

Nature-Based Solutions Mainstreaming: Challenges and Opportunities for Climate-Related Natural Hazards Mitigation in Western Balkans Countries

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ABSTRACT

Nature-based solutions (NbS) provide a unique opportunity to address sustainable development challenges and supply benefits for both people and nature, such as support for climate change mitigation. This study compiles information about the most common climate-related natural hazards in the Western Balkans (WB) region. It assesses the institutional, policy, and legal framework for implementing NbS to address these problems. The study compares the policies, knowledge gaps, and current challenges to NbS mainstreaming in Croatia, a European Union (EU) country, with those in Bosnia and Herzegovina, Serbia, and Albania as non-EU countries. In EU countries, the policy framework transposes the main European Directives, which enforce the need to implement NbS, climate change, and natural hazards mitigation, mainly focused on built infrastructure or technical measures in non-EU countries. The possibilities to mainstream NbS, such as the need for a centralized governance structure, using NbS to integrate different sectoral policies, and the involvement of stakeholders and funding agencies, are discussed. The WB region must advance NbS implementation for climate change adaptation, disaster risk reduction, and other pressing societal challenges. The institutional structure and policy framework relevant to implementing NbS to mitigate climate-related natural hazards show similarities between the WB countries. However, significant differences, particularly regarding transposition of EU Directives between the EU and non-EU WB countries, are easily recognizable.

Keywords: EU and non EU countries; nature-based solutions; climate change; policy and institutional framework

INTRODUCTION

The rapidly rising global population, wide-scale human pressure, and economic development have resulted in unprecedented environmental changes (e.g., Ferreira et al. 2016, Dominique et al. 2021). Climate change, one of the greatest challenges facing humanity, is exerting significant adverse effects on human well-being and infrastructures, leading to financial and economic crises with repercussions from local to global scale (IPCC 2019). Weather extremes and associated natural hazards, such as floods and droughts,

are imposing significant stress on society and ecosystems and are affecting the productivity capacity of systems such as agriculture (e.g., Badura et al. 2021, Raška et al. 2022). Many countries are developing strategies to mitigate and adapt to climate-related risks (Brink et al. 2016), which are fundamental for the broader achievement of the United Nations Sustainable Development Goals (UN SDGs) (Dominique et al. 2021).

Nature-based solutions (NbS) are part of a transdisciplinary umbrella concept encompassing nature's role in addressing pressing challenges facing humanity and

natural systems (IUCN 2020). NbS are defined as “actions which are inspired by, supported by or copied from nature” (EU 2015), aiming to restore, sustain, and (re)introduce ecosystem functions in landscapes (Frantzeskaki and Bush 2021), especially in metropolitan regions where the societal impact is bolder (Hysa et al. 2024). By mimicking and enhancing natural processes and mechanisms, NbS provide diverse benefits to communities and ecosystems and help to deal with environmental problems. For example, they are essential in providing climate-resilient responses (adaptation and mitigation), improving disaster risk management, and reversing ecosystem degradation and biodiversity loss (Ferreira et al. 2020, Ciampa et al. 2021). NbS generally provide multiple benefits, including ecological, economic, social, and business opportunities, relevant to facilitating the transition to sustainable development (Lafortezza et al. 2018).

NbS have attracted increasing societal and political attention in recent years. Many countries already explicitly reference NbS in key policy planning documents (OECD 2020). It is a relatively new, recently developed concept for solving societal challenges. For example, several European Union (EU) member states already included NbS in their flood risk management plans developed under the terms of the EU Floods Directive (Kapović Solomun et al. 2021b). However, despite recognizing the importance of ecosystem services in strategic policy and planning processes and documents (e.g., the Paris Agreement; UNFCCC 2016), there has been no explicit focus on integrating NbS, and the operationalization of this approach is limited. Despite the fact that the implementation of NbS can improve environmental integration and coherence between policy agendas (e.g., land degradation, climate change, biodiversity protection) and help national governments to effectively address societal challenges (Timboe and Pharr 2021), their implementation is still in its infancy (Raška et al. 2022). The integration of NbS into planning and governance must take place at the municipal level, where international and national legislation and policies are translated into practice (Wamsler et al. 2020). Specific pilot programs, dedicated funding efforts, and advocacy by particular actors, such as specific departments within some governments, have supported implementing NbS projects worldwide (Dominique et al. 2021). For example, the EU is supporting projects focusing on NbS through the framework of Horizon 2020 (Moosavi et al. 2021) and the European Green Deal. Nevertheless, the existing NbS projects are relatively limited, and the upscale of NbS is still a significant challenge (Kuriqi and Hysa 2021).

