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Analysis of international public funding flows for the environment, climate change, and sustainability: the case of Bosnia and Herzegovina

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Abstract

Background: Securing adequate financing for the environment, climate change, and sustainable development has been challenging, especially in low- and middle-income economies. Bosnia and Herzegovina is a country aspiring to become a member state of the European Union. Despite undergoing a socio-economic transition, the country is more than four times as energy-intensive as the average European Union member state. Since the end of the war in the 1990s, the country has received significant amounts of bilateral and multilateral development aid, including environmental finance (e.g., climate finance, funding for biodiversity conservation, impact funding). To facilitate future sustainable finance prioritization, this study analyzes Bosnia and Herzegovina's environmental finance.

Results: The study conducted a scoping literature review and detailed analysis of the environmental finance flows for Bosnia and Herzegovina in the period from 2015 to 2020. The results show that the scientific knowledge on the (effectiveness of) environmental finance for Bosnia and Herzegovina is almost non-existent. The country received US$545.6 million in environmental finance in the studied period and more than 99% of this funding was spent on water, energy, waste, and environmental management. In contrast, biodiversity, resource management, chemical safety and environmental noise received less than 1% of total funding. Bosnia and Herzegovina received 58% of the financing in grants, while 38% was provided in various types of loans.

Conclusions: There is a considerable difference in the received funding among different sectors. Funders prioritized a few sectors (e.g., water), whereas others (i.e., biodiversity and nature conservation, chemical safety and noise, and resource management) were neglected. Bosnia and Herzegovina can argue for more equitable funding distribution based on its minor contribution to global greenhouse gas emissions. Providing almost 40% of environmental finance to Bosnia and Herzegovina in loans increases the country's level of indebtedness. It distorts the principle of climate justice since the country has been an irrelevant greenhouse gas emitter.

Keywords: Climate finance, Development aid, Development finance, Public funding, Bilateral funders, Multilateral funders

Background

Achieving the transition to keep the planet within a safe operating space will require enormous financial support [1–3]. To keep the rise in global average temperature below 1.5 °C in line with the Paris Agreement, governments will need to radically bend the greenhouse gas

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(GHG) emissions curves [4, 5]. Global decarbonization is estimated to cost around US$130 trillion by 2050 [6]. By 2030, US$93 trillion would be required to support the development of low-emission and climate-resilient infrastructure globally [7]. Societal transition to a world where GHG emissions will decrease from current levels is impossible without sufficient financial support.

Environmental finance lacks a uniform definition. This study defines it as finance that covers a broad array of interconnected sectors, including environment, climate change, and sustainability [8–11]. Environmental finance has been especially difficult for low(er)- and middle-income countries (LMICs) as they cannot necessarily prioritize investing in climate change action and environmental management [12]. Moreover, private investors are reluctant to invest in developing countries due to socio-economic, political, and security risks and diminishing returns on capital invested [13]. The reluctance of private investors and the lack of domestic finance make LMICs heavily reliant on bilateral and multilateral funding for environmental finance.

Development partner institutions (DPIs) remain a crucial partner for environmental finance in LMICs [14, 15]. DPIs include development agencies, development finance institutions, multilateral development banks, the European Union (EU) and other development partners (e.g., Green Climate Fund and Global Environment Facility). Their support is usually provided to avoid carbon lock-ins and achieve the Paris Agreement goals even when financial support and pledges do not always arrive as planned [16–18].

Ensuring that environmental finance is identified and utilized effectively will maximize its impact on the ground [3, 9, 10]. Without an agreed definition of environmental finance and many DPIs operating in LMICs [19–21], it is hard to track environmental finance and its usage [22–25]. Having better insights into environmental finance flows and structure (i.e., quantifying flows, identifying actors, and mapping actors' strategic focus) helps LMICs better position themselves to take advantage of new funding streams and opportunities [24]. To this end, international public funding flows mapping provides LMICs with aggregate quantification of funding streams and an awareness of how much finance is mobilized and when, who is funding what, and what is targeted [14, 22]. Understanding the broader context of environmental finance, supports LMICs in their relations with DPIs. DPIs can gain information on state-level investments of all other active DPIs and better prioritize targeting and spending their environmental funds. Finally, international public funding flows mapping and identification of DPIs are essential for evaluating the effectiveness of the funding flows on different scales [22, 24, 26].

Since the end of the Cold War, the Western Balkans region, which borders the EU, has seen a significant inflow of bilateral and multilateral development aid (including environmental finance). Bosnia and Herzegovina (BiH) is one of the biggest recipients of foreign financial assistance in the region [27, 28]. Like other LMICs, environmental finance in BiH and the region depends heavily on DPIs [29]. Still, it is difficult to understand if the financial disbursements have been sufficient to achieve the required domestic priorities and international pledges [23]. Since a comprehensive repository of DPIs and knowledge about which sectors are prioritized for funding is lacking, planning to transition to a sustainable, less carbon-intensive future is difficult.

In 2019, the EU endorsed the European Green Deal, an ambitious plan to make the EU climate neutral by 2050 [30]. The European Green Deal enshrined carbon neutrality in European Climate Law, setting targets for achieving climate neutrality. To achieve this, the EU needs to make radical changes including promoting the circular economy, improving the energy efficiency of buildings, decreasing pollution, investing in biodiversity conservation, producing healthier food, and radically decarbonizing the transport sector [30]. To help drive the societal transformation and ensure a just transition that leaves no one behind, the EU plans to finance the effort through a €1 trillion heavy investment plan [31].

The EU and several EU member states are the Western Balkans' most crucial environmental finance providers [29]. Moreover, the EU firmly commits to integrating the Western Balkans through the enlargement process (with Montenegro and Serbia accession talks ongoing, North Macedonia and Albania preparing to start the talks, and Kosovo and BiH classified as potential candidates) and therefore can affect Western Balkans environmental and climate policies.

This study aims to analyze environmental international public funding flows using a case example of BiH in the post-Paris Agreement period (2015–2020). Specifically, the study seeks to answer the following questions:

1. *What research evidence exists on the (effectiveness of) finance for the environment, climate, and sustainability in BiH?*
2. *What were DPIs' environment, climate, and sustainability-related financing flows for BiH from 2015–2020?*
3. *Do identified DPIs have a strategy for BiH, and what is their funding focus concerning BiH's environment-specific policy areas of interest?*

The analysis could be replicated in other Western Balkans countries as the entire region has similar

socio-economic, political circumstances, cultural context, geography, climatic conditions, structure of energy generation systems, and reliance on DPIs for environmental finance [32, 33]. The following section provides a detailed description of BiH's socio-economic and political context, followed by the methods used to analyze international public funding flows in BiH, study results, discussion, and concluding remarks.

