisation, stimulate economic growth and, by improving the environment, make cities more attractive, whilst contributing to mitigation, promotion and raising awareness of climate change issues.

EU Research & Innovation policy on 'Nature-Based Solutions and Re-Naturing Cities' focuses on new and innovative nature-based solutions to societal challenges, but also builds on and supports other closely related concepts and policies, such as the ecosystem approach, ecosystem services, ecosystem-based adaptation and mitigation, and natural, green and blue infrastructure.

https://ec.europa.eu/research/environment/index.cfm?pg=nb

The EU Urban Agenda identifies sustainable land use and nature-based solutions as one of the thematic partnerships, where rapid and uncontrolled growth of the cities, urban sprawl, pollution, pressure on the natural ecosystems - all those challenges call for better management of natural resources, including land, and better integration of urban growth with the surrounding environment.

https://ec.europa.eu/regional_policy/en/policy/themes/urban-development/agenda/

The Climate-Smart Agriculture (CSA) approach promoted by FAO aims to help farmers adapt to the changing climate. Building adaptation and resilience to climate change is one of three main goals of this approach. CSA pursues the following three pillars:

- to sustainably increase agricultural productivity and improve farmers' incomes;
- to build resilience and adaptation to climate change; and,
- to reduce and/or remove GHG emissions, where possible

http://www.fao.org/3/CA2386EN/ca2386en.pdf

4.1.2. Mainstreaming Nature-Based Solutions into National Climate Policies

One of the mechanisms for enabling better and more effective usage of NBS' potential benefits, also strongly advocated by the UNDP[28], concerns their mainstreaming and scaling up within the countries' NDCs.

The below example shows how the Republic of Moldova planned its NBS in the section of its National Climate Change Adaptation Strategy devoted to Risk Management and Climate Change Adaptation in the Forestry Sector:

Moldova's Climate Change Adaptation Strategy by 2020 and its Action Plan set out the following NBS under the section on Risk Management and Climate Change Adaptation in the Forestry Sector:

- Revision and development of new important components of the forestry regulatory basis, as integral parts of the forestry regime, focusing on: maintenance and conservation of forestry stations; conservation of forestry genetic resources; ecological reconstruction of forests; certification of forests, forest products and forest management systems.
- Development and approval of the regulation on implementation and assuring functionality of the principles of participatory management of public forest resources.
- Development of methodologies/technologies to assure forest ecosystems adaptability to climate change.
- Increase of the forest cover, including in the context of climate change mitigation and biodiversity conservation.
- Protection of wetlands to allow groundwater recharge and reduce peak discharges downstream.

http://clima.md/doc.php?l=en&idc=237&id=3741

Within the Draft Low Carbon Development Strategy with Action plan, there are certain measures in the forestry sector within which the NBS are clearly recognized[29]:

[28] https://www.undp.org/content/dam/LECB/docs/pubs-tools-facts/undp-ndcsp-pathway-for-increasing-nbs-in-ndcs-final.pdf

[29] http://www.serbiaclimatestrategy.eu/wp-content/uploads/2018/10/04-Forestry-sector-bioenergy_by-prof-Nenad-Petrovic_The-Forestry-Faculty.pdf

Adaptation measures	Description
Afforestation through mapping of terrain and usage of woody species resistant to climate change	Afforestation (planting forest on soils that have been originally used for another purposes, like abandoned land) considering mapping of the terrain (including information on existing soils and characteristics of climate and vegetation).
Introducing the “climate-smart forestry” approach”	Climate-smart forestry is related to the forest management where the optimal usage of forest areas for the increase of the forest cover is achieved. Optimization approaches are applied along with development of forest roads and forest management that ensures production of firewood, used to replace fossil fuels on local and regional level. Improving forest stands by usage of guidelines for forest management will lead to the increased production of the technical wood for furniture industry and packaging on national and local level, at the same time enabling long-term increase in carbon storage. Reforestation should be performed through application of natural methods and by usage of the best seeds and seedlings, that will enable establishment of youth forests adapted to the future climate changes.
Changing forest management practices towards close-to-nature forest management	Close-to-nature forest management tends to ensure numerous forest functions on different levels. Close-to-nature forest management is one of the components of the sustainable forest management and includes implementation of the measures that will enable permanent forests productivity, ensure its vitality and services delivery in future. The basic principle of this approach is maximum usage of natural processes and self-regulatory mechanisms of the ecosystems that, at the same time, accomplish operational goals in forestry. Increment is controlled and focus is on the high-quality trees, while forest regeneration remains mainly natural. During cuts, the effects on forests stands and soil should be avoided as much as possible.