The implementation and upscaling of NbS require substantive knowledge and expertise from different disciplines to design, plan, implement, and maintain these solutions. Several studies have investigated barriers hindering the broader implementation of NbS and have examined the requirements to overcome these barriers (e.g., Toxopeus and Polzin 2021, Raška et al. 2022). The status quo bias of the existing policy frameworks, weak institutional arrangements, fragmented governance, and inadequate financing approaches have been identified as some of the barriers to broader scaling up of NbS (e.g., Frantzeskaki et al. 2020, Dorst et al. 2021). National governments can play a critical role in mainstreaming and scaling up the use of

NbS by designing the institutional, financial, and regulatory frameworks necessary to adopt NbS in the public and private sectors (Timboe and Pharr 2021). Governance processes should support the involvement of internal and external stakeholders in NbS planning and adaptation to mainstream NbS as environmental, social, economic, and business solutions for sustainable and resilient societies (Frantzeskaki et al. 2020, Frantzeskaki and Bush 2021). For example, governments need to consider compensating landowners since NbS implementation requires significant shifts in land use and spatial planning (Dominique et al. 2021).

Implementing NbS is still challenging even in countries with well-established democracies and well-functioning governments. In developing regions like the Western Balkans (WB), where the governing frameworks are under development, little is known about how NbS are being promoted on the political agenda. In this context, this study aims to evaluate the policy, legal, and institutional framework for implementing NbS to mitigate climate-related natural hazards in the WB region. We start with information about the most common climate-related natural disasters and climate change challenges in WB to stress the need for NbS. Then, the existing policies and institutional capacities to address these problems are analyzed, focusing on whether NbS are considered possible solutions for mitigation and adaptation to natural hazards and climate change. Knowledge gaps and challenges for NbS mainstreaming are then assessed. We bring the cases of four WB countries, i.e., Bosnia and Herzegovina (BiH), Croatia, Serbia, and Albania. These countries have a complex social and political background marked by relatively recent conflicts, which have slowed the development of formal institutional environments (Efendica and Ledeneva 2020). Croatia officially joined the EU in 2013, whereas BiH, Serbia, and Albania are still negotiating EU integration. Since the institutional governance structure of a country affects its policy and environmental legislation (Karakosta et al. 2012), we investigate differences in NbS mainstreaming. It is relevant to assess how current governance in these countries affects NbS implementation and whether there are differences between EU and non-EU countries.

CLIMATE-RELATED NATURAL HAZARDS IN THE WESTERN BALKANS COUNTRIES

The WB region, including the countries of BiH, Serbia, Croatia, and Albania, is highly exposed to climate-related natural hazards (i.e., floods, droughts, wildfires) (Dragović et al. 2017, van 't Wout et al. 2019). They are favored by the typical short and intensive storm events, heterogeneous geomorphological properties, land degradation problems, and climate change (Ferreira et al. 2022). Flooding is the most frequent and damaging climate-related hazard in BiH (Kapović Solomun et al. 2020), Serbia (Ristić et al. 2021), Croatia (Ugarković et al. 2020), and Albania (Pazzi et al. 2016), causing severe social, economic and human losses over the past decade. In May 2014, extreme precipitation led to a flood event covering 30% of the territory of BiH, causing 23 fatalities, 2,000 landslides, and disrupting several minefields, which increased human exposure to risks from

unexploded mines from relatively recent conflicts (AP 2017). The damages to infrastructure and agricultural production caused by this flood accounted for 1.54 billion EUR (Kapović Solomun et al. 2021b). The same precipitation event also caused floods in Serbia, with estimated damage cost at 1.5 billion EUR in 24 municipalities (Ristić et al. 2021), while in Croatia, this flood event was a significant cause of the 1.4% decrease in national GDP (Ministry of Finance 2017). In Albania, flooding is one of the highest national hazards, causing significant financial losses that directly affect the fragile economy (Pojani and Tola 2010).

Besides floods, the main climate-related hazards affecting BiH, Serbia, and Albania are droughts and heatwaves, whose frequency and magnitude are projected to increase in the future due to climate change (Kapović Solomun et al. 2021a; 2021b; Hysa and Teqja 2020). Although droughts significantly impact the WB region, data on the economic impacts are scarce. In Serbia, droughts have caused estimated damage of around 3.5 billion EUR from 2000 to 2021, accounting for nearly 70% of all damage from natural hazards (Kapović Solomun et al. 2021b, Ristić et al. 2021). In Croatia, drought-induced damage between 1995 and 2016 accounted for 38.4% of all reported damage from natural hazards and cost about 1.8 billion EUR (Ministry of Finance 2017). Similarly, from 2005 to 2014, droughts caused 39% of all damage driven by extreme weather and climate disasters (CNPDRR 2019). In Croatia, from 2013 to 2017, extreme weather and climate events resulted in annual losses of 295 million EUR (Croatian Parliament 2020).