Country context

BiH is a middle-income country located in the central part of the Western Balkans. BiH came to the global attention in the 1990s with the breakup of socialist Yugoslavia, as the country experienced war (1992–1995) with more than 100,000 dead and 1 million internally and externally displaced [34, 35]. The war destroyed more than two-thirds of the country's economic output [36] that never fully recovered due to: (1) large public sector and limited private wealth creation; (2) focus on consumption rather than production; and (3) underperforming export sector [37]. The lack of economic progress has made BiH dependent on foreign capital provided by DPIs, especially in financing environment-, climate-, and sustainability-related projects [29].

The Dayton Peace Agreement (signed in December 1995) stopped the war and preserved the country's sovereignty [38]. However, the agreement created a state that could be defined as a complex multi-ethnic[1] federation [35]. Sub-state levels [entities Federation of Bosnia and Herzegovina (FBiH) and Republika Srpska (RS) and Brcko District (BD)] have a high level of autonomy and power in comparison to limited state-level controls. FBiH has a central government supplemented by ten autonomous cantons with governments and legislatures. RS has a centralized parliamentary-style government divided into municipalities. BD is a local self-governing area that functions identically to FBiH and RS municipalities.

The European Union and environment, climate change, and sustainability issues in Bosnia and Herzegovina

BiH applied for EU membership in 2016 [39, 40]. Under the Stabilization and Association Agreement with the EU, BiH agreed to transpose the EU's environmental *acquis* into the country's legal frameworks and to adapt its administrative system accordingly. Given that domestic funding capacities are insufficient [41], BiH needs external funding to finance the EU accession process and accomplish its Paris Agreement pledges by 2050 [42, 43]. Progressing on the process and achieving the pledge's goals is a pressing issue. BiH faces several significant environmental challenges such as air pollution, inefficient waste management, illegal deforestation, lack of mechanisms to protect water and biodiversity, and stagnation in increasing the size of protected areas [43, 44].

The state-level government is missing a legal structure to manage the environment–climate–sustainability nexus. There is no state-level environmental policy and strategy (apart from several state- and entity-level strategic documents to manage water, waste, and the environment in general[2]). The country's Ministry of Foreign Trade and Economic Relations coordinates entity-level activities and acts as a mediator, but entities directly manage and operate their environmental resources. Environmental financing cooperation, coordination and information sharing across the various governance levels are inefficient and duplicated.

The environmental finance provision in BiH is fragmented across multiple DPIs collaborating with institutions on different levels. Assessing the volume and the impact of environmental finance provision is challenging due to the absence of a cohesive tracking and reporting system at the state- or entity-level [42, 44]. In the absence of a coordinating mechanism, it is challenging to employ a principle where various governments can better understand how the different DPIs' agendas interact with the national and international strategies, plans, and needs [42–44]. Addressing and supporting these issues can strengthen the much-needed institutional and legislative environmental frameworks and improve the implementation and enforcement of various environmental policies [44].

To improve the condition of the environment and increase the country's compliance with EU regulations and international environmental agreements, state, entity, and district-level governments are currently preparing the Environmental Strategy and Action Plan (BiH ESAP 2030+, see www.esap.ba). Apart from the state-level strategy and action plan, this effort will contain strategies and action plans for entity-level FBiH and RS, and district-level BD. All

[1] The country has three presidents. Each member of the Presidency is elected as a representative of their respective ethnic group (i.e., Bosniaks, Bosnian Serbs, and Bosnian Croats).

[2] The strategic documents at the state-level are The Environmental Approximation Strategy of BiH adopted in 2017 at the country level, the Climate Change Adaptation and Low-Emission Development Strategy for BiH adopted in 2013, and the Strategy and Action Plan for Protection of Biodiversity in BiH 2015–2020 adopted in 2017. At entity and district levels, the documents are: the Water Management Strategy of the FBiH (2010–2022), the Strategy of Waste Management (2017–2026) and the Strategy for Integrated Water Management (2015–2024) in RS, and the Environmental Protection Strategy of BD (2016–2026). At the same time, several key strategic documents have expired recently, such as the FBiH Environment Protection Strategy (2008–2018), the RS Air Protection Strategy (up to 2017), and the Nature Protection Strategy of RS (up to 2018).

Table 1 Search terms for topic search on Web of Science Core Collections; the full search string is combined as follows: A AND B

A. Setting terms	Bosnia* OR Herzegovin* OR BiH OR Bosn* OR Hercegovin* OR "Western Balkan*"
B. Intervention terms	financ* OR donor* OR aid OR funds OR fund OR funding* OR invest OR investment* OR loan* OR grant* OR reconstruct* OR "World bank" OR EBRD "European Bank for Reconstruction and Development" OR ODA OR "Official development assistance" OR "Global Environmental Facility" OR GEF OR "European Commission" OR USAID OR "US Agency for International Development" OR EIB OR "European Investment Bank" OR IFC OR "International Finance Corporation" OR UN OR "United Nations" OR UNDP OR "United Nations Development Programme" OR UNEP OR "United Nations Environmental Programme" OR WBIF OR "Western Balkans Investment Framework" OR GCPF OR "Global Climate Partnership Fund" OR ICI OR "International Climate Initiative" OR GCF OR "Green Climate Fund" OR GGF OR "Green for Growth Fund" OR "Austrian Development Agency" OR "German Federal Ministry of Economic Cooperation and Development" OR "Czech Development Agency" OR "French Global Environment Facility" OR "Netherlands Development Finance Company" OR GIZ OR "German Technical Cooperation" OR "Japan International Cooperation Agency" OR "German Development Bank" OR "Swiss Development Cooperation" OR "Slovenia* Development Cooperation" OR Sida OR "Swedish International Development Cooperation Agency" OR "Turkish Cooperation and Coordination Agency"

four jurisdiction-level strategies and action plans will include strategic goals, objectives, and clearly defined actions to achieve environmental sustainability [45]. Each jurisdiction will operate its strategy and action plan per BiH's constitutional arrangement. BiH ESAP 2030+ will be of strategic importance for the state of the environment in all jurisdictions across BiH for two reasons. First, the document will clearly define actions to achieve environmental sustainability and improve overall citizen health and well-being, bringing BiH, FBiH, RS, and BD administrative units together under environmental protection. Second, the document will also make crucial contributions to the country's EU accession process (including the goals of the Green Agenda for the Western Balkans) and the BiH's commitment to fulfilling Agenda 2030 and national pledges to the Paris Agreement.