4.2 Ecosystem-based Approaches (EbAs)

The IUCN devotes a lot of attention to ecosystem-based approaches to climate change adaptation, specifying that they involve “a wide range of ecosystem management activities to increase the resilience and reduce the vulnerability of people and the environment to climate change”. The IUCN promotes the use of ecosystem-based adaption as a nature-based solution for addressing the impacts of climate change on people and their environment.

According to the International Institute for Environment and Development (IIED) September 2019 Briefing[30], “EbA is a nature-based approach that uses biodiversity and ecosystem services to help people adapt to the adverse effects of climate change. It involves activities such as planting vegetation on slopes to prevent landslides, restoring coastal habitats to address sea level rise and storm surges, applying integrated water resource management to address water shortages, and managing forests sustainably to prevent erosion and regulate water flow. The approach rests on combining local knowledge with evolving information on climate change”.

The below examples were selected primarily to emphasize the complexity of the interventions and topics, the importance of policy processes, as well as to demonstrate the identified and addressed challenges and benefits to local communities, ecosystems and climate change mitigation and adaptation.

[30] http://pubs.iied.org/17725IIED

Lower Danube Green Corridor

The **Lower Danube Green Corridor Agreement** was signed in 2000 by the governments of Romania, Bulgaria, Ukraine and Moldova. It is a large-scale initiative, which aims to coordinate biodiversity conservation and water management efforts between several countries along the Lower Danube river basin, including Bulgaria and Romania. It particularly aims to ensure the conservation of wetlands and the management of flood plains through a system of protected areas, which will be connected ecologically and economically to several existing Natura 2000 sites. The network includes areas that are strictly protected and areas where economic activities are possible, with buffer zones in-between.

https://climate-adapt.eea.europa.eu/metadata/case-studies/lower-danube-green-corridor-floodplain-restoration-for-flood-protection

Integrated Rhine Programme

The goals of the I**ntegrated Rhine Programme (IRP)** include flood control, as well as the preservation and/or restoration of the Upper Rhine floodplains. It proposes the creation of flood retention areas at 13 sites located on the former alluvial floodplains on the Baden-Württemberg shore of the Rhine; all in all, it seeks to preserve and restore the wetlands along the Upper Rhine to the maximum extent possible

Around 45% of the required retention capacity is currently available and further flood retention areas are in the process of construction or awaiting approval. The Upper Rhine Plain is expected to benefit from recurring wetland biotopes with their diversity of species and multifaceted structures. At the same time, flood hazards will be mitigated.

The Integrated Rhine Programme is prerequisite for the reduction of damage/ losses caused by centennial floods along the Upper Rhine

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www.irp-bw.de

Sustainable Wetlands Usage in Turkey

The “Adaptation to Climate Change and Protection of Biodiversity through Conserving and Sustainably Using Wetlands in Turkey” project aimed to draw up and test a strategy for the conservation and sustainable use of the country’s wetlands. At the national level, the project improved the general conditions for the conservation and sustainable use of wetlands and built capacity. At the local level pilot, management plans for wetlands were drawn up and then implemented through investments (e.g. restoration and anti-pollution measures). The knowledge and experience gained from the pilot projects was passed on to experts and decision-makers at national level so that it can be applied on a broad scale.

Intensive awareness raising, targeting both decision-makers and the general public, greatly contributed to the success of the project.

https://www.international-climate-initiative.com/en/nc/details/project/adaptation-to-climate-change-and-conservation-of-biodiversity-through-conservation-and-sustainable-use-of-wetlands-09_II_019-229/?cookieName=search_results&source=single&iki_lang=en

Advocating Ecosystem Services Assessment and Valuation (ESAV) in Bosut Forests area - integrating biodiversity and ecosystem services in natural resource uses and management

The Case Study aimed to present possibilities for an increase in benefits, both quantitative and qualitative, through the introduction of integrated planning and multipurpose utilization of the Bosut Forests area, near Sremska Mitrovica (Serbia).

A comprehensive study of the conditions, proposed scenarios, and costs and benefits was performed and the most optimal scenario was recommended.

