European Journal of Sustainable Development Research
2026, 10(4), em0425
e-ISSN: 2542-4742
https://www.ejosdr.com/

MODESTUM

Research Article

OPEN ACCESS

Financing biodiversity for sustainable development in Morocco: Public expenditure trends, governance, and pathways to 2035

Reda Benhima [1*], Nabil Dahhou [2], Achraf Mabrouk [3], Ayoub Souileh [4], Ahmed Birouk [5], Mohammed Ibriz [1]

[1] Laboratory of Botany, Biotechnologies, and Plant Protection, Faculty of Sciences, Ibn Tofail University, MOROCCO
[2] Laboratory of Economics and Organizations Management, Faculty of Economics and Management, Ibn Tofail University, MOROCCO
[3] National Forestry School of Engineers (ENFI), Tabriquet, Salé, MOROCCO
[4] Laboratory of Applied Geophysics, Geotechnics, Engineering Geology, and Environment (L3GIE), Mohammadia School of Engineers, Mohammed V University, MOROCCO
[5] Institute of Agronomy and Veterinary Medicine Hassan II (IAV Hassan II), Madinat Al Irfane, MOROCCO
***Corresponding Author:** reda.benhima@uit.ac.ma

Citation: Benhima, R., Dahhou, N., Mabrouk, A., Souileh, A., Birouk, A., & Ibriz, M. (2026). Financing biodiversity for sustainable development in Morocco: Public expenditure trends, governance, and pathways to 2035. *European Journal of Sustainable Development Research, 10*(4), em0425. https://doi.org/10.29333/ejosdr/19015

ARTICLE INFO

Received: 16 Jan 2026

Accepted: 13 Apr 2026

ABSTRACT

Biodiversity loss remains one of the most pressing global environmental challenges, driven in part by insufficient, fragmented, and poorly aligned financial flows. Although the Kunming–Montreal Global Biodiversity Framework calls for a substantial scaling-up of biodiversity finance, empirical national-level assessments remain scarce, particularly in developing and middle-income countries. This study evaluates biodiversity-related expenditures in Morocco over the period 2019–2024 and explores alternative financing trajectories up to 2035. Using a Biodiversity Expenditure Evaluation framework aligned with the BIOFIN methodology, the analysis identifies, classifies, and quantifies public, international, and non-state financial flows that contribute directly or indirectly to biodiversity objectives. The results reveal persistent underinvestment, a declining expenditure trend, strong institutional concentration, and a thematic bias toward conservation and sustainable use, to the detriment of ecosystem restoration and systemic interventions. Scenario-based projections indicate that maintaining current expenditure patterns would be insufficient to halt biodiversity degradation. In contrast, a progressive scaling-up of investments toward approximately 0.3% of GDP by 2035, combined with improved public financial management and diversified financing instruments, could significantly enhance alignment with international biodiversity targets. This study contributes to sustainable development and biodiversity finance literature by providing a longitudinal, policy-relevant assessment of national biodiversity expenditures and by highlighting key structural reforms needed to support a resilient and nature-positive financing framework.

Keywords: biodiversity finance, public expenditure, BIOFIN, Morocco, sustainable development, kunming–montreal global biodiversity framework

INTRODUCTION

The accelerated degradation of biodiversity has emerged as a systemic risk to economic stability, human well-being, and long-term development trajectories. Beyond its ecological implications, biodiversity loss undermines the productive base of economies by eroding ecosystem services that support agriculture, fisheries, water regulation, climate resilience, and public health. The World Bank has similarly emphasized that biodiversity conservation constitutes a critical foundation for sustainable economic development and resilience (World Bank, 2021). Recent assessments emphasize that the persistence of biodiversity decline is not primarily the result of insufficient scientific knowledge, but rather of structural misalignment between economic systems, public finance, and ecological limits (Balmford et al., 2002; Brondizio et al., 2019; Dasgupta, 2021).

Within this context, biodiversity finance has become a central pillar of contemporary environmental governance. Global estimates indicate that current biodiversity-related financial flows are an order of magnitude lower than what is required to halt and reverse ecosystem degradation. The biodiversity financing gap estimated between USD 600 and 800 billion annually reflects both underinvestment in conservation and restoration, and the continued prevalence of fiscal incentives and public expenditures that indirectly drive biodiversity loss. Recent global assessments confirm that public and private biodiversity finance remains substantially below identified needs (OECD, 2020a). These findings have reshaped international policy discourse, culminating in the

adoption of the Kunming–Montreal Global Biodiversity Framework (GBF) in 2022, which explicitly frames biodiversity outcomes as a function of financial systems, public budgets, and investment incentives (CBD, 2022; Deutz et al., 2020; OECD, 2020a). Morocco has subsequently aligned its national biodiversity planning through convergence initiatives extending toward 2035 (Government of Morocco, 2024c).

Despite this global policy shift, empirical evidence on how biodiversity finance is structured, allocated, and prioritized at the national level remains limited, particularly in developing and middle-income countries. Existing literature is largely dominated by global or regional aggregates, donor finance analyses, or sector-specific case studies, offering limited insight into the internal fiscal architecture of biodiversity finance within national public financial management systems (OECD, 2023; Seidl et al., 2020). Moreover, few studies adopt a longitudinal perspective capable of linking historical expenditure patterns with future financing trajectories aligned with national development horizons and international biodiversity commitments.

Addressing this gap requires systematic biodiversity expenditure evaluations that move beyond project-level accounting to examine how biodiversity is embedded or marginalized within state budgets, sectoral policies, and macro-fiscal priorities. Such analyses are essential for understanding whether biodiversity finance reflects strategic investment choices or residual allocations vulnerable to fiscal adjustment. They also provide a necessary empirical foundation for assessing the feasibility of international biodiversity finance targets at the country level.

Morocco constitutes a particularly relevant case for such an analysis. The country hosts diverse and ecologically valuable ecosystems, including Mediterranean forests, wetlands of international importance, extensive coastal and marine zones, arid rangelands, and oasis systems. At the same time, it faces acute pressures from desertification, land degradation, water scarcity, and climate variability, placing biodiversity at the intersection of environmental sustainability, food security, and economic resilience. These ecosystems are increasingly exposed to degradation pressures linked to climate variability, land-use change, and resource overexploitation (Food and Agriculture Organization of the United Nations, 2021). While Morocco has demonstrated strong engagement in climate policy and sustainable development planning, biodiversity finance has received comparatively limited analytical scrutiny, particularly with respect to expenditure trends, institutional allocation, and long-term financing needs.

Against this background, this study provides a comprehensive evaluation of biodiversity-related expenditures in Morocco over the period 2019–2024, complemented by scenario-based projections extending to 2035. The analysis is structured around three interrelated research questions. First, it examines the level and temporal evolution of biodiversity-related expenditures and assesses their magnitude relative to key macroeconomic aggregates. Second, it analyzes the institutional and thematic allocation of these expenditures in order to identify underlying structural patterns and concentration effects. Third, it explores alternative financing trajectories required to align biodiversity expenditures with long-term sustainability objectives and international biodiversity commitments.

By addressing these questions, the paper contributes to the biodiversity finance literature in three ways. First, it provides a nationally grounded, longitudinal expenditure analysis in a context that remains underrepresented in empirical studies. Second, it bridges diagnostic expenditure analysis with forward-looking financing scenarios, linking observed fiscal patterns to strategic biodiversity objectives. Third, it offers policy-relevant insights into the institutional and financial reforms required to transition from fragmented, defensive conservation spending toward a coherent and resilient biodiversity financing framework.

LITERATURE REVIEW

The last decade has consolidated a strong consensus: biodiversity loss is driven not only by weak governance but also by persistent underinvestment and misaligned financial flows. Global assessments consistently show that current biodiversity-related spending is far below what is required to halt and reverse biodiversity decline. The Financing Nature synthesis estimates that annual global biodiversity funding needs are on the order of USD 722-967 billion by 2030, while the annual gap is estimated at USD 599-823 billion (Deutz et al., 2020). Similarly, the assessment prepared by the Secretariat of the Convention on Biological Diversity emphasizes the magnitude of resources required to implement the post-2020 Global Biodiversity Framework, particularly for developing countries. It highlights that biodiversity finance needs extend beyond protected areas and include ecosystem restoration, sustainable use, enabling conditions, institutional capacity, monitoring systems, and the integration of biodiversity objectives into national planning and budgeting processes (Secretariat of the Convention on Biological Diversity, 2021). This gap framing is not merely rhetorical: it has become the backbone of the international biodiversity finance debate and is now embedded in the implementation logic of the Kunming-Montreal Global Biodiversity Framework (GBF).

Adopted under the Convention on Biological Diversity (CBD), the GBF places finance at the core of biodiversity governance. Target 19 calls for a substantial and progressive increase in financial resources from all sources, aiming to mobilize at least USD 200 billion per year by 2030, including scaled-up international finance for developing countries (CBD, 2022). This target links national budgeting, development finance, and private capital mobilization, while Target 18 adds an equally important dimension: identifying and reforming incentives harmful to biodiversity—often estimated in the hundreds of billions annually—thereby connecting biodiversity outcomes with broader public expenditure reform (CBD, 2022; OECD, 2020a, 2020b). The literature emphasizes that biodiversity finance strategies must simultaneously address:

a) insufficient positive finance for conservation and restoration and

b) the much larger volume of finance that indirectly drives ecosystem degradation through subsidies and investment patterns (OECD, 2020a, 2020b).

This requires aligning public expenditure, private investment, and economic incentives with biodiversity objectives, while ensuring that financial systems support nature-positive development pathways (OECD, 2020b).

Within this context, biodiversity finance is increasingly treated as a macroeconomic and financial stability issue rather than a narrow conservation concern. The Dasgupta Review argues that economic systems systematically undervalue nature, creating incentives for overexploitation and undermining long-run wealth, and calls for integrating natural capital into decision-making and accounting frameworks (Dasgupta, 2021; OECD, 2019). This argument has accelerated the movement toward nature-positive policy frameworks and strengthened the case for embedding biodiversity in fiscal policy, financial regulation, and national development planning. Recent evidence further suggests that biodiversity considerations are increasingly integrated into ESG frameworks and sustainable investment strategies, influencing capital allocation and corporate environmental performance (Flammer et al., 2023).