Even though BiH is currently only a potential candidate for the EU, the Green Deal has significant implications for future environmental finance flows. The Green Agenda for the Western Balkans is the EU's new growth strategy for the region (originating from the Green Deal) [46]. The EU pledged to implement the Green Agenda through the Instrument for Pre-Accession (IPA III) using mechanisms such as the Western Balkans Investment Framework, and the European Fund for Sustainable Development Plus. The idea behind the initiative is to provide €9 billion in grants and €20 billion in investments between 2024 and 2030 [47]. With this vision, it is vital to understand the landscape of environmental funders and funding flows to discuss investment priorities for the country's future.

Methods

We employed a scoping review to explore the literature on funding flows in BiH. In addition, we conducted detailed analysis of funding flows and analysis of funding priorities.

Scoping literature review

Web of Science Core Collection (WoSCC) (via Stockholm University library subscription) and Google Scholar were searched to understand what empirical research evidence exists on environmental finance in BiH. Topic search (including keywords, titles, and abstract) in WoSCC was conducted using English search terms. The search string included a combination of context and finance terms (see Table 1 for details). Google Scholar searches were simplified (to accommodate limitations of this search facility) as follows: *allintitle: Bosnia funder OR donor OR finance OR aid OR investment OR loan OR grant*.

All search results were combined into a library of search results in the Eppi-Reviewer Web, removing duplicates [48]. The screening was done in two stages: the title and abstract and the full text (following retrieval). A consistency check was conducted on a randomly selected subset of 100 titles and abstracts independently screened by two reviewers to ensure repeatability and clarify eligibility criteria. The screening decisions were compared, disagreements discussed, and eligibility criteria clarified. After the consistency checking exercise, the rest of the titles and abstract were screened by a single reviewer. All full texts were double screened by two reviewers. The following eligibility criteria were applied at both screening stages:

- Eligible settings: Bosnia and Herzegovina.
- Eligible interventions: Any type of financing from bilateral or multilateral sources on the portfolio-level. Individual project-level financing was not eligible. The study excluded fiscal policy and tax articles, private investments and improving investment options, state budget planning, drafting and adoption, public revenue and spending, remittances, aid conditionality and public debt.
- Eligible outcomes: Any outcomes related to climate, environment, or sustainability, including water, waste, biodiversity, air quality, climate change, energy

Table 2 An overview of included IATI sectors with corresponding key policy areas

Environment, climate, and sustainability policy areas	Corresponding IATI sector
Water (including sanitation)	Water sector policy and administrative management, water resources conservation (including data collection), water supply and sanitation—large systems, water supply—large systems, sanitation—large systems, basic drinking water supply and basic sanitation, basic drinking water supply, basic sanitation, river basins development, education and training in water supply and sanitation, agricultural water resources, flood prevention/control
Waste	Waste management/disposal
Biodiversity and nature conservation	Biodiversity, biosphere protection
Air quality, climate change, and energy	Power generation/renewable sources, hydro-electric power plants, geothermal energy, solar energy, biomass, energy policy and administrative management, energy sector policy, planning, and administration, energy education/training, energy conservation and demand-side efficiency, energy generation, renewable sources—multiple technologies, solar energy for centralized grids, wind energy
Chemical safety and noise	Chemicals
Resource management (composed of subsectors: soil, mineral resources, forests, fisheries, and hunting)	Forestry development, fuelwood/charcoal, forestry services, fishery development, mineral prospection and exploration, coal, ferrous metals, nonferrous metals, precious metals/materials, industrial minerals, fertilizer minerals
Environmental management (including policy)	Environmental policy and administrative management, environmental education/training, environmental research

generation, chemical safety, environmental noise, and natural resources.
- Eligible study types: Any type of empirical studies. Modeling, theoretical or commentary papers were excluded.
- Eligible languages: English.
- Time frame: No limitations.

The eligible studies were narratively summarized.

Analysis of funding flows

The analysis is based on the information from International Aid Transparency Initiative's (IATI) Country Development Finance Data [49]. IATI data is an open data source continually updated with contributions of over 1300 organizations (governments, multilateral institutions, private sector, and civil society organizations). The study analyzed funding flows by year, policy area, and funder; and also included funder mapping and funding priorities.

The downloaded BiH-specific dataset was limited to finance flows from 2015 to 2020. Important to mention is that the years 2021 and 2022 were not included since the research focused on completed annual funding cycles. The study included unfinished projects that might have started before 2015. Eligible types of transactions were disbursement and incoming funds, and all funding flows were shown in US$. The funding amounts examined were provided at face value and at constant prices.

After filtering by period and transaction type, selected funding data from sectors relevant to the environment and climate change were included. The original dataset included 183 sectors spanning from primary health care, human rights, culture, and industrial development to biosphere protection. To choose relevant environmental finance flows, the dataset was filtered using the OECD's climate change mitigation and adaptation markers (also known as Rio Markers), environmental sectors listed in the Environmental Approximation Strategy of BiH, and the seven key policy areas BiH ESAP 2030+ [50, 51]. Within the study, IATI sectors were identified by examining a list of Rio Markers by a sector or a sub-sector and matching those to policy areas of interest for BiH outlined in the country's Environmental Approximation Strategy and BiH ESAP 2030+. The included sectors span from renewable energy and river basin development to forestry services and are based on the priorities of BiH's environmental, climate change, and sustainable development sectors. The final selection resulted in 42 sectors, shown in Table 2. Funding data were merged according to sectors and analyzed in an Excel spreadsheet using the pivot table option, data filter, and several simple Excel formulas. Even though specific sectors could be linked to more than one policy area, this was omitted to avoid double counting funding flows per policy area. Moreover, this study did not analyze cross-sectoral funding flows (i.e., those financing more than one sector) but only the funding within 42 sectors in seven key policy areas (see Table 2). The project classification followed IATI's rules.

For major DPIs identified during finance flows analysis, funder mapping was conducted. To understand DPIs' post-2020 funding priorities and their alignment with key policy areas of relevance for BiH, the websites of key DPIs were searched for BiH-specific information investment

priorities from 2020 to 2030 and for relevant strategic documents. This study included screening relevant documents for information about investments in seven key policy areas (Table 2). The collected information about investments into relevant policy areas was extracted into a spreadsheet and narratively summarized.