The Study proposes "multipurpose utilization of the area (the establishment of a protected area with the reception of flood waves in half of the Nature Park; environmental flooding of the forest complex in order to increase forest vitality and maintain the existent habitat mosaic; the application of traditional animal husbandry as the most economical method of habitat maintenance; increasing yields and profits in the area)."

Furthermore, the authors have demonstrated a likely increase in the value of four ecosystem services, selected as the most important for the area (wood production, flood prevention, meat production and biodiversity), if environmental flooding of the forest complex and increase in traditional animal husbandry are implemented along with joint management and establishment of protected area:

- Wood production would benefit in 30-50% less forest dieback and salvage cuttings related to water depletion, with proportionally higher quality yield in timber;
- Forest retention area will be able to store 100 - 200 million cubic meters of water, with extraordinary importance in flood management;
- Increased number of pigs grazed in Bosut Forests (by 5-7 times) together with better fodder availability will result in 10-14 times multiplied income from traditional farming. Moreover, there will be an additional benefit from better meat taste and quality when compared with conventional pig farms production,
- For 6 habitat types, plankton communities and 9 plant and 11 animal species selected as most important, there will be improvements in their ecological status, number, population, and area of occupancy. Since they are indicators and umbrella species, improvements are expected not only for them but for most other species present in the area as well.

Improvements are also expected for many other ecosystem services (water and air purification, mitigation of climate extremes, tourism, aesthetics, pollination, pest control), improvements are also expected, but have not be quantified.

https://germancooperation.rs/study-on-bosut-forests-ecosystem-services-how-to-achieve-better-flood-protection-income-from-wood-production-traditional-animal-husbandry/

4.3 Green Infrastructure (GI)

In May 2013, the EU Commission launched its Green Infrastructure Strategy[31], which considers GI a successfully tested tool for providing ecological, economic and social benefits through natural solutions. The Strategy provides details about GI's various contributions to European policies and sets out the main strategic developments: integration into key policy areas, creation and improvement of the knowledge base, extension of financial support and implementation of EU-level GI projects.

Green infrastructure is defined as "**strategically planned network of natural and semi-natural areas** with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation and climate mitigation and adaptation. This network of green (land) and blue (water) spaces can improve environmental conditions and therefore citizens' health and quality of life. It also supports a green economy, creates job opportunities and enhances biodiversity"[32].

In contrast to the most common 'grey' (man-made, constructed) infrastructure approaches that serve one single objective, GI promotes multifunctionality, which means that the same area of land is able to perform several functions and offer multiple benefits if its ecosystems are in a healthy state. More specifically, GI aims to enhance nature's ability to deliver multiple valuable ecosystem goods and services, potentially providing a wide range of environmental, social, climate change adaptation and mitigation, and biodiversity benefits.

A typical example of a multifunctional GI area would be one that is capable of combining farming, forestry, housing, as well as tourism and recreational activities in the same space whilst at the same time keeping our freshwater systems clean, our air healthy and our wildlife safe. Another classic example of GI is a healthy floodplain ecosystem which, unlike an artificial dike, not only provides flood prevention but also delivers water filtration and maintenance of the water table, as well as recreation possibilities, carbon storage, timber and interconnected wildlife refuges.[33]

4.3.1 The European Natural Water Retention Measures (NWRM) Platform[34]

The NWRM Platform is the official webpage of DG Environment (www.nwrm.eu) designed to promote the use of **water related nature-based Green Infrastructure solutions**. As specified on the DG Environment webpage, "*Natural Water Retention Measures (NWRM) support Green Infrastructure by contributing to integrated goals dealing with nature and biodiversity conservation and restoration, landscaping, etc.*"

Natural Water Retention Measures (NWRM) are multi-functional measures that aim to safeguard water resources using natural means and processes. NWRM focus on enhancing and preserving the water retention capacity of aquifers, soils and ecosystems and thus improving their status. NWRM provide multiple benefits, including the reduction of the risks of floods and droughts, improved water quality, groundwater recharge and habitat improvement. They can be applied in several types of areas, such as:

- Rivers and wetlands (through flood plain reconnection and restoration, wetland restoration),

[31] https://ec.europa.eu/environment/nature/ecosystems/strategy/index_en.htm
[32] https://ec.europa.eu/environment/nature/ecosystems/index_en.htm
[33] https://ec.europa.eu//nature/ecosystems/docs/green_infrastructure_broc.pdf
[34] http://nwrm.eu/

- Urban areas (improving infiltration though sustainable urban drainage systems, green roofs),
- Agricultural land (green cover, buffer zones),
- Forestry and semi-natural areas (meadows, riparian, woodland).