Climate-related risks are also driven by socio-economic factors. For instance, deforestation (especially during and after the Civil War in 1992) and illegal construction of houses by refugees in flood-prone areas have increased the flood risk in BiH (EC 2020). These factors have also increased the landslide risk to housing, partly driven by a lack of spatial planning (Kapović Solomun et al. 2018). In Croatia, forests cover almost 50% of the territory (Ministry of Agriculture 2022), and their total area has remained constant over the past 100 years (NIR 2021). According to the National Forest Inventory of the Republic of Serbia (NFI 2023), forests cover 39.01% of the territory, which indicates that compared to the previous forest inventory, the area under forests has increased. On the other hand, according to CORINE land cover data of 2018, 36% of the Albanian lands are covered by forests and 16% by pastures and meadows. However, land use and land cover dynamics in Albania have been highly influenced by both natural and human factors (Hyka et al. 2022). Between 2000 and 2018, urbanized areas increased by 1% and agricultural land by 3.5%, while forested areas decreased by 2.1% (Alikaj et al. 2022). However, liberalization, socio-economic restructuring, agricultural and livestock abandonment, and rural depopulation have resulted in uncontrolled biomass expansion in rural areas. Together with afforestation using flammable species (e.g., pine woodlands) (Kisić and Bogunović 2016), this has led to increasing frequency and intensity of wildfires during the past decade (Bogunović et al. 2015). In Albania, wildfires have intensified in recent decades, threatening forest land and critical social-economical assets within the Wildland Urban Interface (WUI) and surrounding metropolitan areas like Tirana (Hysa 2021). However, being located in the southern part of the WB and

opening towards the Mediterranean, including the Adriatic and Ionian Seas, Albania is exposed to various natural disasters like coastal flooding, erosion, and sea-level rise (Bisaro and Meyer 2022). Other climate-related hazards like coastal and riverine flooding, droughts, landslides, and forest fires are also frequent, but flooding is responsible for 60% of losses recorded in Albania during the 20th century.

The WB countries face broadly similar climate-related hazards and disaster risks, which are expected to exacerbate due to climate change (Dragović et al. 2017). Projected changes in weather extremes will lead to more significant risks of floods and droughts (Antolin-Lopez and Garcia-de-Frutos 2019), which are already very important for the WB region.

POLICY FRAMEWORK

BiH, Serbia, and Albania are non-EU countries with independent policy frameworks. At the same time, Croatia, a member of the EU since 2013, has adapted its national legislation to EU regulations. Nevertheless, in all these countries, the policy framework relevant to NbS is mainly connected to the agriculture, forestry, and water management sectors. Thus, these sectors will be elaborated further. Given the ongoing climate change and natural hazards, several global agreements and regional policies are relevant for the WB countries. It is encouraging that the policy domain centered on the United Nations Convention to Combat Desertification (UNCCD) appears to have already significantly integrated NbS considerations for climate change adaptation and disaster risk reduction.

Bosnia and Herzegovina

BiH has a decentralized structure comprising two entities, the Republika Srpska (RS) and the Federation of Bosnia and Herzegovina entity (FBiH), and one district, the Brčko District (BD), which is responsible for its policy frameworks and legally responsible for all natural resources. The FBiH entity consists of 10 cantons, and each have a government and a parliament that can develop policies and adopt laws pertaining to their competencies on the cantonal level. Institutions responsible for developing and implementing NbS to mitigate climate-related hazards at the entity and district levels include the Ministry of Agriculture, Forestry, and Water Management in both entities, as well as the corresponding ministry in the Brčko District. Thus, the complex constitutional structure of BiH requires analysis of the policy framework to be conducted at the respective entity level, considering that the key policy documents relevant to NbS in the sectors of forestry, agriculture, and water management are developed at this level.

The forestry sector is highly relevant to NbS, as forests and forestry management practices influence climate-related risks, e.g., flooding, forest fires, and landslides. Due to BiH's political and institutional structure, a state forest strategy and legal framework do not exist. Instead, policies are designed at the entity and BD levels (see Supplementary Material 1). In the FBiH entity, a Law on Forests was proposed in 2016 by the Parliament of FBiH, but has not yet been passed due to political disagreements between

cantons since each canton has its exclusive jurisdiction over this natural resources. On the other hand, in RS (Parliament of the Republika Srpska 2008, Official Gazette 15/08) and BD (Parliament of Brčko District 2010, Official Gazette 02/10), laws on forests are already being implemented, albeit not synchronized. According to laws on forests, forest management relies on a sustainability approach and management measures, considering climate-related natural hazards, including soil protection, flooding prevention, forest fires, etc. (Parliament of the Republika Srpska 2008, Official Gazette 15/08). However, the current forestry policy framework does not include NbS terminology explicitly, even though implementation measures are based on NbS. Additionally, public forest ownership is still a very sensitive subject of political disagreements between two entities and state-level institutions in post-conflict countries such as BiH (Kapović Solomun et al. 2021b), but this does not affect implementation of the law.