Results

Scoping literature review

The Google Scholar and WoSCC search yielded 2008 results that were imported into EPPI-reviewer Web (for more information, see Additional file 1: Annex S1). After removing duplicates, 100 items were screened by two reviewers to clarify inclusion criteria and assure consistency in screening. After disagreements were discussed and clarified, the rest of the title and abstracts were screened by a single reviewer. Titles and abstracts were mostly excluded on a topic that was not related to financing in the field of climate, environment, and sustainability (1507; 80.2%); lack of eligible climate-, environment-, or sustainability-related outcomes (242; 12.9%) and ineligible type of financing (162; 8.6%).

The analysis included 40 items for full-text screening (2.1%), out of which ten could not be retrieved. Out of 30 screened full texts, 29 studies were excluded. Twelve excluded studies analyzed environmental outcomes without clarifying international public funding flows or focused on either investment needs for the energy sector or improving conditions for attracting direct foreign investments. In addition, four studies focused on the performance of specific environmental projects, but there was no analysis of broader finance flows. Finally, 13 studies did not focus on the environment, climate, or sustainability aspects but included discussion about finance. The only eligible study—by S. Buzar from 2008—focused on finance in the energy sector and examined the European Bank for Reconstruction and Development's (EBRD) project portfolio in the Western Balkan energy sector (see Additional file 3: Annex S3—Fig. S1 for details of information flow in this scoping review) [52]. Overall, the scoping literature review demonstrated a knowledge gap related to (effects of) environmental finance flows in BiH.

Funding flows per year

The total amount of disbursed DPI's funding to BiH in the period 2015–2020 for the environment, climate, and sustainability finance was US$545.6 million (which is about 21% of total development finance to the country received in the same period, including all 183 sectors, see Additional file 2: Annex S2 for raw data). The funding flows level varied significantly from year to year (Fig. 1a). The lowest amount of funding received was in 2017 (US$30.1 million or 5.5% of the total), while the highest was US$206.2 million in 2020 (37.7% of the total). On average, BiH received US$90 million per year between 2015 and 2020. The total funding commitments for the analyzed period (including the agreed policy areas) were US$323.7 million, which is lower than the disbursed amount (see Additional file 2: Annex S2). Therefore, more finance was reported as disbursements than commitments in the studied period. This can happen when a commitment actioned before the studied period is disbursed during the studied period. Given that the analysis included unfinished projects that might have started before 2015, this result is not surprising.

Funding flows and trends per policy area

The analysis showed that seven policy areas (see Fig. 1b), water (US$300.6 million) and air quality, climate change, and energy (US$182.3 million) attracted 88% of the total environmental funding (US$545.6 million). The waste sector followed the funding trend with US$42.7 million (7.8%) and environmental management[3] with US$19.9 million (3.6%). The four policy areas accounted for more than 99% of the DPI environmental finance funding BiH received in the post-Paris Agreement era.

The investment in the water policy area was around 55% for large infrastructure projects (or US$158.5 million of total funding) for water supply and sanitation (see Additional file 3: Annex S3—Table S1). Municipal water infrastructure in the city of Banja Luka, city of Sarajevo wastewater project, sewerage network and wastewater treatment plant city of Bijeljina, and multiple projects for improving water supply efficiency in FBiH and RS municipalities are the types of projects constituting DPIs investment portfolio for water policy area.

The analysis was limited to the waste policy area since IATI's database had only one classification category for waste projects (i.e., waste management/disposal) in the analyzed dataset for BiH (see Additional file 3: Annex S3—Table S2). However, a detailed analysis of all waste projects (see Additional file 2: Annex S2) showed that this policy area was dominated by investments in infrastructure projects strengthening solid waste management systems across BiH (e.g., solid waste management projects in the cities of Sarajevo, Banja Luka, and Mostar).

Preferential investment in air quality, climate change, and energy policy areas was observed. For instance, the "Wind Farm Mesihovina" project attracted US$83.9 million of total funding, making renewable energy the most attractive investment in air quality, climate change, and energy policy. Hydropower was the second most

[3] The environmental management theme covers the different horizontal policy areas: data management, monitoring, environmental assessment, permitting and enforcement.