A central contribution of the biodiversity finance literature is the development of practical approaches to measure biodiversity-related spending and to distinguish between direct, indirect, and harmful expenditures. Biodiversity expenditure evaluation typically responds to three recurring challenges:

a) Biodiversity is cross-cutting and rarely appears as a dedicated budget line;

b) Sectoral spending (agriculture, forestry, fisheries, water, infrastructure) can generate significant biodiversity co-benefits or damages; and

c) Outcomes are complex and time-lagged, complicating performance evaluation.

Methodological approaches have converged around expenditure reviews that combine budget screening, project-level classification, and attribution coefficients. A prominent peer-reviewed contribution is Seidl et al. (2020), who propose a global estimation of public biodiversity investments based on country-level budget line screening and the application of attribution percentages when biodiversity is a secondary objective. This approach formalizes a key practice now common in national biodiversity expenditure reviews: weighting expenditures by their relevance to biodiversity rather than counting entire programs as fully "biodiversity spending" (Seidl et al., 2020). Such methods help reduce overestimation and create comparability across jurisdictions.

In practice, the most widely disseminated operational methodology is the UNDP's BIOFIN (Biodiversity Finance Initiative) framework, which guides countries through:

a) A biodiversity expenditure review,

b) A needs assessment, and

c) The design of a biodiversity finance plan (UNDP BIOFIN, 2024).

BIOFIN's structured taxonomy for classifying spending by thematic categories (e.g., protected areas management, sustainable use, restoration, pollution control, enabling conditions) has improved the consistency of expenditure mapping across countries and is increasingly used as a common analytical language in national strategies. The literature also highlights the importance of institutionalizing "green budgeting" or budget tagging systems so that biodiversity expenditure tracking becomes routine rather than a one-off diagnostic (OECD, 2020a; UNDP BIOFIN, 2024).

However, a critical gap remains: the relationship between expenditures and biodiversity outcomes. While expenditure reviews can reliably characterize "how much is spent and on what," they often struggle to demonstrate "what spending achieves" due to weak biodiversity indicators, fragmented monitoring systems, and confounding drivers. The literature therefore calls for stronger links between biodiversity public financial management and results frameworks, potentially through performance-informed budgeting, natural capital accounting, and program evaluation designs that can attribute ecological changes to interventions (Dasgupta, 2021; OECD, 2020a). Natural capital accounting frameworks provide an additional mechanism for linking biodiversity outcomes to economic decision-making and budget planning (SEEA-EA Technical Working Group, 2024).

The literature distinguishes biodiversity finance sources into domestic public finance, international public finance (ODA, multilateral funds), and private finance, with growing attention to innovative and blended mechanisms. Empirically, domestic public budgets remain the dominant source in most countries, but they are frequently insufficient, volatile, and concentrated in a small number of agencies (OECD, 2020a, 2020b; Seidl et al., 2020). International finance, particularly through GEF, bilateral donors, and development banks, has historically funded protected areas, sustainable land management, and capacity building, yet it is often projectized and time-bound, creating sustainability risks once donor cycles end (CBD Secretariat, 2021; OECD, 2023). Development finance institutions continue to play a central role in biodiversity funding, especially in developing and emerging economies, where domestic resources alone are insufficient to address growing conservation and restoration needs (OECD, 2023).

As a result, recent work emphasizes blended finance and nature-based solutions (NbS) financing, especially where biodiversity, climate, and land restoration goals overlap. UNEP's State of Finance for Nature series argues that NbS finance must scale significantly by 2030 and 2050 to meet climate and biodiversity objectives, and underscores the need for better alignment across public, private, and philanthropic flows (United Nations Environment Programme [UNEP], 2021, 2023). This overlap is especially relevant for countries where ecosystem restoration supports climate adaptation, water security, and rural livelihoods, allowing biodiversity finance to be partially mobilized through climate-labeled instruments (e.g., green bonds funding ecosystem restoration) and NbS pipelines.

Market-based mechanisms biodiversity offsets, payments for ecosystem services (PES), conservation trust funds, and emerging biodiversity credits are widely discussed as complements rather than substitutes for public finance. The OECD notes that biodiversity offsets and compensation

mechanisms can mobilize resources but raise concerns over additionality, ecological equivalence, and governance integrity (OECD, 2020a). The literature stresses that these mechanisms require robust regulation, transparent measurement, and long-term monitoring to prevent "paper gains" that do not translate into real biodiversity improvements. Similarly, PES schemes are often effective in specific contexts (watershed protection, forest conservation) but depend on clear land tenure, credible enforcement, and sustained funding sources.

Within the global literature, Morocco is particularly relevant because it combines:

a) High ecosystem diversity (Mediterranean forests, wetlands, coastal and marine ecosystems, oases, and arid zones),

b) Acute pressures from desertification, water stress, and land degradation, and

c) Growing strategic alignment with international biodiversity commitments through updated planning horizons to 2035.

In such contexts, biodiversity expenditures tend to be concentrated in forestry and land management agencies, while biodiversity-relevant spending in agriculture, water, and territorial development remains under-tagged and weakly coordinated—an institutional pattern widely observed in BIOFIN country experiences (UNDP BIOFIN, 2024).

The emerging Moroccan evidence base (national expenditure reviews and strategy documents) indicates that biodiversity finance diagnostics typically reveal three structural issues: Insufficient scale, high concentration (few institutions and thematic categories dominate), and limited diversification of instruments beyond public budgets and donor-funded projects. These patterns mirror the global evidence that public finance alone, especially in middle-income settings facing competing social priorities, rarely reaches the funding levels implied by GBF targets and restoration ambitions (CBD, 2022; Deutz et al., 2020). Consequently, Morocco's 2019–2035 trajectory is best interpreted within the "transition" literature: How countries move from fragmented, project-driven funding toward integrated finance planning that blends domestic resources, improved public financial management, international catalytic funding, and selective private sector participation.

Strategically, the Moroccan pathway to 2035 is also shaped by the broader policy turn toward nature-based solutions and natural capital framing. This creates a plausible window for mainstreaming biodiversity into climate adaptation and water security investments—particularly through restoration, watershed protection, and coastal resilience. The literature suggests that this "co-benefits" strategy can accelerate resource mobilization, but it also risks "biodiversity dilution" if biodiversity objectives become secondary to climate metrics. Hence, Morocco's expenditure evaluation should not only track volumes but also assess whether spending portfolios genuinely target biodiversity priorities (species and habitat outcomes) rather than only land-cover outputs or infrastructure delivery (OECD, 2020a; UNEP, 2021).

Three controversies dominate current biodiversity finance debates and directly inform Morocco-focused research design. First is the effectiveness question: Increases in biodiversity spending do not automatically produce ecological recovery. Without credible targeting, governance, enforcement, and monitoring, spending may stabilize budgets without bending biodiversity trends. The literature increasingly calls for evaluation designs and indicators that can connect expenditure categories to ecological outcomes and to drivers of biodiversity loss (Dasgupta, 2021; OECD, 2020a).

Second is the political economy of harmful subsidies. GBF Target 18 formalizes a global commitment to reform harmful incentives, but empirical work shows that subsidy reform is institutionally difficult and politically contested, especially in agriculture and fisheries where livelihoods and food security narratives are powerful (CBD, 2022; OECD, 2020a). For Morocco, a robust expenditure evaluation should therefore explicitly map not only positive biodiversity expenditures but also biodiversity-harmful fiscal flows and their sectoral rationales, enabling scenario analysis for repurposing rather than abrupt elimination.

Third is the realism of private biodiversity finance. While policy discourse often highlights private capital as a major solution, the literature remains cautious: investable nature projects are constrained by weak revenue models, unclear risk pricing, and measurement integrity issues. Private finance is more likely to scale when embedded in regulated frameworks (offset obligations), strong value chains (certified sustainable products), or blended structures that de-risk projects (OECD, 2020a, 2020b; UNEP, 2023). This implies that Morocco's 2019–2035 financing trajectories should treat private finance as contingent on institutional reforms, pipeline development, and governance credibility, rather than as an automatic substitute for public spending.

Taken together, the literature frames biodiversity expenditure evaluation as a bridge between biodiversity strategy and fiscal reality. For Morocco, the academic and policy evidence suggests that a credible diagnostic must:

a) Apply robust classification and attribution rules (to avoid inflated estimates),

b) Connect spending to GBF-aligned priorities (protection, restoration, sustainable use, enabling conditions),

c) Identify concentration risks and underfunded categories, and

d) Integrate a forward-looking financing narrative that recognizes both resource mobilization opportunities (NbS/climate synergies, green budgeting) and structural constraints (subsidy politics, private finance limitations).

This positioning supports a research agenda that is both empirical (tracking and trend analysis for 2019–2024) and strategic (scenario-based trajectories to 2035), while contributing to the broader scholarly debate on how national finance systems can be redesigned to deliver nature-positive development.

METHODOLOGY

This study applies a Biodiversity Expenditure Evaluation (BEE) framework grounded in the Biodiversity Finance

Initiative (BIOFIN) methodology and aligned with international best practices in environmental public expenditure reviews. The objective is to systematically identify, quantify, classify, and analyze financial flows dedicated to biodiversity conservation, sustainable use, and ecosystem restoration in Morocco, while assessing past trends (2019–2024) and future financing trajectories up to 2035. The methodological approach combines a retrospective expenditure analysis with forward-looking, scenario-based projections to ensure both empirical rigor and strategic relevance.

The analysis focuses on national-level biodiversity-related financial flows in Morocco and covers three main sources:

1. Domestic public finance, including state budget allocations and expenditures by line ministries and public agencies with mandates related to biodiversity.
2. International public finance, comprising grants and concessional loans from multilateral and bilateral partners that directly or indirectly support biodiversity objectives.
3. Private and non-state finance, to the extent that expenditures are documented and demonstrably linked to biodiversity outcomes, such as corporate environmental investments and NGO-led conservation initiatives.