The online platform contains information on NWRM at the EU level. It provides substantial data on NWRM, various NWRM related concepts and includes a comprehensive database of practical solutions, case studies and examples of different measures applied across the EU. It also includes an online practical guide on the implementation of NWRM.

NWRM cover a wide range of measures and land use types. The catalogue of measures given on the web page is categorized by sector and can be searched by measure, region and/or sector (forest, urban, agriculture or hydro geology).

Selected Examples of NWRM in the EU

Project Title	Short description of the measures/projects	Estimation of costs/benefits
Optimal use of GI elements for ecosystem service delivery from freshwater ecosystems, France[36]	Innovative measures to ensure enhanced and continued ecosystem service delivery from freshwater ecosystems, through Restoration zones (adaptation of infrastructure, restoration of wetlands and natural connectivity of rivers) and Sustainable use of areas (purchase of wetlands to ensure sustainable management).	The initiative has a positive benefits-cost ratio in terms of the water purification ecosystem function of wetlands. The benefits of the project are primarily related to improved water quality estimated at €2,500 - 3,000 ha/year, mostly achieved by avoided costs of treatment.
Flood protection regulations through wetland, UK[37]	The project aimed at estimating the value of selected ecosystem goods and services generated by wetlands, freshwaters and floodplains in the UK. Flooding is becoming increasingly problematic in the UK, as well as across Europe.	The project showed that the value of an additional hectare of wetland in the UK, due to flood protection properties, stands at £407 ha/year for inland wetlands and £2,498 ha/year for coastal wetlands. The default estimates of annual benefits are £303 ha/year for inland wetlands and £1,856/ha for coastal wetlands.

[35] https://ieep.eu/uploads/articles/attachments/86632cb3-e2d3-45f1-82f9-d90d0b39707d/GI_Case_Analysis_4_-_Freshwater_and_Wetlands.pdf?v=63664509767 (pp. 31-34)

[36] https://www.rspb.org.uk/our-work/our-positions-and-casework/our-positions/water-and-wetlands/current-water-policy-issues/sustainable-flood-management/

Vienna water charter[38]	The drinking water supply for the city of Vienna is almost exclusively obtained from mountain springs originating in the Lower Austrian-Styrian high alpine zones. Vienna established water protection areas in 1965 (and extended in 1988), and preservation areas were proclaimed around the supply sources to ensure sustainable use of the water resource. The City of Vienna now administers a total area of approximately 32.000 ha of forest, mountain pastures and meadows, enabling the city administration to coordinate the use of rural, tourism, hunting and fishing activities with the requirements of spring protection.	The benefits of the city's efforts are improved water quality and safe guarded water supply for Vienna. Additional benefits are linked to preserving biodiversity.

Picture No. 4 - The Potsdamer Platz in Berlin –Urban Green Blue Grids Project
https://www.urbangreenbluegrids.com/projects/potsdamer-platz-berlin-germany/

[37] https://www.wien.gv.at/english/environment/watersupply/supply/index.html

4.3.2 Urban Innovative Actions (UIA)[38]

Urban Innovative Actions (UIA) is an EU initiative providing urban areas throughout Europe with resources to test new and unproven solutions to address urban challenges. The initiative devotes particular attention to climate change adaptation projects.

Several European cities have already developed measures enabling the application of NBS for mitigating climate change impacts. The texts below describe selected projects More examples are available on UIA's website.

There are many other EU networks and initiatives established in order to support, promote or unlock the potential of NBS for sustainable urban development.

- NATURVATON Project for Nature Based Urban Innovation, https://naturvation.eu/home
- Project ENABLE for Enabling Green and Blue Infrastructure Potential in Complex Social-Ecological Regions; http://projectenable.eu/
- GREEN SURGE Project for Green Infrastructure and Urban Biodiversity for Sustainable Urban Development and the Green Economy, https://greensurge.eu/

The Greater Manchester Project

The **Greater Manchester** project aims to address several issues caused by climate change in urban areas. Estimates are that Greater Manchester requires a 10% uplift in urban green infrastructure by 2038 and in order to reach the goal, several solutions have been offered. They include substantial retrofit programs of urban green infrastructure or NBS to combat urban overheating (provision of shade and evaporative cooling), as well as slowing the flow of excess water caused by extreme weather. The NBS will also help improve air quality, the visibility of the region, increase the level of biodiversity within an urban environment and help improve the health and well-being of citizens.