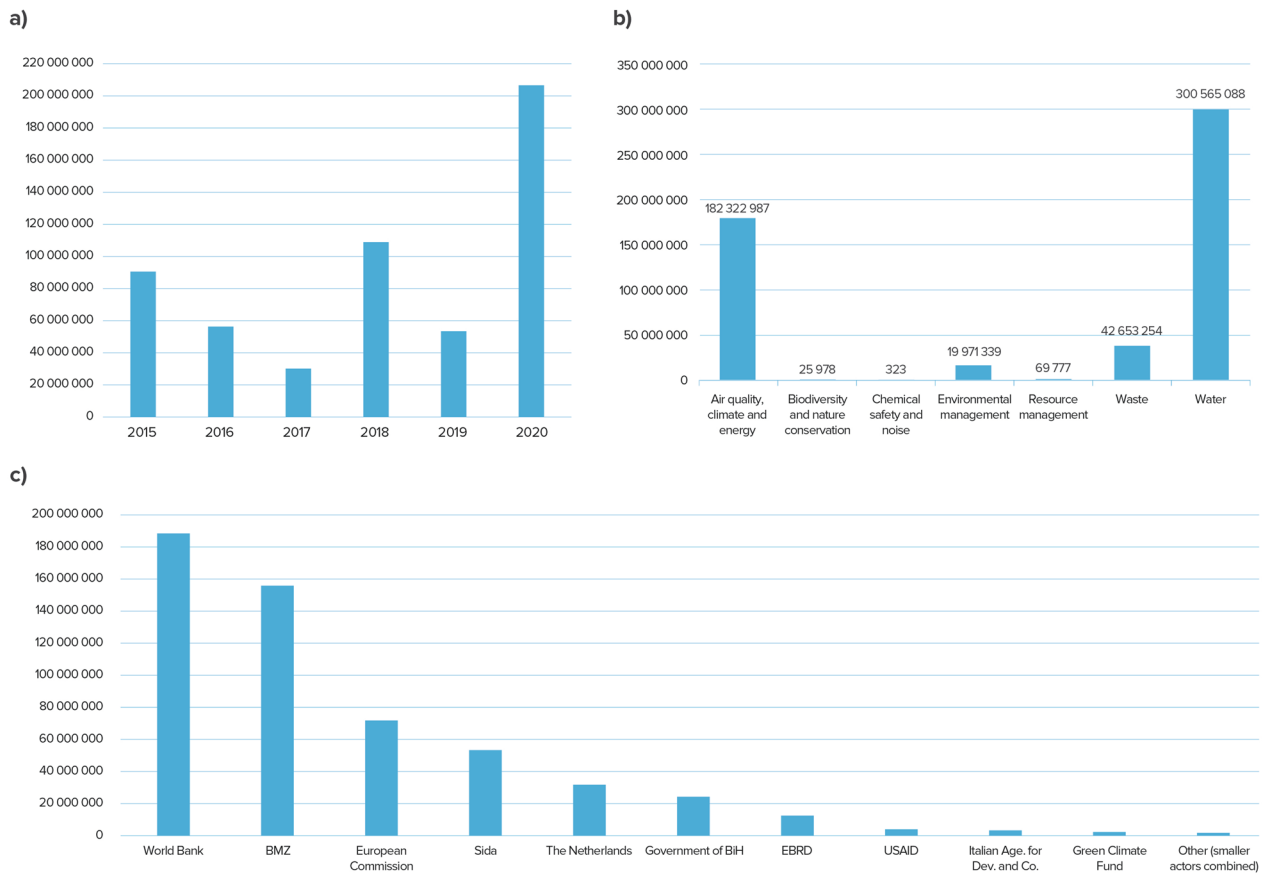

Fig. 1 Distribution of environment, climate, and sustainability finance for BiH per **a** year, **b** policy area, **c** funder 2015–2020, in US$

important renewable energy source funded, while solar and biomass did not receive significant funding (see Additional file 3: Annex S3—Table S3).

Environmental management and policy attracted the fourth most considerable amount of funding (see Fig. 1b) that attracted substantial funding (see Additional file 2: Annex S2 and Additional file 3: Annex S3—Table S4). This is due to the policy area being orientated toward increasing society's capacity to take care of the environment by providing regulatory and legal support. This policy area included funding for projects supporting different government levels across BiH to implement policies, build legal structures and processes that facilitate appropriate planning, strategic steering, and actions in all environmental areas.

The three least funded policy areas were resource management[4], chemical safety and environmental noise, and biodiversity and nature conservation. They jointly acquired only slightly above US$96 thousand or 0.02% of total funding (see Additional file 3: Annex S3—Table S5).

Resource management is a complex policy area composed of several sub-sectors from soil management, forestry, hunting, and mineral resources. Only one subsector (i.e., forestry development) received a significant share of the funding for this broad underfunded policy area (see Additional file 3: Annex S3—Table S5). Additionally, funding for hunting and soil management included in the resource management policy area (see Table 1) was found neither in the examined data nor the entire IATI dataset, including all 183 sectors.

The chemical safety and environmental noise policy area is also underfunded. Namely, this could be because the investment in these areas is difficult to quantify. Moreover, these cross-sectoral topics are intertwined in other policy areas (e.g., waste management, public health, and environmental protection). Therefore, acquiring more information about their funding would require a detailed analysis of individual cross-sectoral projects. Additionally, the IATI database does not have

[4] Resource management is a broad policy area encompassing challenges associated with important non-renewable natural resources (i.e., land, forests, other or non-wood forest products, hunted wild game, fish stocks, and mineral resources).

environmental noise as a sectoral classification category and noise-related funding flows. Three projects containing environmental noise components were classified under the IATI's health policy sector and not included in the examined dataset.

Finally, biodiversity conservation received less finance than resource management (but still more than chemical safety), even though this is a vital sector for climate adaptation. The total amount of funding received was slightly below US$26 thousand, while identified funding for chemical safety was only US$323.

Funder mapping

We have identified the following institutions as funders investing in BiH in the period 2015–2020 (in alphabetical order): EBRD, European Commission, Food and Agriculture Organization of the United Nations (UN), German Federal Ministry for Economic Cooperation and Development (BMZ)[5], Government of BiH, Green Climate Fund, Greenways, Italian Agency for Cooperation and Development (AICS), Government of the Netherlands[6], Slovak Aid, Spanish Ministry of Foreign Affairs and Cooperation, Swedish International Development Cooperation Agency (Sida), Swiss Agency for Development and Cooperation, UN Development Programme, UN Environment Programme, United States Agency for International Development (USAID), and World Bank[7].

Funding flows per funder and their funding priorities

The World Bank was the biggest provider of funding with US$188 million (34% of total funding), BMZ was in second place with US$155 million (28% of total funding), followed by the European Commission, with US$71.4 million (12.8% of total funding), and Sida with US$53.2 million (9.7% of total funding). These four funders accounted for US$465.3 million, or 85% of total funding (see Fig. 1c). Other notable DPIs were the Government of the Netherlands, the USAID, and EBRD (see Fig. 1c). AICS and the Green Climate Fund appeared on the list of the first ten funders, but their contributions were below 1% of total funding (see Fig. 1c).

The World Bank, BMZ, and the European Commission funded more than 80% of all projects in the water policy area (see Fig. 2a). BMZ, World Bank, and Sida, with 83% of total funding, were the three most important sources of finance for the air quality, climate change, and energy policy area (see Fig. 2b). The European Commission, the World Bank, and Sida were significant sources of finance for the waste policy area providing 95% of all funding (see Fig. 2c). Sida was the most important environmental management and policy funding source and provided more than two-thirds (76%) of total funding (see Fig. 2d). The Government of BiH (including all administrative levels of BiH, FBiH, RS, and BD) ranked sixth, providing US$23.7 million (see Fig. 1c). Nevertheless, this amount was not taken to further analysis because the Government of BiH is not a DPI, and the amount is co-financing for different projects.

The funder mapping exercise and analysis of future funding priorities showed that all major DPIs, except Green Climate Fund, have strategies relevant and specific to BiH (see Additional file 3: Annex S3—Table S6). The EU, in the case of the European Commission, has a Western Balkans–orientated plan that encompasses BiH [46]. World Bank strategy is dated until 2020 [53]. Sida has recently adopted a new strategy for the Western Balkan region covering 2021–2027 [54].

Water, air quality, and waste are three policy areas featured in the strategic engagement plans of five of seven major DPIs. The air quality, climate change, and energy policy area was featured as a strategic priority of all examined DPIs. Special attention is given to the process of decarbonization through the promotion of renewable energy. The funders' priorities in their post-2020 strategies are similar to those identified in the analysis. Water, air quality, and waste are policy areas of preference, while biodiversity, resource management, and chemicals are far from being prioritized.