Regarding the agricultural sector, laws on agricultural land (e.g., Law on Agricultural Land RS 2006, Law on Agricultural Land FBiH 2009) are developed and adopted in all three administrative units (FBiH, RS, and BD). Each law addresses aspects relevant to sustainable land management that can be understood and performed as NbS, but this terminology is not cited in the legislation. Each entity in BiH has developed its water management strategy relevant to floods and droughts, but there is also no mention of NbS. Sometimes, even within one entity, water management strategy has encountered barriers to adoption. For instance, the first water management strategy for FBiH was delayed for three years due to the complex institutional structure of that entity (including ten cantons) and entity-level decision-making. The Integrated Water Management Strategy for 2014-2024 of the Republika Srpska adopted in 2014 does not contain NbS as a term but recognizes water protection and sustainable management prescribing measures, which are not explicitly listed as NBS (riparian buffers, afforestation upstream, etc.).

Generally, the policy and strategic process centering on land degradation (including forestry, agriculture, and water management sectors) is also relevant for NbS in BiH and its entities (NAP 2021, Kapović Solomun, 2022). These sectors are connected to management of natural resources, where soils, forests and water are the most important ones, and land degradation is a process which interconnects them. The most recent strategic policy documents are land degradation neutrality reporting targets for the period up to 2030, which are specified and published for each entity (Kapović Solomun et al. 2018, Čustović and Ljuša 2018). Regarding the relevance for NbS, the reporting targets explicitly acknowledge the dual role of forest ecosystems in drought risk reduction (through water provisioning services) and flood risk reduction (through water retention). Further, the targets include potential NbS measures for forestry, including improving forest management practices and expanding protected areas.

Serbia

Serbia is a centralized country, and the leading institutions for NbS are the Ministry of Agriculture, Forestry and Water Management, the Ministry of Environmental

Protection, and their internal departments. Like in BiH, the existing national legislative and institutional frameworks, strategies and public policies, ecosystem values, and their contribution to climate change adaptation and mitigation are recognized. However, NbS are not explicitly mentioned in them nor recognized as actions or tools related to climate change (see Supplementary Material 1).

The existing legal framework in the forestry sector emphasizes the need for NbS by promoting multifunctional sustainable forest management (e.g., biodiversity conservation, carbon storage, and ecosystem services). Several measures regarding forest management and interventions have been established to mitigate climate change, such as afforestation of bare areas, restoration of natural forests, conversion of coppice forests, and rehabilitation of forests damaged by fire. However, in the Law of Forests (Serbian Parliament 2018, Official Gazette No. 30/2010, 93/2012, 89/2015, and 95/2018), the term NbS is not explicitly mentioned, nor is it linked to climate change. In the agriculture sector, the existing Law on Agricultural Land (Official Gazette No. 62/2006, 65/2008, 41/2009, and 112/2015) (Assembly of Serbia 2015) recognizes NbS in the context of sustainable planning, protection, arrangement and use of agricultural land. The challenges facing agriculture are clearly linked to the effects of climate change, but the legislative framework does not consider the concept of NbS as a possible solution. Also, the Law of Land Protection (Serbian Parliament 2015, Official Gazette No. 112/2015) foresees measures of importance for the protection and preservation of land resources, which can be performed as NbS, but this term is not cited. In the water resource management sector, the legislative framework (Serbian Parliament 2018, Official Gazette No. 30/2010, 93/2012, 101/2016, 95/2018,) includes measures that can be recognized to some extent as NbS actions. They relate to the preservation of the existing natural flood zones, the restoration of floodplains, the construction of green corridors along river courses, or the formation of protective forest greenery and grass communities along important "floodwater streams". Again, this law does not include NbS as a term. In addition, the Land Degradation Neutrality Report (2019), published within the framework of Serbia's UNCCD activities, proposes measures connected to the ratified Convention that are of great significance for the forestry, agriculture, water resources management, and nature protection sectors in the country. The proposed measures can be identified with the concept of NbS. In order to ensure the maximum benefit from the existing natural phenomena and ecosystems in Serbia, it is necessary that the NbS be institutionally included and that their application clearly connects with different sectoral measures and plans. However, horizontal and vertical communication between institutions collecting data and government organizations is insufficiently well-developed, and there is no exchange of information on the availability of the existing data relevant to NbS (Ristić et al. 2021). Administrative capacities in the environmental sector in Serbia are pretty weak but also complex, and knowledge and capacity building are required to deal with multiple environmental challenges. Realization of public policies, involvement of interested parties, multi-sector approach, and public participation are equally

crucial for implementing NbS and their recognition in the framework of national strategies and public policies.

Albania

The political fragility and the ongoing legal and administrative reforms cause uncertainties in distributing disaster risk reduction responsibilities among governmental bodies. For example, the latest local administrative reform in Albania (2014) has decentralized key responsibilities like disaster risk management, natural resources conservation, and territorial development, transferring competencies from central government to local municipalities (Hysa and Baskaya 2018). The process of integrating NbS in national policies is relatively slow in Albania. Of the 19 available policies on Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR), only a few explicitly mention NbS (Bisaro and Meyer 2022). We only list the most relevant CCA and DRR policies here and highlight their relevance to NbS (Table 1 and Supplementary Material 1). Accordingly, NbS was included for the first time in the Revised Nationally Determined Contribution (NDC) (Ministry of Environment of Albania 2021) by elaborating a set of adaptation measures for different sectors that must be prioritized and include NbS (e.g., for the coastal sector). It is worth mentioning that NbS is used in combination with ecosystem-based adaptation (EbA). In 2017, EbA was integrated into the National Adaptation Plan (Draft 2) by the Albanian Government for the first time, relatively earlier than NbS. The coastal plan and priority actions include EbA for coastal flood protection. Similarly, the 4th National Communication to the UNFCCC (2022) includes several measures of NbS jointly used with EbA. For instance, regarding the adoption of NbS and/or EbA for Climate Change Delivery measures, the document suggests the following actions with very high priority: (i)