The expenditure review covers the period 2019–2024, selected to capture recent fiscal dynamics and structural shifts, while projections extend to 2035, consistent with Morocco's long-term biodiversity and sustainable development planning horizons.

Primary data were collected from official budgetary and financial documents, including the Annual Finance Laws issued during the period 2019–2024 (Government of Morocco, 2019–2024), medium-term expenditure frameworks, sectoral performance reports, macroeconomic expenditure assessments, and biodiversity expenditure reviews. These sources were complemented by institutional and international reports from development partners and multilateral organizations in order to capture external financing flows. The identification and classification of biodiversity-related expenditures were also informed by the national BIOFIN diagnostic assessment conducted for Morocco (Government of Morocco & United Nations Development Programme, 2024). Secondary data were also used for contextualization and international benchmarking.

To enhance robustness, a triangulation process was applied by cross-validating budgetary data with sectoral reports and donor documentation. Where actual execution data were incomplete, conservative assumptions based on average execution rates reported in public finance assessments were applied, consistent with standard practices in biodiversity expenditure reviews.

Biodiversity-related expenditures were identified through a systematic screening of budget lines, programs, and projects across the institutions considered in the analysis.

Selection Protocol for Biodiversity-Related Expenditures

The selection of biodiversity-related expenditures was not based solely on budget line titles. Instead, it relied on a qualitative examination of the objectives, activities, and expected outcomes associated with each program or project. A budget line was retained only when a demonstrable link—either direct or indirect—could be established with biodiversity conservation, sustainable use, or ecosystem restoration.

The selection protocol followed five successive steps.

First, an initial screening of candidate budget lines was conducted. All programs and projects implemented by the targeted institutions were systematically reviewed to identify interventions likely to affect ecosystems, habitats, species, or the sustainable management of natural resources.

Second, the substantive content of each budget line was examined. Descriptions provided in performance documents and program reports were analyzed to distinguish genuinely relevant activities from those related solely to administrative functions, general support services, or expenditures with no identifiable biodiversity impact.

Third, an inclusion or exclusion decision was made. A budget item was included when it contributed either directly to biodiversity conservation or indirectly through sufficiently clear environmental co-benefits. Conversely, it was excluded when no credible link to biodiversity could be established based on the available documentation.

Fourth, each retained budget line was classified according to the BIOFIN expenditure taxonomy, which groups spending into standardized categories such as sustainable use of biological resources, ecosystem restoration, protected areas management, pollution control, biodiversity awareness and knowledge, and biodiversity planning and enabling activities. This classification ensures consistency with international BIOFIN applications and facilitates cross-country comparability.

Finally, an attribution coefficient was applied to estimate the share of each expenditure effectively attributable to biodiversity outcomes within the total budget amount considered.

Attribution of Biodiversity Expenditures

To avoid overestimation, a coefficient-based attribution system was applied to each expenditure item. The attribution logic relies on the distinction between primary and secondary expenditures.

A primary expenditure refers to a budget allocation whose principal objective is explicitly related to biodiversity conservation, such as the management of protected areas or ecological reforestation programs. These expenditures were attributed at 100% to biodiversity.

A secondary expenditure refers to spending whose main objective may be economic, social, productive, or territorial but which nonetheless generates identifiable positive effects for biodiversity. Such expenditures were weighted using attribution coefficients reflecting the estimated share of the expenditure contributing to biodiversity outcomes.

The scale of attribution coefficients follows the BIOFIN methodological approach adopted in this study, with values ranging from 1% to 100% depending on the strength of the relationship with biodiversity outcomes (**Table 1**). In practice,

Table 1. Attribution levels and coefficients for biodiversity-related expenditures

Attribution level	Attribution coefficient	Examples of activities / actions
Primary / Direct Actions directly related to biodiversity	100%	Management of protected areas, coral reef restoration, anti-poaching efforts, eradication of invasive species
Secondary – High relevance Strong link to biodiversity	75%	Biodiversity awareness and education, support for organic agriculture
Secondary – Medium relevance Moderate link to biodiversity	50%	Support for organic agriculture, watershed management
Secondary – Medium to low relevance Partial link to biodiversity	25%	Sustainable use of wetlands, sustainable fisheries, ecosystem-based adaptation
Low-relevance categories Indirect and weak link to biodiversity	1–5% (depending on the intensity of the indirect link)	Improvement of irrigation systems, reduction of fertilizer use, sustainable silviculture, activities with limited intentional impact on biodiversity such as pollution control or irrigation efficiency improvements

Source: United Nations Development Programme (UNDP) / BIOFIN. (2018). The BIOFIN Workbook: 2018 Edition

a coefficient of 100% was assigned to expenditures explicitly dedicated to biodiversity conservation or ecosystem restoration. Intermediate coefficients such as 50%, 25%, 10%, or 5% were applied when biodiversity represented only a partial component of the funded intervention.

The biodiversity-attributed expenditure for each budget line was calculated by combining three elements: the observed budget allocation, the execution rate applied when necessary to approximate actual spending, and the biodiversity attribution coefficient. This rule ensured methodological consistency across sectors and over time.

Expert Review and Validation of Attribution Coefficients

The assignment of attribution coefficients did not rely on individual judgment but rather on a structured collective process involving the study team, sectoral experts from institutions covered by the ADB, and methodological support from international BIOFIN experts. This collaborative process was conducted through bilateral consultations and technical exchanges dedicated to the coding and classification of expenditures.

In total, the process mobilized twelve experts, including four sectoral experts representing key policy domains, two international BIOFIN methodological experts, and six members of the study team responsible for the analytical work. For transparency purposes, the affiliations of participants are reported in anonymized form across three categories: Sectoral administration, study team, and BIOFIN methodological support.

The areas of expertise involved included agriculture, marine fisheries, water and forestry management, sustainable development policy, public budgeting, and the application of BIOFIN methodology to expenditure categorization and attribution. This diversity of expertise ensured that the coding process captured both the policy context and the technical dimensions of biodiversity-related expenditures.

For each budget line retained in the analysis, attribution decisions were based on a qualitative examination of the content and objectives of the program or project, its classification under the BIOFIN taxonomy, and the extent to which biodiversity constituted either a primary objective or a secondary co-benefit.

The validation procedure combined several complementary steps. Preliminary coding proposals were first developed within the analytical team. These proposals were subsequently reviewed collectively during technical meetings where experts assessed the justification and consistency of the proposed coefficients. Final coding decisions were then consolidated in the working spreadsheet used for the expenditure review.

When differing interpretations emerged, the final decision resulted from methodological discussion and collegial arbitration aimed at retaining the attribution class most consistent with the purpose of the expenditure and its degree of relevance to biodiversity conservation.

It should be noted that, in this first exercise, validation relied primarily on an expert-based collective review process. However, no formal statistical protocol for assessing inter-rater reliability was implemented. The absence of such a procedure represents a methodological limitation that should be considered when interpreting the results.

Analytical Approach and Scenario Projections

The quantified expenditures were analyzed along several complementary dimensions:

- Temporal analysis, examining trends and interannual variations in biodiversity expenditures over the 2019–2024 period.
- Macroeconomic benchmarking, expressing biodiversity expenditures as a share of GDP and of total public expenditure.
- Institutional and thematic allocation, identifying concentration patterns across institutions and BIOFIN categories.
- Comparative assessment, situating Morocco's biodiversity finance effort relative to international benchmarks and global biodiversity finance targets.

Future biodiversity financing pathways were explored through three scenario-based projections:

(i) A status quo scenario, maintaining current expenditure intensity relative to GDP;

(ii) A realistic acceleration scenario, reflecting gradual mainstreaming of biodiversity into sectoral policies and public financial management; and

(iii) An ambitious convergence scenario, aligned with international biodiversity finance commitments under the Kunming–Montreal Global Biodiversity Framework.

Table 2. Biodiversity expenditures relative to GDP and the General State Budget (2019–2024)

Year	Biodiversity expenditure (MDH)	GDP (MDH)	Share of GDP (%)	General State Budget (MDH)	Share of Budget (%)
2019	2,361	1,239,836	0.23	339,991	0.69
2020	2,226	1,152,419	0.20	299,796	0.74
2021	2,226	1,276,563	0.18	302,778	0.74
2022	2,081	1,330,558	0.14	329,520	0.63
2023	2,018	1,463,358	0.14	377,167	0.54
2024	1,987	1,596,799	0.10	397,535	0.50

Source: Authors' extraction from ADB results

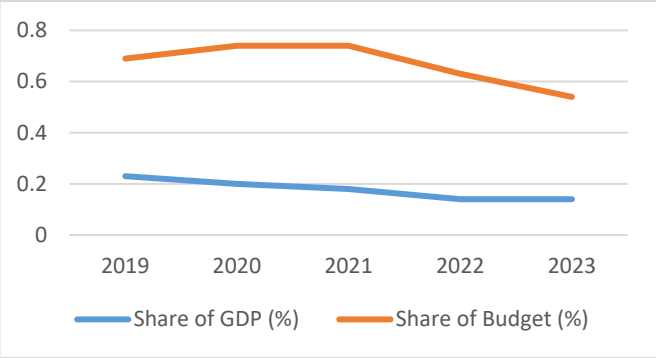

Figure 1. Evolution of biodiversity expenditures as a share of GDP and of the State Budget in Morocco (2019–2024) (Source: Authors' own elaboration, based on BIOFIN methodology and national budget data (Ministry of Economy and Finance, Morocco))

Projections were derived by combining assumed expenditure-to-GDP ratios with macroeconomic growth assumptions, based on national accounts and macroeconomic projections provided by the High Commission for Planning (2024), while preserving observed expenditure structures and institutional constraints.

RESULTS

Share of Biodiversity Expenditures in National GDP and the State Budget (2019–2024)

Assessing biodiversity-related public expenditures relative to national macroeconomic aggregates provides a robust indicator of the priority accorded to biodiversity within public financial policy. Over the period 2019–2024, biodiversity-related public expenditures in Morocco averaged approximately 2,150 million Moroccan dirhams (MDH) per year, reflecting a limited fiscal effort when measured against the size of the national economy and the State Budget.