Amsterdam RESILIO Project

The **Amsterdam RESILIO** project aims to address critical urban climate challenges related to flooding, heat, water supply, energy consumption and urban livability by repurposing the rooftops of climate-vulnerable Amsterdam neighborhoods. The 10,000m2 area of smart blue green roofs is expected to help the city adapt to climate change by reducing impacts of heavy rain, the urban heat island effect and drought, while improving building insulation, biodiversity and quality of life. Extra water can be stored on these roofs under the green plant layer. This water buffer layer reduces the chance of damage to houses and their surroundings in case of heavy rain and increases the cooling effect and survival rate of the plant layer in case of drought.

The Serbian National Green Roof Association was established in Novi Sad in May 2018 with the aim of rallying professional and public expertise and proactively raising awareness of the need for green construction in each segment of the construction industry[39].

The Association is advocating the "systemic application of the green concept", involving the use of a series of individual green elements, such as green roofs, balconies, walls or eco-

[38] https://uia-initiative.eu/en/about-us/what-urban-innovative-actions
[39] https://www.nazk.org

points. The green housing concept has been promoted by the construction of a building in Novi Sad (completed in December 2018), where the green roof and balcony concept was practically applied to demonstrate the advantages and benefits of nature-based solutions.

4.4 Costs and Benefits of Nature-Based Solutions Actions

With a view to enabling evidence that EbA can be cost-effective, often more cost-effective than alternative approaches, the International Institute for Environment and Development (IIED), together with the International Union for Conservation of Nature (IUCN) and the UNEP World Conservation Monitoring Centre (UNEP-WCMC), analyzed 13 EbA initiatives from 12 countries (the full Report and examples are available on IIED's website)[40]. The analysis concluded that "EbA can provide a variety of strong, long-lasting and wide-reaching adaptation-related benefits, social co-benefits and ecosystem-related benefits."

The estimate of the costs and benefits of Green Infrastructure projects indicates their potential to deliver cost-efficient solutions and provide many additional benefits, e.g. contribute to ameliorating high temperatures in urban areas, energy efficiency in buildings, climate change mitigation (through, e.g., reduced energy demand), etc. Examples of the economic benefits from water-related GI projects have shown that large savings can be achieved in a number of sectors. Information available on the European Commission website[41] indicates that the GI's flood protection functions have a large potential for significantly reducing the increasing costs of flood damage (amounting to billions of EUR across Europe annually) and lowering flood risk management costs.

Given that NBS may represent cost-effective, efficient and sustainable solutions to some of the above-mentioned issues, the possibilities of applying them, in particular the identified priority climate change mitigation and adaptation areas (forestry, hydrology, biodiversity, agriculture), should be thoroughly examined.

The examples given by the World Resources Institute contain estimates that the Portland Water District (Portland, USA) would save an expected USD 12 million - and possibly as much as USD 110 million - over the next 20 years by investing in Green Infrastructure alternatives to grey infrastructure (i.e., a membrane filtration plant)[42]. Moreover, a case study in McKenzie Watershed (Oregon, USA) estimates the value of riparian buffers at between USD 2,548 - 6,588/ha annually, based on a range of benefits delivered via associated ecosystem services, from water supply and quality to recreation.

4.5 Nature-Based Solutions Application in Serbia

Given that NBS are a relatively novel concept still in its inchoate phase of development, it was not easy to identify case studies and projects applying NBS in Serbia. However, the analysis of examples of application of NBS in other countries leads to the conclusion that the challenges that can be addressed by NBS across the world are very similar to those faced by and identified in Serbia. The greatest similarities have been identified in the policy planning processes

[40] https://pubs.iied.org/pdfs/17651IIED.pdf
[41] https://ec.europa.eu/environment/nature/ecosystems/pdf/Green%20Infrastructure/GI_water.pdf
[42] https://www.wri.org/blog/2012/02/payments-watershed-services-pilot-projects-watershed-protection

at the national level and in the need to improve institutional capacity to apply NBS, as well as in the lack of a systemic approach to using the existing ecosystems and natural solutions for climate change mitigation and adaptation.