“reforesting with vegetation resistant to high temperatures and humidity, such as forest belts of poplar, willow, acacia, etc. in the riversides, especially near the embankments to protect the soil from erosion”, and (ii) “managing current flood risks by maintaining green areas and natural buffers around streams in urban settings; building of natural and semi-natural areas; public green spaces, parks, and gardens, etc.”.

Croatia

Within the classical centralized structure, legislation in Croatia is primarily centralized on a national level, with a small portion of responsibility on the municipality level. At the national level, the Law on Forests (Croatian Parliament, 2018a, Official Gazette No. NN 68/18, 115/18, 98/19) regulates the management and protection of forests and forest soils as a natural resource. In particular, it aims to maintain biodiversity and ensure management based on economic sustainability, social responsibility, and ecological acceptability. Moreover, the Law on Forest recognizes NbS in the context of climate protection. It states that forests should be managed according to sustainable management criteria, i.e., maintenance and enhancement of forest ecosystems and their contribution to the global carbon cycle. However, hazards such as wildfires are covered by obligations on post-fire management that rest with forest owners and fire protection measures in forests or forest lands. The Rulebook covers detailed measures on Forest Protection against Fire (Croatian Parliament 2020, Official Gazette 33/2014). However, risks from wildfires will be exacerbated due to predicted elevated temperatures, strong winds, and decreased precipitation in 2040-2070 (Croatian Parliament, 2020). NbS must be considered in other legislative documents to mitigate climate threats. Legislation

Table 1. Primary Policy documents regarding Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) in Albania (adapted from Bisaro and Meyer 2022).

Policy	Gov.	Year	Sector	NbS Relevancy
Nationally Determined Contribution (INDC)	ME	2015	CCA	Addresses energy and industry for the mitigation of climate change (no adaptation)
3. National Communication to the UNFCCC	GoA	2016	CCA	Vulnerability of Ecosystems to Climate Change Integrated 18 'green' adaptation measures
National Adaptation Plan (NAP) (Draft 2)	GoA	2016	CCA	Coastal plan priority action includes EbA and ICZM principles
National Climate Change Strategy and Plan (NCCSP)	GoA	2017	CCA	Coastal EbA Better forestry management against land degradation Preparation and implementation of river basin management plans
Law on Climate Change	ME	2021	CCA	Establishes mitigation framework, including carbon sequestration
Revised Nationally Determined Contribution (NDC)	ME	2021	CCA	Elaborated set of adaptation measures for different sectors that are prioritized and included NbS, e.g., for the coastal sector
4. National Communication to the UNFCCC	MTE	2022	CCA	The EbA is used jointly with NbS throughout the document Encourage afforestation and reforestation activities
National Strategy for DRR and Civil Protect	MI	2014	DRR	Refers to ecosystems vulnerable to CC, but no explicit discussion of the role of nature in DRR.
National Civil Emergency Plan	ACP	2004	DRR	Promotes reforestation Misuse of natural resources increases social and economic vulnerability
Law on Civil Protect.	ACP	2019	DRR	Includes some aspects of DRR management

* Abbreviations: MTE- Ministry of Tourism and Environment, ACP- Agency for Civil Protection, ME- Ministry of Environment, MI- Ministry of Interior, GoA- Government of Albania.

in the agricultural sector is well developed but only partially relevant for NbS. The Law on Agriculture (Croatian Parliament 2018b, Official Gazette No. NN 118/2018) recognizes NbS by supporting the sustainable management of natural resources and the adoption of environmentally friendly agriculture. More detailed NbS measures, primarily to mitigate land degradation, can also be discerned in the Law on Agricultural Land (Croatian Parliament 2018c, Official Gazette No. NN 20/2018). Several measures for adaptation and the reduction of the devastating impact of climate extremes are considered in the Regulation 2018/848 (EU) on organic production and labelling of organic products and the Rulebook on Agrotechnical Measures (Croatian Parliament 2019, Official Gazette 22/2019). These policies cover the subjects of cultivation methods and maintenance of agricultural land in conditions for growing plants; prevention of weed infestation and overgrowth with perennial plants; suppression of organisms harmful to plants; management of plant residues; maintenance of organic matter and humus in the soil; maintaining a favorable soil structure; protection against erosion; and maintenance of soil fertility. Overall, the mentioned aims and measures for sustainable land management can be regarded as NbS in terms of soil moisture regulation, biodiversity loss, and other degradation processes related to settling, compaction erosion, and diffuse pollution, but not related to flooding or other climate-related hazards like wildfires. Measures to mitigate flooding are not part of agricultural or forestry legislation. Operational flood risk management and direct implementation of flood protection measures are determined by the National Flood Defence Plan (Official Gazette No. NN 84/2010), adopted by the Government of the Republic of Croatia (2010) and the Main Flood Protection Implementation Plan adopted by Croatian Waters (2018). Flood defence in Croatia follows the EU Floods Directive guidelines and is organized into territorial flood defence units. Both documents contain flood protection measures, from which the preventative measures can be regarded as NbS.