The chemical safety and environmental noise policy area was the focus of only two DPIs. Biodiversity and nature conservation, resource management, and environmental management were featured slightly more than chemical safety and noise but were still missing the importance they deserve. This can be problematic since these policy areas risk being continuously underfunded. Unbalanced funding can only impede BiH's transition to sustainability. For example, efforts in decarbonization (e.g., transitioning away from coal) must be simultaneously complemented by advancements in biodiversity protection (e.g., increasing the surface of protected areas). Only in this manner can the country progress by adhering to the EU and Agenda 2030 principles, leaving no one behind.

Type of funding support

Data included several types of funding support including standard grants, standard loans, aid loans excluding debt reorganization, investment-related loans to developing

[5] BMZ funding included some funding provided by the German Federal Foreign Office.

[6] Composed of funding provided by the country's Enterprise Agency and Ministry of Foreign Affairs.

[7] Including Trust Funds, International Development Association, International Bank for Reconstruction and Development, and the International Finance Corporation.

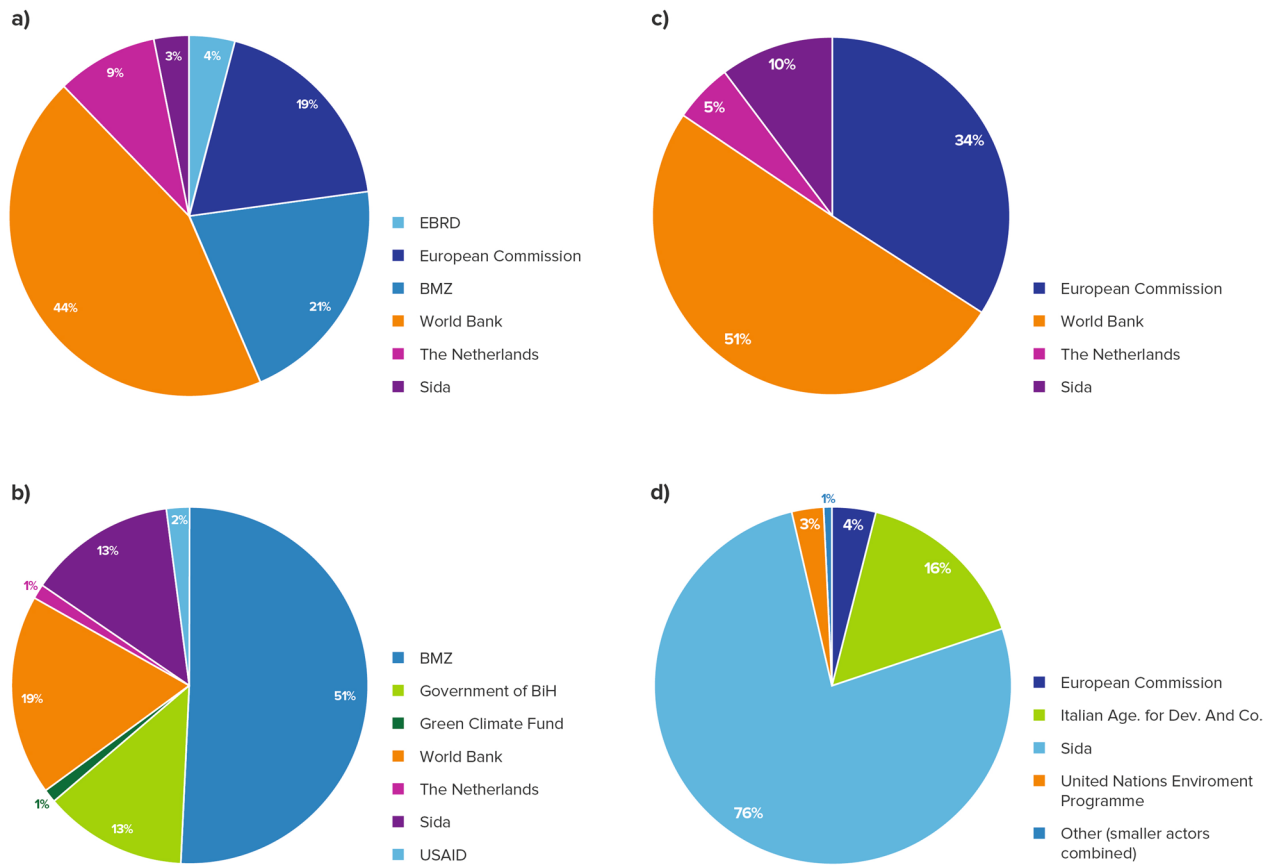

Fig. 2 Significant sources of funding for **a** water, **b** air quality, climate change, and energy, **c** waste, **d** environmental management and policy 2015–2020, in %

countries, and funding support instruments not classified by the IATI database. Standard grants are transfers in cash or in-kind for which no legal debt is incurred by the recipient country [55]. Standard loans are defined as transfers in cash or in-kind for the recipient country that incurs legal debt issued by creditors [55]. Aid loans, excluding debt reorganization, are borrowed development-focused funds that charge interest and must be repaid [56]. However, aid loans excluding debt funding do not encompass bilateral arrangements involving both the creditor and the debtor that change the terms established for servicing an existing debt [57]. Investment-related loans to developing countries are classified as blended finance instruments through which DPIs invest in private sector projects in developing countries [56, 57].

As presented in Fig. 3, a little over half (58%) of received funding in 2015–2020 was standard grant funding free of interest and with no obligation for repayment. The standard loan was the second most prevalent type of payment where the recipient country incurs legal debt (22%). This finding is relevant because BiH will need to repay US$120.7 million, plus the respective interest (see Additional file 2: Annex S2). Aid loan, excluding debt reorganization, transfers in cash for which the recipient incurs legal debt, was the third-largest finance type amounting to 14%. The remaining were investment-related loans to developing countries (totaling 4% of funds received).

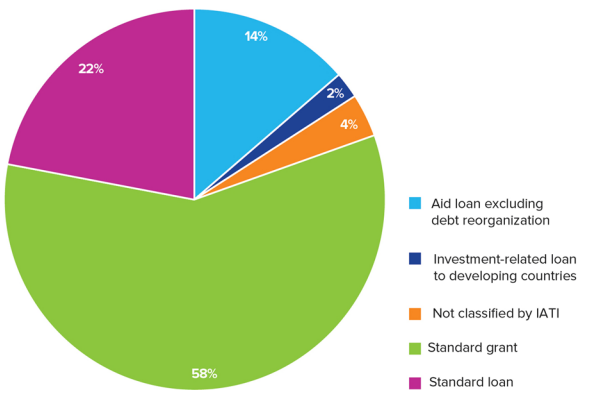

Fig. 3 Type of funding support, 2015–2020, in %

BMZ was the bilateral institution that provided all US$120.8 million of standard loans for funding BiH's renewable energy and large water supply systems (see Additional file 2: Annex 2 for more information). EBRD provided all funding in investment loans funding solely on large systems for water supply and sanitation (see Additional file 2: Annex S2). The World Bank provided all US$75.8 million in funding aid loan excluding debt reorganization (see Additional file 2: Annex S2).