Figure 1 shows a simultaneous and continuous decline in biodiversity expenditures relative to both GDP and the State Budget over the period 2019–2024. While the budgetary share decreases from 0.74% to 0.50%, the GDP share drops more sharply from 0.23% to 0.10%, confirming a progressive erosion of biodiversity's macro-fiscal priority. This dual contraction indicates that biodiversity is losing both absolute and relative weight within national public finance. The evolution of biodiversity expenditures relative to GDP and the General State Budget over the period 2019–2024 is presented in **Table 2**.

On average, biodiversity expenditures represented 0.16% of national GDP and 0.63% of the General State Budget during the study period. These ratios indicate that biodiversity remains a marginal budgetary component, despite its strategic importance for ecosystem resilience, agricultural productivity, water security, and climate adaptation. From a budgetary structure perspective, expenditures were moderately skewed toward investment spending (56%), while operating expenditures accounted for 44%, suggesting a partial emphasis on capital-intensive actions such as infrastructure, restoration works, and equipment, alongside recurrent operational costs.

Table 3. Institutional distribution of biodiversity expenditures (MDH)

Sector	2019	2020	2021	2022	2023	2024
Agriculture	490	540	538	542	564	608
Maritime fisheries	551	548	575	402	416	211
Water and forests	1,259	1,078	1,072	1,114	1,007	1,153
Sustainable development	61	60	41	23	31	15
Total	2,361	2,226	2,226	2,081	2,018	1987

Source: Institutional ADB breakdown

A clear downward trend emerges over the period. While biodiversity expenditures relative to GDP declined gradually from 0.23% in 2019 to 0.10% in 2024, the contraction relative to the General State Budget was more pronounced, decreasing from 0.74% in 2020–2021 to 0.50% in 2024. This divergence reflects the combined effect of nominal growth in the overall State Budget and stagnation or decline in biodiversity allocations, pointing to a progressive erosion of biodiversity's relative budgetary weight.

Institutional Allocation of Biodiversity Expenditures

Biodiversity-related expenditures exhibit a highly uneven institutional distribution, revealing strong concentration within a limited number of public actors. The Water and Forests sector consistently emerges as the primary contributor throughout the study period, reflecting its central mandate in forest conservation, land restoration, and ecosystem management under the Morocco Forest Strategy 2020–2030 (Government of Morocco, 2020). **Table 3** provides a detailed overview of the institutional distribution of biodiversity expenditures across major sectors over the study period.

Agriculture constitutes the second-largest contributor, with relatively stable allocations that increase slightly over time, suggesting a growing integration of biodiversity-related actions within agricultural policies. In contrast, expenditures associated with Maritime Fisheries display significant volatility, with a marked decline after 2021, despite the sustainability objectives promoted under the Halieutis strategy (Government of Morocco, 2021), indicating fluctuating policy priorities or project cycles. Allocations to Sustainable Development remain marginal and declining, underscoring the limited financial weight of cross-cutting coordination, planning, and governance functions.

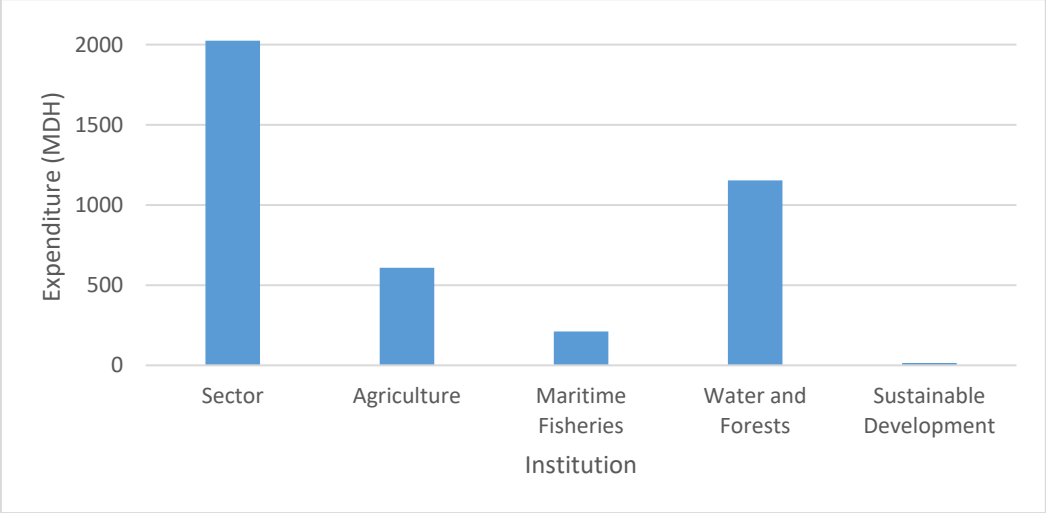

Figure 2. Institutional distribution of biodiversity expenditures in Morocco (2024) (Source: Authors' own elaboration, based on institutional biodiversity expenditure data (BIOFIN classification))

Overall, this institutional pattern indicates that biodiversity finance remains largely sector-driven rather than systemically mainstreamed across public policies.

Figure 2 highlights the extreme institutional concentration of biodiversity expenditures, with the Water and Forests sector absorbing the dominant share, far ahead of agriculture and maritime fisheries. This structure confirms that biodiversity finance in Morocco remains largely confined to traditional conservation institutions and has not yet been effectively mainstreamed across sectoral public policies.

Biodiversity Expenditures by Attribution Level

Applying the BIOFIN attribution framework reveals the dominance of secondary (indirect) biodiversity expenditures, which account for 53% of total biodiversity-related spending over the study period, compared to 47% for primary (direct) expenditures. This composition highlights the extent to which biodiversity objectives are embedded within broader sectoral programs rather than pursued through explicitly biodiversity-focused interventions. The evolution of biodiversity expenditures by attribution level (primary versus secondary) is summarized in **Table 4**.

Table 4. Evolution of biodiversity investment expenditures by attribution level (MDH)

Year	Primary expenditures	Secondary expenditures	Total
2019	1,240	1,121	2,361
2020	1,090	1,137	2,226
2021	1,096	1,130	2,226
2022	1,130	951	2,081
2023	1,050	967	2,018
2024	1,212	775	1,987

Source: BIOFIN attribution analysis

Figure 3 shows that secondary (indirect) expenditures systematically exceed or closely match primary (direct) biodiversity expenditures over the study period. This confirms that biodiversity objectives are predominantly pursued through sectoral co-benefits rather than through explicitly biodiversity-centered policies, raising concerns about the strength, traceability, and effectiveness of ecological outcomes.

In absolute terms, secondary expenditures averaged 1,241 MDH per year, while primary expenditures averaged 825 MDH. Although direct biodiversity expenditures remain substantial, the predominance of indirect expenditures suggests a reliance

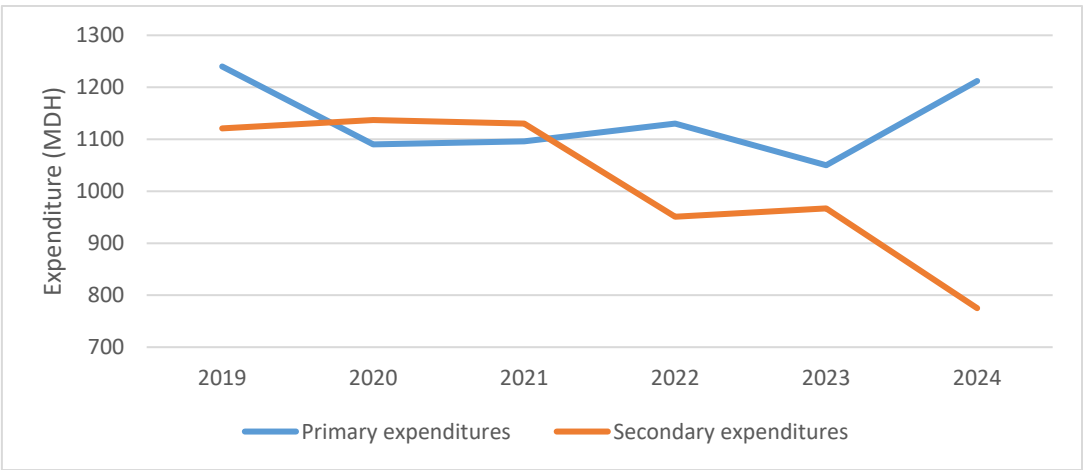

Figure 3. Primary and secondary biodiversity expenditures in Morocco (2019–2024) (Source: Authors' own elaboration, based on BIOFIN attribution methodology)

Table 5. Biodiversity expenditures by BIOFIN category (MDH)

BIOFIN category	2019	2020	2021	2022	2023	2024
Green economy	2.64	2.22	2.10	1.60	1.36	1.58
Pollution management	60.87	55.21	38.64	22.25	30.01	13.99
Biodiversity planning	0.90	0.69	0.73	1.97	1.98	0.99
Restoration	38.12	39.88	38.29	38.57	38.77	50.79
Awareness and knowledge	283.12	308.10	344.00	281.00	272.21	326.48
Sustainable use	1,352.68	965.88	1,231.00	944.49	965.76	372.92
Protected areas & conservation	686.85	593.53	590.27	587.81	930.95	1,066.32
Total	2,361.08	2,226.47	2,225.56	2,080.75	2,017.86	1,987.63

Source: BIOFIN categorical breakdown

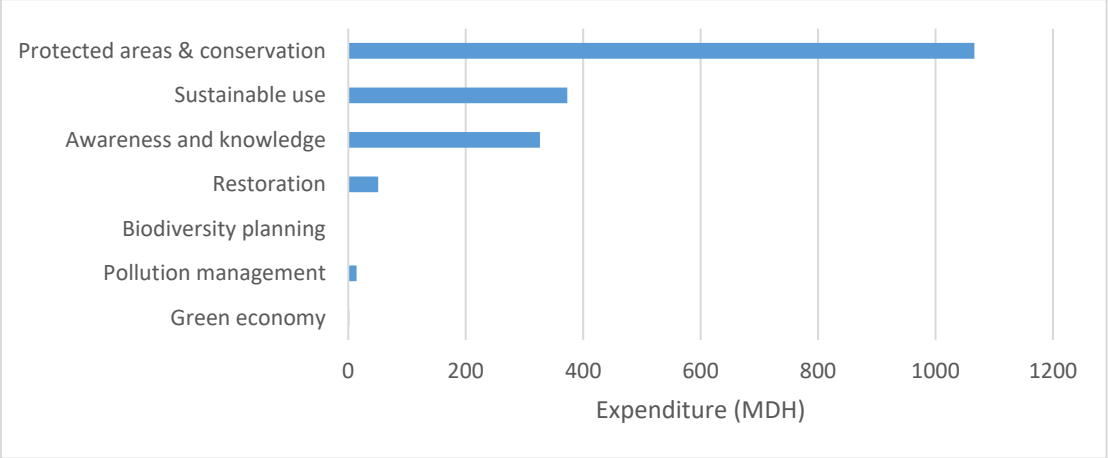

Figure 4. Biodiversity expenditures by BIOFIN category in Morocco (2024) (Source: Authors' own elaboration, based on BIOFIN expenditure classification framework)

on co-benefits from agriculture, fisheries, water management, and land-use programs, raising questions about the strength and measurability of biodiversity outcomes.