As mentioned above, the NbS for climate hazards are adopted nationally in Croatia and most legislation has already been aligned with the EU *acquis* (see Supplementary Material 1). However, the NbS related to several climate disaster threats should be integrated into future policies to reduce disaster risks. Nevertheless, Croatia has developed a Climate Change Adaptation Strategy (Croatian Parliament 2020) following the recommendations of the EU Adaptation Strategy, with the support of EU financial instruments. This strategy identifies priority measures and activities, as well as ways to integrate adaptation measures into sectoral development plans and strategic documents. Climate Change Adaptation Strategy recognizes the NbS as a tool for adaptation. However, until today, new sectoral policies with listed procedures for defining priority measures, activities, and propositions have yet to be created.

DISCUSSION

Comparative Discussion and Challenges

This section compares policy contexts, existing institutional models, and relevant policies for NbS across

WB. As non-EU countries, BiH, Serbia, and Albania follow a pre-accession process and harmonization with the relevant EU directives, stipulating policies prioritizing inclusive governance, monitoring, and evaluation frameworks aligned with NbS (Eggermont et al. 2015). However, they have their legislation which, even without mentioning the NbS terminology, supports the implementation of the underlying concept through, e.g., forest, agriculture, and water-specific legislation (joint measures of the legislation are related to sustainable land management, protection from floods, drought mitigation and measures for the prevention of wildfires). Moreover, the institutional structure and policy framework relevant to implementing NbS to mitigate climate-related natural hazards show similarities between the WB countries. However, significant differences, particularly regarding implementation between EU and non-EU WB countries, are easily recognizable. Nevertheless, disaster risk management in WB, EU, and non-EU countries is still primarily based on grey infrastructure, such as upstream dams and local defence for flooding, irrigation systems to combat drought, etc. As an EU member, Croatia has already implemented some EU directives into national legislation, such as the Floods Directive, which includes principles of mimicking natural processes, such as enhancing local water infiltration and retention. At the same time, non-EU WB countries partially transposed the Floods Directive into national legislation. The implementation of EU legislation into national legislation of non-EU countries is a long-term process. However, additional NbS could be integrated into new strategies and plans to combat natural hazards. Looking forward, new developments at the EU level may further advance the integration of NbS concepts into Croatia's policy, addressing climate change hazards more efficiently.

While comparing the policy frameworks in the WB, two different types of outcomes become distinguishable. Enabling policy environments for NbS measures depends on embedding the NbS concept in the policy context to identify and highlight the multiple benefits that nature and ecosystem restoration and conservation can supply. It is precisely such embedding of the NbS concept in policy that is needed to overcome the 'silos' of sectoral planning observed in these four WB economies studied.

In the investigated countries, the policy framework does not recognize NbS explicitly, even though several laws relevant to NbS implementation are already in place (Supplementary Material 1). Generally, a lack of comprehensive assessments of disaster risk and climate change impact on critical sectors pose an essential challenge to NbS mainstreaming within a country (Ferreira et al. 2021). One reason for this may be the lack of an appropriate NbS concept embedded in the policy contexts of the WB countries, as reported elsewhere (Han and Kuhlicke 2021). Furthermore, the NbS concept is relatively new, and it takes time to accumulate a body of case studies and analyses demonstrating the effectiveness and benefits of NbS (Seddon et al. 2020). Moreover, in the case of countries with a decentralized structure, such as BiH, the complex institutional structure as discussed above and a lack of existing data (relating to forestry, agriculture, water management, natural hazards, etc.) generate constant political tensions and institutional barriers, since a system for information exchange, e.g., on natural hazard impacts, is

absent (Kapović Solomun et al. 2020). Like in BiH, the fragile political structure of Albania and the lack of reliable data about critical sectors like forestry, agriculture, and water management have been hampering NbS integration in the policy framework. The lack of historical data about natural resource management, territorial transformation, natural hazards, and disaster risk is hard to recover. Especially for countries like Albania and BiH, programs of historical data extraction from available satellite imagery are vital for collecting information regarding the magnitude and impacts of previous disasters (Rahmati et al. 2021) and thus for supporting well-informed NbS against territorial management challenges. The lack of data is currently a relevant challenge for territorial planning and management (Hysa et al. 2021).