The World Bank (US$112.4 million), European Commission (US$71.8) and Sida (US$53.2 million) were the biggest providers of grants (see Additional file 2: Annex S2) and European Commission and Sida provided all their funding to BiH in the form of standard grants. In addition, BMZ provided US$32.5 million in grants (see Additional file 2: Annex S2 for more information). The remaining US$1.8 million of BMZ funding was "not classified" by the IATI database. Also, BiH (including financial engagements of all four jurisdictions) made considerable investments through co-financing, ranking sixth in size with slightly over US$20 million.

Discussion

The analysis identified only one scientific article relevant to environmental financing in BiH, specifically focusing on energy finance. The scoping review revealed that the topic of environmental finance is not well researched in this context. The results indicated a need for more scientific evidence to support a transition toward sustainability in BiH.

Furthermore, the financial flow analysis confirmed BiH's heavy dependence on bilateral and multilateral environmental finance. Additionally, the amount of US$545.6 million BiH received in environmental finance between 2015 and 2020 was equivalent to the mean value of around US$110 million per year. This is not surprising because globally developed countries failed to mobilize the promised US$100 billion a year between 2010 and 2020 in climate finance for developing countries [17].

In general, underfunded sectors in BiH reflect the global trends. Funding flows into global biodiversity conservation are two to four times smaller than governmental expenditures into other sectors and some other environmentally harmful practices [58]. The low amount of funding received for biodiversity, chemical safety and environmental noise, and resource management is alarming because these policy areas are crucial in supporting BiH's overall transition to environmental sustainability.

The analysis of the financial flows data (see Additional file 2: Annex S2) demonstrated that large-scale infrastructure projects (e.g., wind turbines and wastewater purification facilities) attracted more funding than other projects (e.g., fast-growing plantation forests).

The market matureness in BiH (including the ability of the different governance levels to understand the benefits of investments in nature conservation and resource management) is still at an early stage. The general interest of policymakers (and thus policies and financial mechanisms) to support different underfunded sectors has yet to be developed and enforced. Moreover, investments into these sectors might not be seen as attractive to BiH authorities (compared to, for example, water management and energy efficiency), thus not being high on the country's agenda of interest. Initiatives such as BiH ESAP 2030+ set a positive example by including the neglected noise management in environmental strategic planning, pioneering an initiative that requires visibility domestically and among the DPIs [59].

The results revealed how biodiversity and nature conservation and resource management received minuscule funding compared to the water and waste sectors. Learning from this, policymakers should redirect their focus to obtaining more future funding for underfunded sectors. The distribution of the financing through the Green Agenda allows sectors such as biodiversity to receive more funding [60].

Over a third of received environmental finance was through loans. Therefore, BiH is increasing the risk of storing additional debt burdens lasting far into the future while trying to transition to sustainability. Standard loans generate unsustainable debt burdens for many LMICs, including BiH. Besides, financing transition to sustainability with increasing the risk of sovereign debt burdens for LMICs is not in line with just transition principles, especially for countries like BiH that in 2019 emitted 27 million metric tons of carbon dioxide equivalent ($MtCO_2$), or only 0.07%, from the global total of 36441 million $MtCO_2$ [61]. Like a standard loan, the recipient country is obliged to repay interest for aid and investment-related loans. In the case of BiH, these two loan categories amount to 18% of the overall amount. Hence, BiH debt that needs to be repaid is 40% of total funds received between 2015 and 2020 (the IATI database did not classify 4% of funds received).

The government of BiH was identified as one of the most important providers of environmental finance. This was because several bilaterally or multilaterally financed projects required different government levels to participate via co-financing. Co-financing was funder-driven, arguing that energy efficiency and renewable energy projects are revenue and savings-generating projects and need to be co-financed. This model can increase the ownership and understanding of the benefits and value of implementing projects. The effort could have increased the interest in energy efficiency and renewable energy investments, thus potentially contributing to market

matureness and increased interest. The minimum percentage of required co-financing by end-users/governments has been funder-dependent since there was no common threshold.

Limitations

Limitations of this study arise from the methodological approach and data (reporting) quality. Namely, the scoping review relied only on the WoSCC and Google Scholar. We used English-language search terms and included only English-language literature; future research should expand search sources as well as search languages. The financial flow dataset had some reporting issues. For example, some data points were missing and had to be marked as "not classified" in the analysis process (see, for example, Fig. 3). Original data also included spelling mistakes, lack of project's start or end year, or primary funding data (e.g., consistent information on DPI's environmental finance commitments), which partially limited in-depth analysis of specific issues (such as understanding of all types of funding support or correctly identifying the funder behind the project).

Furthermore, loan amounts presented in the analysis are at face value (nominal value or dollar value) instead of the grant equivalent (an estimate of funding at the present-day value of money), making it impossible to estimate how much is being given away over the life of a financial transaction while being compared by the transaction at market terms. In addition, organizations submitting the data to IATI have a level of autonomy in project classification according to sectors which represents a drawback if a project is cross-sectoral. If an organization is not a member of IATI, there is a risk that the funding it provides is not recorded in the dataset.

Although more than 1000 organizations are contributing to this comprehensive database, there is still a chance that a particular funding stream could be unnoticed (e.g., the Czech Development Agency, which is present as an energy projects funding actor in BiH, is not a member of IATI). Finally, DPIs simply do not report every activity they finance. For example, Japan International Cooperation Agency (JICA) financed the Ugljevik coal power plant desulfurization project from 2009 to 2019, directly improving the population's health and the state of the environment. Although JICA reports partly to IATI, this project cannot be found in the IATI's BiH dataset. This could be because different DPIs update their projects at different times and they classify projects differently. Although IATI has guidelines for classification and tagging, certain types of multifaceted projects covering simultaneously different topics (e.g., water supply, energy security, environmental protection) could be tagged differently per the donor's preference.

The study did not explore how efficiently the funding was spent and whether the DPIs had any insight or control over the spending of the funds. This was not conducted due to limitations in accessing relevant data. However, the matter of control over the expenditure of the funds could be further explored.