Although it is not possible to simply "copy-paste" some of the presented case studies or examples of NBS application, it is extremely important to explore the addressed issues and whether they can be tackled by applying NBS in Serbia.

Inadequate response to the effects of climate change, lack of systemic solutions for agricultural adaptation to climate change are, for example, mentioned among the key challenges in the Serbian Agriculture Strategy. Lack of awareness of climate change impacts on agriculture is also mentioned in this document.

The Serbian forestry sector is, for example, facing many challenges that are an indicator of the historic and economic conditions of that sector, and of the absence of an adequate national forest policy and instruments for its implementation, which are reflected in the following facts:

- Only 28.8% of all forests in Serbia are high forests.
- The percentage of overmatured forests with no increment is high,
- Silvicultural measures are inadequately applied, and
- 57% of all forests in Serbia are coppice and devastated forests.

As per the Sustainable Urban Development Strategy of the Republic of Serbia when it comes to urban development, Serbia is facing a trend of uncontrolled urbanization and expansion of urban areas, along with extremely inefficient use of construction land and excessive conversion of agricultural and forest land. In the 2000-2013 period, 1.15% of the total land area was subject to repurposing. The greatest changes occurred in urban areas, where pastures and agricultural land were converted into construction sites.[43] The Serbian Sustainable Urban Development Strategy, for example, alerts to the uneven quality of the environment and the urban settlements' non-adaptation to climate change.

As per the protection of nature/biodiversity[44], the need has been identified for stronger links and interactions between scientific networks, decision makers and stakeholders dealing with climate change, on the one hand, and biodiversity experts, on the other. There is still no coordinated monitoring of the effects of climate change on biodiversity, and there is a visible need for raising public awareness of the influence of climate change on biodiversity and for building the capacity of the relevant institutions. However, the contribution of ecosystem preservation and biodiversity protection to climate change mitigation and adaptation has been clearly recognized as one of the goals in the future.

There are numerous initiatives and programs focusing on urban green solution issues across Europe, and offering innovative, relevant and useful solutions that can also be implemented in Serbia. Sporadic Green Infrastructure initiatives are noticeable in Serbia as well. Although they are only local and marginal for now, they can nevertheless serve as demonstration projects to raise awareness and thus influence policy making and enforcement, and, consequently, contribute to the implementation of NBS in practice.

[43] Second National Communication of the Republic of Serbia (p. 25)

[44] Draft Nature Protection Program, available in Serbian at https://www.ekologija.gov.rs/wp-content/uploads/razno/PredlogProgramaZastitePrirodeRS2020-2022.pdf

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Key Findings on Nature-Based Solutions Implementation in Serbia

NBS are a rather novel concept, defined as actions that "use ecosystems and the services they provide to address societal challenges such as climate change, food security or natural disasters". It was, therefore, too ambitious to expect that NBS would be clearly recognized as such in Serbia's strategic and policy framework.

The existing national programs and strategies recognize the values of ecosystems and their contribution to climate change adaptation and mitigation, but **NBS are not explicitly mentioned or recognized as actions or tools associated with climate change**. However, some of the nature-based concepts (like green infrastructure or some ecosystem-based approaches) appear sporadically among actions recommended in Serbia's strategies. Unfortunately, most of the strategies are not accompanied by a monitoring and evaluation system, wherefore it is impossible to follow up on the implementation and effects of the proposed measures.

A brief review of Serbia's GHG emissions[45] shows a tendency towards an increase in removal by sink in the forestry sector compared with 2000, but that the quality of the data in the national GHG inventory for the AFOLU sector should be further improved to demonstrate its full potential.

The Serbian INDC recognized the following areas as vulnerable: agriculture, hydrology, forestry, human health and biodiversity. The assessment of the available strategic, policy or program documents in Serbia within compatible sectors (forestry, agriculture, biodiversity, environmental protection) indicates that **the issue of climate change is still under-recognized**.

[45] Based on Serbia's Second National Communication and First Biennial Report

There are specific climate change adaptation measures in some of the strategic sectorial documents, but almost none of them are directly associated with NBS, except, in the case of forestry and, marginally, urban development. Some of the national programs and strategies recognize the values of ecosystems (for example, in the case of nature protection), even their contribution to climate change adaptation and mitigation. However, even in these cases, NBS are neither explicitly mentioned nor recognized as actions or tools associated with climate change.