As an EU country, Croatia is also seeking new strategies and plans with a stronger connection and use of NbS. Implementing NbS in Croatia should be encouraged when developing strategies, plans, and programs for individual sectors and in specific cases where certain structural measures can be implemented without legislation as part of spatial planning. In order to derive maximum benefits from the existing natural phenomena and ecosystems, NbS need to be mainstreamed, and their application must be strongly linked with other sectoral measures and plans. In that respect, exploring the NbS potential for tackling some of the identified challenges in agricultural production, forest, and water management to prevent climate-related natural hazards could be the next step in combating climate change for EU and non-EU countries.

Possibilities for Nature-based Solutions Mainstreaming in the Western Balkans Countries

The issues described in previous sections reveal the urgent need for new policies that integrate the NbS concept and are adapted to the WB countries' socioeconomic and cultural conditions. Except for Croatia, where the NbS term is mentioned in the climate change adaptation strategy to be implemented up to 2040, and with a focus on 2070 (Croatian Parliament 2020), the WB countries studied here have not yet directly developed the NbS concept in their policy. Even though Croatia has already implemented the primary EU legislation, it did so without using NbS terminology. Moreover, Croatia has yet to develop strategies to combat natural hazards like droughts. Legislation concerning these issues should promote NbS, with the creation of green infrastructure being a good example, in addition to other measures. Any of the WB countries should not miss this opportunity. For example, under the EU Forest Strategy, drought protection strategy and soil conservation strategy should also be applied in Serbia, BiH, and Albania, using NbS solutions as the primary approach to achieve resilience of the environment and build up national to local capacity to combat the disaster.

Although several new and ambitious policies (e.g., EU Green Deal, EU Climate law, EU Soil Strategy for 2030) have been launched recently, it appears that the WB countries have not been prompted in their reaction to the NbS implementation, even though individual national specificities could be implemented into new strategies and policies using NbS as the central guiding concept.

Nevertheless, since BiH, Serbia, and Albania are willing to join the EU, compliance with EU legislation is essential for integrating NbS into policies. Weak points in the complex constitutional structure in BiH and Albania have caused a delay in the ratification of several laws relating to natural hazards.

Weak governance and inefficient administration are relevant barriers to NbS mainstreaming in non-EU countries (BiH, Serbia, and Albania). This is particularly the case of BiH, a decentralized country with a complex administrative and institutional framework involving 13 Ministries of Agriculture, Forestry, and Water Management that have legal responsibility in flood, drought, and wildfire management but act non-synchronized. This decentralized structure contributes to a certain level of policy fragmentation (Kostadinov et al. 2019). Furthermore, the ongoing political tensions and the post-conflict environment weaken institutional cooperation and impair the implementation of the existing policies (Kapović Solomun et al. 2018), comprising critical constraints for NbS mainstreaming. Besides weak inter-entity cooperation, different sectors (forestry, agriculture, water management, biodiversity, etc.) within each entity require an approach that integrates processes across temporal, spatial, and institutional scales. Developing new laws and documents represents an opportunity to promote NbS integration in the existing policy frameworks. On the other hand, when a natural hazard becomes a disaster, it triggers higher decentralization and, thus, higher local disaster risk management (Tselios 2021).

In terms of barriers to the integration of NbS across the WB region, several observations that apply to multiple economies can be made. Firstly, adaptation planning in non-EU WB countries has a limited focus on NbS-related approaches. This is a relevant barrier for NbS integration since the existing policies focus on built infrastructure or technical measures and institutional or capacity-building actions. Secondly, and more fundamentally, there is good recognition in policy of the critical threats posed by climate change, land degradation, and decreasing biodiversity to achieving broad social and economic development goals (Faire et al. 2017). However, there is much less recognition of the role of nature in climate change adaptation, particularly in disaster risk reduction. Overcoming this barrier of not acknowledging the potential role of NbS in climate change adaptation and disaster risk reduction would be relevant for NbS mainstreaming (Sekulova and Anguelovski 2017). This can be supported by accumulating and disseminating evidence on NbS in various contexts. The integration of NbS into policy is at a relatively early stage, and these aspects should be considered and integrated in order to achieve progress on sustainable and effective NbS implementation. New strategies and legislation should mainstream NbS as a starting point for the recognition of the role of nature in climate change adaptation, specifically in disaster risk reduction. While the fragility of administrative responsibilities among central and local level governmental bodies still exists, the opening of the accession negotiations processes, e.g., between Albania and the EU on 19 July 2022, is expected to improve the situation. The new political status that Albania earned towards EU membership will result in the ratification and adaptation of environmental

policies according to EU directives. As part of educational programs, namely at a high education level, it is relevant to emphasize the importance of services provided by ecosystems and the need and opportunities to use NbS (e.g., the implementation of Blue-Green Infrastructure) (Potočki et al. 2023). In addition to good governance, partner selection and other general success factors, the success in planning, starting and implementing NbS projects include building strong support in strategies and policy support, support in local governments and the public domain, as well as youth education (Naumann et al. 2014). These factors should ensure that NbS are accepted as a solution and that NbS realize their full potential and deliver long-term benefits. Consolidating governing institutions and well-informed decision-making processes will facilitate NbS mainstreaming in the WB countries.