Distribution of Biodiversity Expenditures by BIOFIN Category

The thematic allocation of biodiversity expenditures is highly concentrated, with three BIOFIN categories accounting for 96.33% of total expenditures. Protected areas and conservation measures represent the largest share (43.40%), followed by sustainable use of biological resources (38.53%) and awareness and biodiversity knowledge (14.09%). **Table 5** presents the detailed distribution of biodiversity expenditures across BIOFIN categories over the period 2019–2024.

By contrast, expenditures related to ecosystem restoration, pollution management, green economy initiatives, and biodiversity planning remain marginal throughout the period. This distribution suggests a strong focus on conservation and resource use, with limited investment in systemic transformation, prevention of biodiversity loss, and long-term ecological restoration.

A detailed breakdown of biodiversity expenditures by BIOFIN category and implementing sector over the period 2019–2024 is provided in **Appendix A**.

Figure 4 reveals a highly unbalanced thematic structure of biodiversity finance, dominated by protected areas, sustainable use, and awareness-related spending. In contrast, ecosystem restoration, pollution control, and strategic biodiversity planning remain marginal. This indicates a predominantly defensive conservation model, with limited investment in long-term ecological transformation and recovery.

Table 6. Biodiversity share of donor financial flows (MDH)

Year	Total donor flows	Biodiversity share (MDH)	Attribution coefficient (%)
2019	385	12.31	3.19
2020	2,194	228.53	10.41
2021	2,255	232.32	10.30
2022	2,312	230.15	9.95
2023	2,753	314.54	11.43
2024	3,250	511.77	15.75

Source: Donor ADB analysis

Contribution of International Donors to Biodiversity Financing

International donors play a non-negligible but fluctuating role in Morocco's biodiversity financing landscape (Government of Morocco, 2024b). Over the period 2019–2024, total donor flows with biodiversity relevance amounted to approximately 13.14 billion MDH. The share explicitly attributed to biodiversity increased steadily, from 3.19% in 2019 to 15.75% in 2024, indicating a growing donor focus on biodiversity objectives. The contribution of international donor flows to biodiversity financing is detailed in **Table 6**.

Despite this positive trend, donor financing remains project-based and inherently volatile, limiting its capacity to compensate for declining domestic public expenditures.

Figure 5 shows a marked increase in biodiversity-related donor finance since 2019, but with strong year-to-year volatility. This pattern confirms the catalytic but structurally

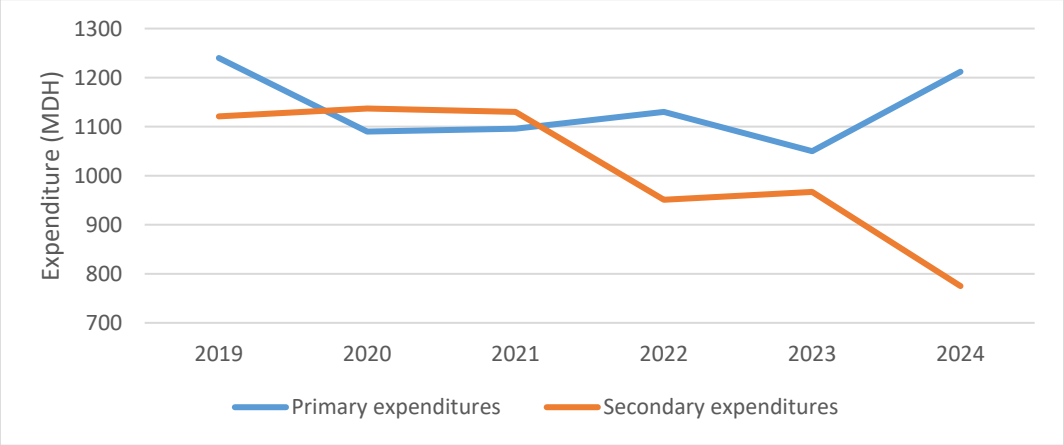

Figure 5. Biodiversity-related donor finance in Morocco (2019–2024) (Source: Authors' own elaboration, based on donor financial flows and BIOFIN attribution analysis)

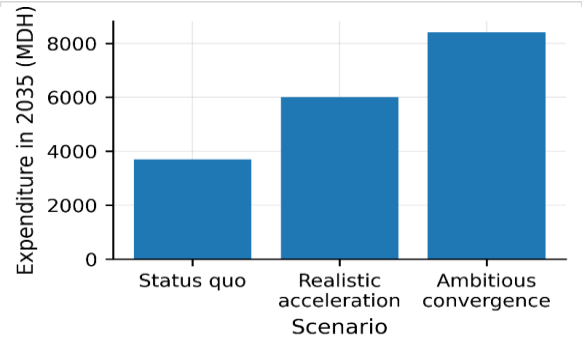

Figure 6. Projected biodiversity expenditure in 2035 under alternative scenarios (Source: Authors' own elaboration, based on scenario projections and GDP growth assumptions)

unstable role of international finance, which cannot substitute for a stable and predictable domestic public financing base.

Biodiversity Expenditures Relative to the Primary Sector GDP

When normalized by the economic output of biodiversity-dependent sectors, biodiversity expenditures exhibit a declining intensity trend. The ratio of biodiversity expenditures to primary sector GDP decreased from 1.76% in 2019 to 1.18% in 2024, despite sustained growth in agricultural, forestry, and fisheries output. Primary sector GDP estimates were derived from the satellite accounts produced by the High Commission for Planning (2023).

This declining expenditure intensity suggests that biodiversity-related investments have not scaled proportionally with the expansion of sectors that exert direct pressure on ecosystems. From an economic perspective, this divergence may increase future adjustment costs by amplifying degradation risks and reducing the resilience of primary-sector productivity.

Figure 6 illustrates the high sensitivity of long-term biodiversity financing to changes in fiscal prioritization. Small increases in the GDP share allocated to biodiversity generate large differences in absolute funding levels by 2035, confirming that policy choices, rather than economic growth alone, will determine Morocco's capacity to meet its biodiversity commitments.

Projection of Biodiversity Expenditures under Alternative Scenarios (2025–2035)

To assess the medium- to long-term sustainability of biodiversity financing in Morocco, expenditure projections were developed under three stylized scenarios, reflecting alternative policy and institutional trajectories. These scenarios extrapolate observed expenditure patterns over 2019–2024 and explore their implications for biodiversity financing up to 2035, using GDP growth as the scaling variable.

Scenario 1: Status quo (trend continuation)

The status quo scenario assumes the continuation of observed trends over the period 2019–2024, with no structural change in public policies, budgetary priorities, or financing mechanisms related to biodiversity. This scenario reflects institutional inertia, characterized by the weak and implicit integration of biodiversity into sectoral strategies, modest budgetary allocations, and the absence of innovative or incentive-based financing instruments at the national level.

Under this scenario, biodiversity expenditures remain anchored to their historical average of 0.16% of national GDP, corresponding to the mean observed during 2019–2024. No additional fiscal effort is assumed, and expenditure dynamics are driven exclusively by overall economic growth.

Assuming an average annual GDP growth rate of 3.5%, biodiversity-related public expenditures would increase mechanically from 1,987 MDH in 2024 to approximately 3,700 MDH by 2035, purely through GDP indexation effects. This trajectory does not reflect an expansion of biodiversity priorities but rather a passive adjustment to macroeconomic growth.

This scenario does not require specific policy conditionalities, as it presupposes:

a) The continuation of existing budget lines within the Departments of Sustainable Development, Water and Forests, Maritime Fisheries, and Agriculture;

b) The maintenance of international donor flows at levels comparable to those observed during 2019–2024; and

c) The absence of major exogenous shocks further constraining public finances or altering expenditure priorities.

From an economic standpoint, this trajectory implies a persistent underinvestment in biodiversity and a widening gap between financing needs and ecological pressures.

Scenario 2: Realistic acceleration

The realistic acceleration scenario assumes a gradual policy-driven scaling-up of biodiversity expenditures, starting from the observed baseline of 0.16% of GDP and reflecting a progressive integration of biodiversity into public financial management. This scenario acknowledges fiscal constraints while assuming improved budgetary programming, enhanced intersectoral coordination, and better alignment between biodiversity objectives and sectoral investments.

Under this trajectory, the share of biodiversity expenditures in GDP increases steadily to reach 0.27% by 2035. Although this level remains below the 0.5% GDP benchmark frequently cited in international biodiversity finance discussions, it represents a more than twofold increase relative to the current baseline.

In absolute terms, projected annual biodiversity expenditures would reach approximately 5,800–6,200 MDH by 2035, depending on GDP growth dynamics. This level is comparable to the highest historical expenditure levels observed in 2019 but reflects a sustained and predictable financing effort over time.

The implementation of this scenario is conditional upon:

a) Strengthened green budgeting and planning capacities.

b) Increased mobilization of international biodiversity finance.

c) Improved expenditure efficiency through performance monitoring and results-based approaches; and

d) Reinforcement of institutional and legal frameworks to anchor biodiversity commitments within national and sectoral planning instruments.