Conclusion

As per scoping review results, this study is the first to provide comprehensive quantitative mapping and analysis of the environment, climate, and sustainability of international public funding flows for BiH in the post-Paris Agreement era, including an analysis of major DPIs' strategies for BiH. A better understanding of global environmental public funding flows provides multiple benefits to funders and recipients of funding, helping to shape their future policy decisions. Consolidated knowledge about funding landscape, flows, and priorities can point to underfunded areas, help mobilize more funds, and facilitate the development of necessary financial structures for receiving and distributing funding more efficiently and equitably.

The study attempted to understand BiH's funding flows for the environment, climate change, and sustainability sectors and found several areas requiring further attention from different actors. Namely, the research literature on (the effects of) international public funding flows in BiH is scarce, pointing to a lack of scientific scrutiny and independent evaluations of the impacts of international funding, hampering future learning. This points to the need for more significant investment and involvement of academia and the larger research society in the sector.

The analysis showed that the water policy area received slightly over 50% of all funding. Air quality, climate change, and energy; waste; and environmental management policy areas received almost all remaining funds. The policy areas of biodiversity, chemical safety and environmental noise, and resource management obtained a minuscule funding share.

The funder mapping exercise and analysis of future funding priorities showed that all significant DPIs have strategies relevant and specific to BiH. This result points to maintained interest and strategy for environmental finance and investing in BiH. The analysis further showed that the funders prioritized several particular sectors, whereas others were utterly neglected, and this situation might remain in the future. BiH could benefit from diversifying in environmental finance, both from funder and recipient perspectives. This would increase accountability and ownership and develop and bring closer other sectors such as academia, civil society, and the private sector.

BiH receives most funding as grants, but a considerable amount is loans that can incur more debt. The analysis therefore implies that BiH can argue for more equitable funding distribution based on its minor contribution to global GHG emissions.

Moreover, although the funding data are comprehensive, future analyses of funding flows would benefit from even more complete and uniform reporting. In that respect, a key finding of this study is that contributors to the IATI database should be more thorough when reporting their data to the IATI. Providing more detailed, accurate, and up-to-date information on their projects is of great value for researchers, especially desk research analyses such as this study. The quality of their data impacts the research that examines IATI's database.

BiH policymakers will need to look for different opportunities to scale up future environmental financial flows. The EU's Green Agenda will provide €9 billion in direct grants and potentially mobilize €20 billion in private investments in 2024–2030. There are currently no available details on what amount of funding will be received by each Western Balkan country. The key priority of the EU is to embrace a complete transition to the circular economy in the Western Balkan countries. Improving the sustainability of production, use, and recycling of different raw materials will be at the center of receiving funding to bolster the development of the circular economy. Therefore, the Green Agenda provides the country with an innovative platform in which policymakers and private sector investors could better coordinate their actions and increase the amount of private investment.

Furthermore, there needs to be a stronger push by relevant authorities in BiH to mobilize domestic environmental finance. For example, green bonds could play a role in helping the investment required to achieve the transition to sustainability. The European Green Deal, via the Green Agenda, is expected to stimulate various reforms in BiH that can indirectly help the country develop domestic mechanisms to attract more green capital.

BiH has considerable development needs (environmental sector included) and will require external support for environmental, climate, and sustainability projects to reach the Paris Agreement targets for 2030 and 2050. Nevertheless, many investments done by the BiH government via co-financing signal local motivation and continuous interest in environmental finance, which is crucial for a sustainable transition.

BiH ESAP 2030+ will have indicative financial frameworks for all four jurisdictions that will contain detailed cost estimates for every measure (slightly below 1900 in total) and recommendations for potential funding sources (public, private, bilateral, and multilateral). In this regard, BiH ESAP 2030+ is a ground-breaking document because, for the first time in BiH's history, there will be an all-encompassing and detailed plan defining the cost of each measure and suggesting the funding source. Therefore, authorities across jurisdictions and DPIs will have a well-structured plan to pave the way for easier cooperation and more efficient mobilization of funds.

Improving the energy efficiency of buildings, decreasing air pollution, establishing a functional circular economy, decarbonizing the transport sector, and strengthening overall environmental management is no easy task. In addition to being expensive, it is a technically demanding undertaking and requires a lot of qualified human resources to support the effort. Consequently, it will not be easy for BiH to achieve these goals without international support, not because it is an administratively complex country but because the transition to sustainability is systemic rather than incremental.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13705-022-00359-z.

Additional file 1: Annex S1. It includes an overview of scoping literature review process, including searching and screening outputs as follows—Sheet 1: Overview of searches conducted with search results. Sheet 2: Overview of excluded records at title and abstract screening stage with reasons for exclusion. Sheet 3: List of unretrievable articles. Sheet 4: Overview of included and excluded records at full text screening stage with reasons for exclusion.

Additional file 2: Annex S2. It includes financial flow datasets including—Sheet 1: Financial flows data downloaded from IATI database, for BiH in period 2015–2020, no filtering applied. Sheet 2: Data used for the analysis, including disbursement amounts for 7 policy areas. Sheet 3: Data used for the analysis including committed amounts for 7 policy areas.

Additional file 3: Annex S3. Figure S1. Roses flow diagram indicating included and excluded records throughout the review process, adapted from Haddaway et al. [1]. **Table S1.** Water policy area breakdown of funding per IATI sector, 2015–2020, in US$. **Table S2.** Waste policy area breakdown of funding per IATI sector, 2015–2020, in US$. **Table S3.** Air quality, climate change, and energy policy area breakdown of funding per IATI sector, 2015–2020, in US$. **Table S4.** Environmental management and policy area breakdown of funding per IATI sector, 2015–2020, in US$. **Table S5.** Major providers of finance and breakdown of funding per IATI sector for biodiversity and nature conservation, chemicals and noise, and resource management, 2015–2020, in US$. **Table S6.** Strategic priorities of major funders for BiH.

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Author contributions

AC designed the study, collected, and analyzed data. BM designed and executed a literature review. AC with BM wrote the first draft of the manuscript. SA contributed to the results and discussion, BP contributed to the introduction and conclusion. All authors edited the final manuscript. All authors read and approved the final manuscript.

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Availability of data and materials
The data supporting this study's findings are openly available in IATI's Country Development Finance Data at https://iatistandard.org/en/iati-tools-and-resources/country-development-finance-data/. BiH's financial flows and bibliographic information of records included and excluded during the review process are available in Additional files. All data generated and analyzed during this study are included in this published article and its Additional files.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
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Competing interests
The authors declare no competing interests.

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