Poor political communication and lack of cooperation are significant challenges for the existing land governance, particularly in BiH and Albania, where land governance is still a sensitive political issue given the post-conflict environment (Kapović Solomun et al. 2021b, Hysa et al. 2021). Although the NbS concept is somehow integrated into its primary legislation in Serbia, its implementation is still weak. Although Croatia, as an EU country, is more advanced in NbS implementation, significant challenges remain regarding the mainstreaming of different measures in the existing legislative and strategic framework, owing to a lack of economic investment and other priorities of the country. Economic aspects have been identified as a relevant barrier to implementing NbS (e.g., Han and Kuhlicke 2021) and represent an additional challenge for developing countries such as BiH, Serbia, and Albania. Subsidies and financial incentives could help implement NbS, e.g., more capital for farmers could encourage them to develop sustainable grazing activities and implement buffer strips along the main rivers that have long acted as flood control areas (water meadows). Specific programs for non-EU members (GEF, GCF, World Bank, etc.) could increase the subsidies for farmers and land use managers who use more environmentally friendly practices. Also, EU investments in rural areas of non-EU countries through programs to enhance the use of NbS, particularly green and blue infrastructure, would be essential to support NbS mainstreaming. Effective NbS may not function efficiently within the borders of a single country, especially territorially small countries like BiH.

Even though the mainstreaming of NbS in the existing legislation is in its infancy, there are encouraging initiatives led by international agencies and specific projects that contribute to building consciousness about the importance of NbS at both central and local levels. The “Kune-Vain Lagoon (KVL) restoration project” case is an excellent example of NbS implementation project in the region. KVL is among the most essential Albanian Mediterranean lagoon ecosystems and a natural reserve, extending 10–15 km in the north-south axis and 1.5–3.0 km between east and west (Aliko et al. 2022). The project was developed between the Albanian government and the Global Environment Facility (GEF), a pilot program established in the Paris Agreement to support developing countries in implementing solutions to protect ecosystems and biodiversity. Significant sand

strips that define the lagoon are disappearing each year due to climate-driven coastal flooding, and the coastal communities are exposed to devastating flood events due to sea level rise (UNEP 2020). However, the afforestation plans within the project aim to restore the 30 m by 2,000 m sand corridor of the lagoon, which serves not only to biodiverse wildlife but also safeguards the nearby community against coastal erosion. The afforestation initiatives comply with the Law on Forests, which identifies a special forest category of “protective forests”, whose function is mainly to protect the soil from erosion, landslides, and floods, protect agricultural lands from winds, and stabilize and improve the quality and quantity of the water regime (Albanian Government 2020). The capacity building of decision-makers on the local level is an important aspect and has been considered one of the main barriers to implementing NbS in many countries, including in the EU (e.g., Han and Kuhlicke 2021, Raška et al. 2022). All stakeholders need to be educated about how they can contribute to more sustainable land-use management options.

CONCLUSIONS

This study provides an overview of the most common natural disasters and climate change mitigation and adaptation challenges in the Western Balkans region and the institutional capacity of the countries in the region to address these problems using NbS. The countries studied, Bosnia and Herzegovina (BiH), Croatia, Serbia, and Albania, have a complex historical background marked by relatively recent conflicts, which have impeded the development of formal institutional environments, especially in BiH and Albania. The institutional governance structure that has emerged in these countries has affected policy and environmental legislation and, consequently, the implementation of NbS. To date, NbS terminology has not been integrated into relevant policies in BiH, Croatia, Serbia, and Albania. This indicates that enabling policy environments for NbS measures requires the NbS concept to be embedded in the policy context in order to highlight the multiple benefits that nature and ecosystem restoration and conservation can produce. The existing policies tend to focus on built infrastructure or technical measures and institutional or capacity-building actions, although lightly addressing a few measures based on natural processes (e.g., maximizing water infiltration). There is little recognition of the role of nature in climate change adaptation, particularly in disaster risk reduction. In Croatia, however, the climate change strategy is already using NbS. As an EU country, the transposition of the EU directives into national legislation has involved the implementation of disaster risk measures based on natural processes. The lack of economic resources for implementing NbS is an additional challenge, particularly in developing countries like BiH, Serbia, and Albania. The integration of NbS into policy is at a relatively early stage and must be promoted to make progress on sustainable and effective NbS implementation. The issues described in this study reveal the urgent need for new policies that integrate the NbS concept and are adapted to the socioeconomic and cultural conditions of the Western Balkans region.

Author Contributions

MKS and CSSF conceived and designed the research, SE, IB, AH, GČ, IČ processed the data and performed the analysis, all authors wrote the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary Material 1 - The list of legislation of WB countries relevant for the NbS. Supplementary data show legislation framework within the Western Balkan countries which is relevant for the nature based Solutions.

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