- The Second National Communication to the UNFCCC recognize the potential for NBS in the forestry and, partly, the water management sectors in Serbia, and NBS are included in some of the proposed measures for climate change adaptation/risk reduction. However, further development of indicators is required to facilitate monitoring of progress or of the effects of those measures, and the estimation of climate adaptation co-benefits and reduction of GHG emissions triggered by these actions. Authors of future reports under the UNFCCC should explore opportunities for NBS' contribution to climate change mitigation and adaptation measures, particularly in the AFOLU sector;
- Serbia's Agricultural Strategy clearly links the challenges for agriculture with impacts of climate change, but does not consider NBS or similar concepts among the potential solutions;
- One of the most recently adopted strategic documents in Serbia, the Sustainable Urban Development Strategy, commendably takes into account the cross-sectoral approach, recognizes the importance of climate change, if only sporadically, considers the latest developments in urbanization, and includes some, albeit marginal, measures for applying NBS in urban settlements;
- Although the development of a new policy document, the National Forestry Program, is still ongoing, the review of its goals and planned measures indicates clear links and synergies between forest planning, forest management and climate change. The document clearly recognizes and incorporates climate mitigation interventions involving NBS.
- The Draft Low Carbon Development Strategy of the Republic of Serbia provides a comprehensive and realistic climate change assessment within the different sectors (environment, agriculture, economy, social protection).

In January 2020, the public discussion was concluded on the Draft Serbian Low Carbon Development Strategy and which adoption is expected after the inter-ministerial consultations, whereas the National Adaptation Plan has been pending since 2015. Therefore, there is still a need for cross-sectoral and comprehensive integration of climate change issues in other sectors in Serbia.

The detailed analysis of the concepts, approaches, examples and lessons learnt from the application of NBS shows that policy enforcement, stakeholder engagement, a multi-sectoral approach and local participation are just as important for the applicability of NBS as their recognition in the national strategic and policy framework.

Given that NBS are a relatively novel concept, it was not easy to identify case studies and projects applying NBS in Serbia. However, the analysis of examples of application of NBS in other countries indicates that the **challenges that can be addressed by NBS across the world are very similar to those faced by and identified in Serbia**. The greatest similarities

have been identified in the policy planning processes at the national level and in the need to improve institutional capacity to apply NBS, as well as in the lack of a systemic approach to utilizing the potential of the existing ecosystems and natural solutions for climate change mitigation and adaptation.

5.2 The Way Forward in Implementing Nature-Based Solutions in Serbia

The analysis of numerous case studies around the world shows that most NBS actions were strongly backed up by the relevant national, regional or sub-regional policies, high stakeholder involvement, scientific research and awareness raising activities aiming to facilitate long-term and sustainable effects of the proposed measures. Therefore, in order to derive maximum benefits from the existing natural phenomena and ecosystems in Serbia, **NBS need to be mainstreamed and their application strongly linked with other sectoral measures and plans**. In that respect, exploration of the NBS' potential for tackling some of the identified challenges in urban development, agricultural production, biodiversity and flood protection in Serbia could be the next step in combating climate change in these sectors.

Given the overarching and cross-sectoral character of Serbia's Climate Strategy and the relevant reports Serbia must submit under the UNFCCC, as well as the fact that NBS should permeate many other sectors, **climate-related national policies and programsprimarily the NDC, are the most feasible solution for mainstreaming NBS**. For example, particular attention should be paid to the current and projected removals by sink in the AFOLU sector.

The ongoing policy development and review processes in Serbia, notably, the development of the Climate Strategy and its Action Plan and the National Forestry Program (NFP), as well as the preparation of the Third National Communication and the Second Biennial Update Report under the UNFCCC, are an excellent opportunity to ensure that measures involving the application of NBS or similar concepts are taken into consideration and mainstreamed in these documents.

A **paradigm shift in the relevant actors' perceptions of NBS'** potentials that exist in Serbia needs to occur in order to ensure that this untapped potential is clearly recognized and properly utilized in the context of climate change mitigation and adaptation. This process definitely calls for a systemic and cross-sectoral approach, which must be overseen by the relevant state authority charged with climate policy (the Nature Protection and Climate Change Unit of the Serbian Ministry for Environmental Protection) and thus linked with other climate policy planning processes (above all the development of the National Climate Strategy and reports under the UNFCCC).