Scenario 3: Ambitious convergence toward international commitments

The ambitious convergence scenario assumes a strategic alignment with international biodiversity finance commitments, particularly those under the Kunming–Montreal Global Biodiversity Framework. Recognizing national fiscal constraints, this scenario targets an intermediate convergence level of 0.33% of GDP by 2035, corresponding to approximately two-thirds of the international reference target of 0.5% of GDP.

Biodiversity expenditures increase from 0.16% of GDP in 2024 to 0.33% by 2035, implying a significantly steeper growth trajectory than in the realistic acceleration scenario. In absolute terms, biodiversity-related public expenditures would reach approximately 8,200–8,600 MDH in 2035, depending on macroeconomic conditions.

This trajectory implies a substantive reallocation of public resources, potentially supported by the gradual phase-out of expenditures harmful to biodiversity and their redirection toward ecosystem restoration, conservation, and nature-based solutions. It further assumes the establishment of a structural biodiversity financing architecture, including:

Table 7. Biodiversity expenditures as a share of primary sector GDP

Year	Primary sector GDP (MDH)	Biodiversity expenditures (MDH)	Share (%)
2019	134,428	2,361	1.76
2024	168,739	1,987	1.18

Source: Sectoral ADB synthesis

a) The institutionalization of a national biodiversity financing mechanism and innovative financial instruments.

b) Explicit integration of biodiversity targets into medium-term budgetary frameworks; and

c) Systematic mobilization of private sector and subnational actors.

Successful implementation of this scenario critically depends on strong political commitment, inclusive governance arrangements, and effective multisectoral coordination.

Table 7 presents the projected evolution of biodiversity-related public expenditures in Morocco under three alternative scenarios, highlighting the magnitude and sensitivity of long-term financing outcomes to changes in expenditure intensity relative to GDP. Under the status quo scenario, biodiversity expenditures remain fixed at 0.16% of GDP, implying that the observed increase in nominal spending between 2024 and 2035 is entirely attributable to baseline economic growth. In this case, biodiversity financing does not benefit from any relative reprioritization within public expenditure, resulting in a flat expenditure-to-GDP ratio and a persistent underinvestment pattern.

By contrast, the realistic acceleration scenario introduces a gradual increase in biodiversity expenditure intensity, reaching 0.27% of GDP by 2035. This trajectory generates a nonlinear increase in nominal expenditures, as higher expenditure ratios interact with economic growth. Compared to the status quo, this scenario more than doubles the nominal level of biodiversity expenditures by 2035, indicating that even moderate adjustments in expenditure intensity can produce substantial cumulative effects over time.

The ambitious convergence scenario exhibits the strongest divergence, with biodiversity expenditures rising to 0.33% of GDP by 2035. This scenario produces a nominal expenditure level more than twice that of the status quo scenario and approximately 35–45% higher than the realistic acceleration scenario. The resulting spread between scenarios illustrates the dominant role of expenditure intensity—rather than GDP growth alone—in shaping long-term biodiversity financing paths.

Overall, **Table 7** demonstrates that projected biodiversity expenditures are highly elastic to changes in fiscal prioritization, with small variations in GDP shares translating into large differences in absolute funding levels over the projection horizon. These results confirm that maintaining current expenditure ratios would lead to a widening gap between biodiversity financing needs and available resources, whereas incremental increases in expenditure intensity can significantly alter long-term financing trajectories. A

Table 8. Summary of biodiversity expenditure projections under alternative scenarios (2035)

Scenario	Biodiversity expenditures (% of GDP)	Estimated expenditures in 2035 (MDH)	Policy intensity
Status quo	0.16%	~3,700	Low
Realistic acceleration	0.27%	5,800–6,200	Moderate
Ambitious convergence	0.33%	8,200–8,600	High

Source: Authors' projections based on ADB results and GDP growth assumptions

summary of projected biodiversity expenditures under the three alternative scenarios is provided in **Table 8**.

DISCUSSION

The results clearly indicate that biodiversity-related expenditures in Morocco remain structurally insufficient relative to both national ecological challenges and international biodiversity finance benchmarks. With an average allocation of approximately 0.16% of GDP over the 2019–2024 period, Morocco's biodiversity spending falls well below the levels implied by recent global assessments, which suggest that effective biodiversity protection and restoration require investments closer to 0.3–0.5% of GDP (Deutz et al., 2020; OECD, 2020a). This conclusion is consistent with international analyses suggesting that substantially higher investments are required to achieve global conservation targets, including the protection of 30% of terrestrial and marine areas by 2030 (Waldron et al., 2020). This gap is not merely quantitative but reflects a deeper issue of biodiversity's marginal position within public financial decision-making.

The observed declining trend in biodiversity expenditures is particularly concerning. Rather than converging toward international commitments under the Kunming–Montreal Global Biodiversity Framework, public biodiversity finance has proven highly pro-cyclical and vulnerable to fiscal shocks, notably during periods of economic stress. This pattern is consistent with findings in other middle-income countries, where environmental expenditures tend to be treated as discretionary rather than strategic investments (OECD, 2023). From a sustainability perspective, such volatility undermines long-term conservation outcomes, as biodiversity loss often accelerates precisely when funding contracts.

A salient result of the analysis is the high institutional concentration of biodiversity expenditures, with forestry and land ecosystem agencies accounting for a dominant share of total spending. While this reflects the central role of forests and rangelands in Morocco's biodiversity profile, it also reveals a limited degree of biodiversity mainstreaming across sectoral policies. Biodiversity finance remains largely confined to traditional conservation institutions, rather than being systematically integrated into agriculture, water, infrastructure, tourism, and territorial development budgets.

This institutional configuration mirrors patterns documented in BIOFIN country studies, where biodiversity expenditures are often clustered in a narrow set of agencies with historical mandates, rather than distributed across sectors driving biodiversity loss (UNDP BIOFIN, 2024). Such concentration increases fiscal and operational risks: any budgetary contraction affecting a single dominant institution can disproportionately affect overall biodiversity finance. Moreover, it constrains policy coherence, as sectoral investments with significant biodiversity impacts may proceed without explicit biodiversity safeguards or co-financing mechanisms.

The thematic allocation of biodiversity expenditures reveals a strong bias toward sustainable use and conservation, while ecosystem restoration, pollution management, green economy initiatives, and strategic planning receive marginal funding. This imbalance suggests that biodiversity finance in Morocco remains predominantly defensive, aimed at maintaining existing ecosystems rather than transforming degraded systems or addressing upstream drivers of biodiversity loss.

From an international perspective, this pattern contrasts with the evolving global agenda, which increasingly emphasizes large-scale ecosystem restoration and nature-based solutions as central pillars of biodiversity and climate strategies (UNEP, 2021; CBD, 2022). The limited allocation to restoration is particularly problematic given Morocco's high exposure to desertification, land degradation, and water stress. Without a significant reorientation of expenditures toward restoration and systemic interventions, conservation efforts risk becoming increasingly costly and less effective over time.

The results confirm that international donors play a significant but unstable role in financing biodiversity-related actions, while private sector and NGO contributions remain marginal. This configuration exposes biodiversity finance to external volatility and donor programming cycles, which may not align with long-term national conservation priorities. Similar patterns have been observed in other developing and middle-income countries, where donor-funded biodiversity projects often lack continuity once external financing ends (OECD, 2023).

The weak mobilization of private finance reflects structural constraints highlighted in the literature: biodiversity projects often lack clear revenue streams, face high ecological and regulatory risks, and suffer from measurement and verification challenges (OECD, 2020a). While recent policy discourse emphasizes the potential of private capital to close the biodiversity finance gap, the Moroccan case illustrates that private finance cannot substitute for strong public investment without enabling institutional frameworks, robust pipelines of investable projects, and appropriate risk-sharing mechanisms.

The scenario analysis underscores the strategic importance of policy choices in shaping future biodiversity outcomes. Under the status quo trajectory, biodiversity finance remains insufficient to halt ecosystem degradation, implying rising future costs associated with restoration, disaster risk, and lost ecosystem services. In contrast, the realistic acceleration and ambitious convergence scenarios suggest that progressive increases in biodiversity expenditures, combined with improved budget integration and diversification of financing

sources, could significantly enhance Morocco's capacity to meet national and international biodiversity objectives.

However, the ambitious convergence scenario approaching 0.33% of GDP by 2035 should be interpreted not merely as a financing target but as an indicator of structural transformation in public financial management. Achieving this trajectory would require systematic biodiversity mainstreaming, reform of environmentally harmful subsidies, and the creation of durable financing instruments such as biodiversity funds or green budgeting frameworks. Importantly, the literature cautions that increasing expenditure volumes alone is insufficient; effectiveness, targeting, and governance quality are equally critical determinants of ecological outcomes (Dasgupta, 2021).

This article contributes to the growing empirical literature on biodiversity finance in three main ways. First, it provides one of the few longitudinal biodiversity expenditure analyses in a North African context, covering both historical trends and long-term projections. Second, it demonstrates the analytical value of combining BIOFIN-based expenditure reviews with scenario-based macro-fiscal projections, bridging short-term diagnostics and long-term strategic planning. Third, by explicitly highlighting institutional concentration, thematic imbalance, and financing vulnerability, the study reinforces the argument that biodiversity finance challenges are fundamentally systemic rather than sectoral.

Overall, the findings support the emerging consensus that biodiversity finance reform must be embedded within broader fiscal, economic, and development policy frameworks. This perspective is consistent with international environmental performance assessments linking environmental investment, governance quality, and sustainable development outcomes (World Bank, 2023). For Morocco, aligning biodiversity finance with the 2035 horizon represents not only an environmental imperative but also a strategic investment in economic resilience, climate adaptation, and intergenerational equity.

CONCLUSION AND POLICY IMPLICATIONS

This study provides a comprehensive evaluation of biodiversity-related expenditures in Morocco over the period 2019–2024, complemented by scenario-based projections to 2035. The results reveal a persistent underinvestment in biodiversity, characterized by low expenditure levels relative to GDP, a declining funding trajectory, and strong institutional and thematic concentration. Biodiversity finance remains largely confined to traditional conservation actors and focused on protective and resource-use measures, with limited emphasis on ecosystem restoration, pollution control, and systemic transformation.

The analysis further highlights the structural vulnerability of biodiversity financing to fiscal constraints and macroeconomic shocks, as well as a high dependence on external funding sources. Scenario projections demonstrate that maintaining current expenditure patterns would be insufficient to halt biodiversity degradation, while progressive scaling of investments—combined with improved public financial management—could significantly enhance alignment with international biodiversity commitments and national sustainability objectives.

Overall, the findings confirm that biodiversity finance in Morocco is not primarily constrained by technical feasibility, but by institutional prioritization, budgetary integration, and strategic coherence. Addressing these constraints is essential for shifting from a defensive conservation model toward a resilient, long-term biodiversity financing framework. These financing trajectories are also consistent with the orientations proposed in the draft National Biodiversity Strategy and Action Plan 2025–2035 (Government of Morocco, 2025)

The results yield several policy-relevant implications for biodiversity finance reform in Morocco and comparable contexts.

First, biodiversity must be mainstreamed into public financial management systems. The establishment of biodiversity budget tagging or green budgeting mechanisms would enhance transparency, facilitate monitoring, and support evidence-based resource allocation across sectors. Such tools are critical to ensuring that biodiversity considerations extend beyond environmental agencies and influence core development investments.

Second, the scale and stability of domestic public financing must increase. Progressive convergence toward internationally referenced expenditure levels (around 0.3% of GDP) should be pursued through medium-term budget planning, while insulating biodiversity expenditures from short-term fiscal volatility. This may include earmarked funding mechanisms or minimum expenditure thresholds for ecosystem-related investments.

Third, thematic rebalancing of expenditures is required. Greater emphasis on ecosystem restoration, nature-based solutions, and pollution management is necessary to address structural drivers of biodiversity loss and reduce long-term ecological and economic costs. This reorientation should be explicitly reflected in national biodiversity strategies and sectoral investment plans.

Fourth, international finance should be leveraged strategically rather than substitutively. External funding should prioritize catalytic and transformative interventions, institutional capacity building, and co-financing mechanisms that strengthen domestic ownership and sustainability.

Finally, private sector engagement must be enabled through appropriate regulatory and financial frameworks, rather than assumed as an automatic solution. Blended finance instruments, biodiversity funds, and incentive-compatible mechanisms such as payments for ecosystem services or regulated biodiversity offsets can play a complementary role, provided that governance, monitoring, and ecological integrity are ensured. Strengthening biodiversity finance could also generate co-benefits in terms of green employment and territorial resilience (International Labour Organization, 2023).

In conclusion, aligning biodiversity finance with the 2035 horizon requires a shift from fragmented project-based funding toward an integrated, predictable, and outcome-oriented financing architecture. Such a transition would position biodiversity not as a residual environmental concern,

but as a core pillar of sustainable development, economic resilience, and long-term national prosperity.

Author contributions: RB: conceptualization, methodology, formal analysis, investigation, data curation, supervision, writing - original draft, writing - review & editing; **DN:** conceptualization, methodology, formal analysis, investigation, data curation, writing - original draft preparation, writing - review and editing, supervision; **AM:** conceptualization, methodology, formal analysis, investigation, data curation, supervision, writing - original draft, writing - review & editing; **AS:** conceptualization, methodology, formal analysis, investigation, data curation, supervision, writing - original draft, supervision, writing - review & editing; **AB:** conceptualization, methodology, formal analysis, investigation and data collection, writing-original draft preparation, supervision, writing - review & editing; **MI:** conceptualization, methodology, formal analysis, investigation, data curation, supervision, writing - original draft, writing - review & editing. All authors agreed with the results and conclusions.

Acknowledgements: The authors would like to thank all institutions, experts, and stakeholders who contributed to this study through interviews, data provision, and technical discussions. The authors are also grateful to their affiliated institutions for providing a supportive academic and institutional environment that enabled the completion of this research.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical statement: The authors stated that the study relies entirely on information extracted from publicly available official documents and institutional reports. It does not involve human participants, animals, or personal data. Accordingly, ethical approval and informed consent were not required.

AI statement: The authors stated that no generative AI or AI-assisted tools were used in the preparation of this manuscript.

Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from corresponding author.

REFERENCES

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R. E., Jenkins, M., Jefferiss, P., Jessamy, V., Madden, J., Munro, K., Myers, N., Naeem, S., Paavola, J., Rayment, M., Rosendo, S., Roughgarden, J., Trumper, K., & Turner, R. K. (2002). *Economic reasons for conserving wild nature. Science, 297*(5583), 950-953. https://doi.org/10.1126/science.1073947

Brondizio, E., Diaz, S., Settele, J., & Ngo, H. T. (2019). *Global assessment report on biodiversity and ecosystem services of the Intergovernmental science-policy platform on biodiversity and ecosystem services*. IPBES Secretariat. https://doi.org/10.5281/zenodo.3831673

CBD. (2022). *Kunming–Montreal Global Biodiversity Framework* (Decision 15/4). Secretariat of the CBD. https://www.cbd.int/gbf

Dasgupta, P. (2021). *The economics of biodiversity: The Dasgupta review*. HM Treasury. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957629/Dasgupta_Review_-_Full_Report.pdf

Deutz, A., Heal, G. M., Niu, R., Swanson, E., Townshend, T., Zhu, L., & Tobin-de la Puente, J. (2020). *Financing nature: Closing the global biodiversity financing gap*. Paulson Institute. https://www.paulsoninstitute.org/key-initiatives/financing-nature-report/

Flammer, C., Truskowski, M., & Karolyi, G. A. (2023). Biodiversity and finance: Evidence from ESG integration. *Journal of Environmental Economics and Management, 120*, Article 102115. https://doi.org/10.1016/j.jeem.2023.102115

Food and Agriculture Organization of the United Nations. (2021). *Global forest resources assessment 2020: Main report*. FAO. https://doi.org/10.4060/ca9825en

Government of Morocco, & United Nations Development Programme. (2024). *BIOFIN diagnostic report: Morocco*. United Nations Development Programme. https://www.biofin.org

Government of Morocco. (2019–2024). *Annual finance laws. Ministry of Economy and Finance*. https://www.finances.gov.ma

Government of Morocco. (2020). *Morocco forest strategy 2020–2030*. Ministry of Agriculture, Maritime Fisheries, Rural Development, Water and Forests. https://www.eauxetforets.gov.ma

Government of Morocco. (2021). *Halieutis Plan: Sustainability strategy for fisheries resources*. Ministry of Agriculture and Fisheries. https://www.agriculture.gov.ma

Government of Morocco. (2024a). *Macroeconomic analysis of biodiversity expenditures*. Ministry of Economy and Finance. https://www.finances.gov.ma

Government of Morocco. (2024b). *Review of external biodiversity financing 2019–2024*. Ministry of Economy and Finance. https://www.finances.gov.ma

Government of Morocco. (2024c). *National convergence plan for Kunming–Montreal. Ministry of Energy Transition and Sustainable Development*. https://www.environnement.gov.ma

Government of Morocco. (2025). *National Biodiversity Strategy and Action Plan 2025–2035* (Draft). Ministry of Energy Transition and Sustainable Development. https://www.environnement.gov.ma

High Commission for Planning. (2023). *Satellite account of the primary sector*. High Commission for Planning. Rabat, Morocco. https://www.hcp.ma

High Commission for Planning. (2024). *National accounts of Morocco 2019–2024*. High Commission for Planning. Rabat, Morocco. https://www.hcp.ma

International Labour Organization. (2023). *Green jobs in Africa: Employment opportunities in the transition to sustainability*. ILO. https://www.ilo.org/global/topics/green-jobs/publications/WCMS_871780/lang--en/index.htm

OECD. (2019). *Biodiversity: Finance and the economic and fiscal policy agenda*. OECD Publishing. https://doi.org/10.1787/689afed1-en

OECD. (2020a). *A comprehensive overview of global biodiversity finance*. OECD Publishing. https://www.oecd.org/environment/resources/biodiversity/report-a-comprehensive-overview-of-global-biodiversity-finance.pdf

OECD. (2020b). *Biodiversity: Finance and the economic and business case for action*. OECD Publishing. https://doi.org/10.1787/eb88c9ec-en

OECD. (2023). *A decade of development finance for biodiversity (2011–2020)*. OECD Publishing. https://doi.org/10.1787/28074d5a-en

Secretariat of the Convention on Biological Diversity. (2021). *Estimation of resources needed for implementing the post-2020 global biodiversity framework (CBD/SBI/3/INF/12)*. Convention on Biological Diversity. https://www.cbd.int/doc/c/abb5/f80d/35524c40d2fe5504fd4c2f72/sbi-03-inf-12-en.pdf

SEEA-EA Technical Working Group. (2024). *Natural capital accounting for biodiversity*. United Nations. https://seea.un.org

Seidl, A., Mulungu, K., Arlaud, M., van den Heuvel, O., & Riva, M. (2020). Finance for nature: A global estimate of public biodiversity investments. *Ecosystem Services, 46*, Article 101216. https://doi.org/10.1016/j.ecoser.2020.101216

UNDP BIOFIN. (2024). *Biodiversity Finance Initiative Workbook and country reports*. https://www.biofin.org

United Nations Environment Programme [UNEP]. (2021). *State of Finance for Nature: Tripling investments in nature-based solutions by 2030*. https://www.unep.org/resources/state-finance-nature

United Nations Environment Programme [UNEP]. (2023). *State of Finance for Nature 2023*. https://www.unep.org/resources/state-finance-nature-2023

Waldron, A., Adams, V. M., Allan, J., Arnell, A., Asner, G., Atkinson, S., Baccini, A., Baillie, J. E. M., Balmford, A., Beau, J. A., Brander, L., Brondizio, E. S., Bruner, A., Burgess, N. D., Burkart, K., Butchart, S. H. M., Button, R., Carrasco, R., Cheung, W. W. L. … Zhang, Y. P. (2020). *Protecting 30% of the planet for nature: Costs, benefits and economic implications*. Campaign for Nature. https://doi.org/10.13140/RG.2.2.19950.64327