Finally, in order to bring further the concept of NBS and enable its practical implementation, more detailed sector-based studies tackling specific local issues (like watersheds, biodiversity, forest, protected areas, Ramsar sites, urban settlements or similar) should be performed.

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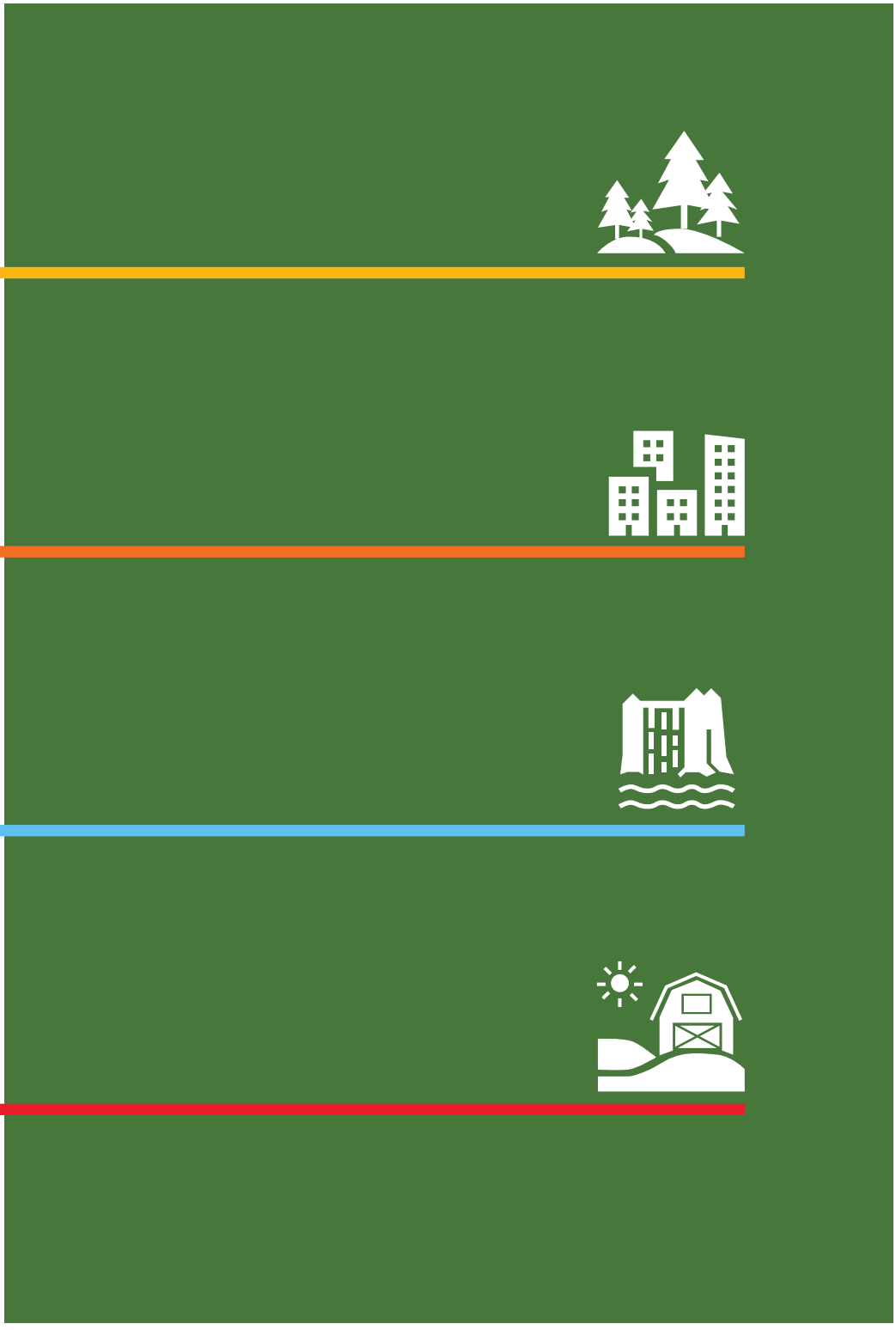

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