World Bank. (2021). *Biodiversity and conservation: Building a sustainable framework for global development*. World Bank. https://www.worldbank.org/en/topic/biodiversity

World Bank. (2023). *Environmental performance index 2023*. World Bank. https://data.worldbank.org/topic/environment

APPENDIX A

Table A1. Evolution of biodiversity expenditures by BIOFIN category (2019–2024)

BIOFIN category / Theme	2019	2020	2021	2022	2023	2024
Green economy	2,642,522	2,219,855	2,095,052	1,598,320	1,360,106	1,577,891
└ Sustainable development	10,133	172	171	183	176	181
└ Marine fisheries	2,632,389	2,219,683	2,094,881	1,598,137	1,359,930	1,577,710
Pollution management	60,873,118	55,211,709	38,641,859	22,253,851	30,009,867	13,993,105
└ Agriculture	1,703,088	1,790,823	1,753,865	1,783,839	1,488,867	1,970,653
└ Sustainable development	58,836,130	53,104,547	36,622,202	20,451,485	28,243,368	11,722,911
└ Marine fisheries	333,900	316,339	265,793	318,527	277,632	299,541
Biodiversity planning and development	898,981	686,369	730,092	1,973,162	1,979,062	994,188
└ Agriculture	580,318	512,171	626,225	800,450	705,460	624,654
└ Sustainable development	318,663	174,197	103,867	1,172,712	1,273,602	369,534
Restoration	59,573,869	41,378,280	39,849,013	40,352,776	40,469,699	52,944,713
└ Agriculture	38,115,926	39,881,160	38,290,608	38,568,109	38,768,755	50,787,390
└ Water and forests	21,457,944	1,497,120	1,558,405	1,784,667	1,700,944	2,157,322
Awareness and biodiversity knowledge	283,272,919	308,286,249	344,191,534	281,201,772	272,419,016	326,745,905
└ Agriculture	232,134,999	255,309,494	233,848,124	230,476,817	258,109,880	279,861,759
└ Sustainable development	1,546,643	946,839	555,750	589,069	631,391	252,112
└ Water and forests	16,147,878	15,289,358	10,767,868	12,940,284	3,566,763	4,523,757
└ Marine fisheries	33,443,400	36,740,558	99,019,792	37,195,601	10,110,983	42,108,277
Sustainable use of biological resources	1,034,410,952	947,908,908	921,251,555	842,886,275	722,159,954	501,582,369
└ Agriculture	217,870,019	242,208,701	263,756,638	270,250,328	265,092,260	274,917,846
└ Marine fisheries	513,690,721	507,932,814	472,380,144	362,030,448	399,093,226	153,134,980
└ Water and forests	302,850,213	197,767,394	185,114,773	210,605,498	57,974,469	73,529,542
Protected areas and other conservation measures	919,403,661	870,782,161	878,797,969	890,481,482	949,466,129	1,089,795,875
└ Marine fisheries	738,612	895,824	876,512	935,630	5,014,489	14,162,383
└ Sustainable development	168,175	6,217,343	3,273,392	831,704	723,084	2,728,730
└ Water and forests	918,496,874	863,668,994	874,648,065	888,714,147	943,728,556	1,072,904,762
Grand total	2,361,076,022	2,230,783,197	2,146,155,504	1,775,011,747	1,850,467,401	1,364,262,256

Source: Authors' calculations based on BIOFIN classification and ADB results

APPENDIX B

Data Sources, Selection Protocol and Coding of Biodiversity Expenditures

This annex provides a transparent description of the data sources used, the selection rules applied to budget lines, and the coding logic employed to identify biodiversity-related expenditures in Morocco over the period 2019–2024. Its purpose is to enable readers to clearly understand the origin of the data, the rationale behind the inclusion or exclusion of specific budget lines, and the methodology used to assign attribution coefficients.

Data sources

The analysis primarily relies on official budgetary documents of the Moroccan government, including the Annual Finance Laws issued during the period 2019–2024 (Government of Morocco, 2019–2024), performance plans of the ministries and institutions concerned, economic and financial reports, and reports issued by the Court of Auditors on budget execution. These documents made it possible to identify both investment and operational expenditures, the titles of programs and projects, and the levels of actual execution observed.

The main public institutions covered by the analysis include the Department of Agriculture, the Department of Maritime Fisheries, the National Agency for Water and Forests (ANEF), and the Department of Sustainable Development.

To complement the review of domestic public expenditures, the study also examined project documents and financing agreements from several technical and financial partners, including the African Development Bank (AfDB), the World Bank/IBRD, the European Union, the French Development Agency (AFD), the Green Climate Fund (GCF), the International Fund for Agricultural Development (IFAD), ENABEL, and the Global Environment Facility (GEF).

Table B1. Main data sources used in the analysis

Data source	Sector	Period	Institutions
Performance plans	Agriculture	2019, 2020, 2021, 2022, 2023, 2024	MAPMDREF
Performance plans	Water and forests	2019, 2020, 2021, 2022, 2023, 2024	ANEF
Performance plans	Maritime fisheries	2019, 2020, 2021, 2022, 2023, 2024	Department of maritime fisheries
State budget execution reports	All sectors	2019, 2020, 2021, 2022, 2024	Ministry of economy and finance
Finance laws	All sectors	2019, 2020, 2021, 2022, 2024	Ministry of economy and finance
Sixth national report on the implementation of the convention on biological diversity	Sustainable development	2019	GEF / UNDP / Department of sustainable development
Developing a national framework on access and benefit-sharing of genetic resources and traditional knowledge as a strategy to contribute to the conservation and sustainable use of biodiversity in Morocco	Sustainable development	2019	GEF / UNDP / Department of sustainable development
Circular economy approach for the conservation of agro-biodiversity in the Souss Massa Region of Morocco	Agro-biodiversity	2021	GEF / UNDP / ADA
Status of the Implementation of the United Nations Convention to Combat Desertification (UNCCD)	Combating desertification	2017–2018	UNEP–GEF
Operationalization of the National Access and Benefit-Sharing (ABS) framework and pilot testing of innovative products derived from genetic resources to strengthen benefit-sharing for sustainable rural development and biodiversity conservation	Genetic resources	2019	GEF / UNDP / UNEP / GIZ / Department of sustainable development
GEF small grants programme	Biodiversity and community initiatives	2021–2025	GEF SGP / UNDP
Support to ICCAs – Indigenous and community conserved areas and territories	Genetic resources	–	German federal ministry for the environment
Phase II of the Global Support Initiative for Indigenous Peoples' and Community Conserved Territories and Areas (ICCA-GSI): Implementation of targets 3, 21, 22 and 23 of the global biodiversity framework	Biodiversity	2019–2024	Government of Germany (BMUV)
Community development and knowledge management programme for the Satoyama initiative	Biodiversity	–	UNDP
Civil society organizations, local communities and institutional actors at local and national levels	Biodiversity initiatives	Various	Multiple stakeholders

APPENDIX C

Table C1. Sample of coded budget lines

Sector	Budget line or programme	BIOFIN category	Nature of expenditure	Attribution coefficient	Explanation of coding
Agriculture	Project 10 – Development of oasis and argan tree areas	Ecosystem restoration	Secondary	20%	The programme primarily aims at the integrated development of oasis areas and the argan ecosystem, but it also includes significant actions related to combating desertification, restoring ecosystems and promoting the sustainable use of natural resources. This justifies a partial but substantial attribution to biodiversity.
Agriculture	Agricultural Development Fund (FDA)	Sustainable use / agro-biodiversity	Secondary	5% in part of the analysis, and 20% in the consolidated summary of certain sections, indicating that a clear methodological arbitration needs to be stabilized in the final version	The fund mainly finances productive investments, but some components support sustainable agriculture, agroecology, rangeland management, and traditional farming systems; biodiversity therefore represents only a partial share of the financed activities.
Agriculture	Development and improvement of rangelands	Awareness and knowledge / or sustainable use depending on the classification used	Primary	25%	This budget line contributes to rangeland regeneration, the reduction of pressure on pastoral ecosystems, and the conservation of natural vegetation. The biodiversity impact is significant but shared with broader pastoral improvement objectives.
Maritime fisheries	Marine protected areas	Protected areas and other conservation measures	Primary	100%	The expenditure is directly related to the creation, management, or monitoring of marine protected areas and therefore falls entirely within the scope of biodiversity spending.
Maritime fisheries	Protection of fishery resources	Sustainable use / sustainable fisheries	Secondary	50%	This line covers surveillance, inspection, actions against illegal fishing, and resource monitoring. These activities have a strong impact on the conservation of fish stocks and marine ecosystems, even though they also serve the regulation of the fisheries sector.
Maritime fisheries	Aquaculture development	Sustainable use / sustainable management of aquatic biological resources	Secondary	10%	Aquaculture primarily pursues productive objectives, but certain sustainability requirements—such as the use of local species, effluent management, and protection of coastal ecosystems—generate limited ecological co-benefits.
Maritime fisheries	Fisheries research	Biodiversity awareness and knowledge	Secondary	50%	Funded research activities improve knowledge of species, fish stocks and marine ecosystems. However, part of the research is also oriented toward improving the technical and economic performance of the sector.
Water and forests	Production of seedlings, reforestation and forest stand management	Restoration / sustainable use	Primary	100%	This budget line directly finances ecological restoration actions, forest cover regeneration, and habitat restoration.
Water and forests	Urban and peri-urban forests	Other conservation measures	Secondary	5%	The programme mainly responds to landscape, social, and recreational objectives, with biodiversity benefits that are real but secondary.
Sustainable development	Strengthening the pollution monitoring system	Pollution management	Secondary	50%	Pollution monitoring primarily serves environmental regulation purposes, but it also reduces pressures on water, soil, and ecosystems.
Sustainable development	Integrated coastal zone management	Protected areas and conservation	Secondary	75%	The protection of coastal ecosystems, wetlands, and littoral environments generates strong ecological benefits, even though the programme also serves spatial planning and governance objectives.