

## RESEARCH ARTICLE

# The “ranger blindspot”: Global policy and implementation gaps

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**Abstract** Achieving conservation targets like protecting and conserving 30% of the planet by 2030 (“30 x 30”) depend fundamentally on ground-level implementation capacity, in particular rangers. We audited 45 global macro-governance documents and 21 National Biodiversity Strategies and Action Plans (NBSAPs), establishing the first empirical baseline of ranger workforce visibility. The analysis reveals a profound blindspot: macro-frameworks exhibit a near-invisible Ranger (or equivalent) term density of 0.46 matches per 10 000 words, drastically lower than Area (32.15) and Finance terms (37.88). While domestic NBSAPs marginally improve visibility (0.82), they remain a fraction of Finance (56.10) and Area (26.85). Qualitative analyses show that only two macro-documents and fewer than half the NBSAPs formally integrate rangers into policy and forward planning. By decoupling capital and area from labour, environmental governance risks proliferating unmanaged paper parks. We recommend government and NGO policy negotiators urgently eliminate this gap by codifying ranger targets and standardising labour within policy, planning and reporting.

**Keywords** Conservation finance · Convention on biological diversity · National biodiversity strategies and action plans · Paper parks · Policy · Rangers

## INTRODUCTION

Over the last half century, conservation has focused particularly on area-based protection as a solution for reducing biodiversity loss. The convention on biological diversity’s (CBD) Kunming–Montreal global biodiversity framework (KM-GBF) Target 3 calls for protecting 30% of land and ocean by 2030 (the 30 × 30 target) through systems of protected areas and other effective area-based conservation measures (OECMs), while recognising and respecting the rights of Indigenous Peoples and local communities, and recognising the contributions of Indigenous and traditional territories where applicable (CBD n.d.). The target emphasises the importance of effective management but provides minimal guidance on how this is to be achieved (see CBD n.d.). KM-GBF Target 20 on capacity building confines indicators of success to issues relating to research, information and technology, with no mention of who does the work. Target 3 research focuses on where new sites are to be located (Geldmann 2025), whether protected areas or OECMs are the best choice (Fitzsimons et al. 2025), and how to raise finance (Buckley 2023). Far less attention has been paid to the implications for the workforce needed to manage such sites (notable exceptions include Appleton et al. 2022).

While rangers are not entirely analogous to “workforce” or “labour”, they are responsible for the bulk of ground-level implementation of Target 3 and comprise over half of the total protected area workforce (Appleton et al. 2022). Rangers are defined by the International Ranger Federation (IRF 2025) as “any person regardless of title, including but not limited to wildlife warden, forest guard, forester, scout, watcher, game scout, marine ranger, park guard, and others working in conservation, with responsibilities for

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safeguarding nature, wildlife, biodiversity, landscapes and habitats, and for the preservation of cultural and historical heritage”. Far from being simple cogs in an administrative machine, rangers fulfil complex, interdisciplinary roles, such as ecological monitoring, anti-poaching law enforcement, community development, human–wildlife conflict mitigation, ecosystem restoration, climate change mitigation and adaptation, regenerative economy and pandemic management. Such roles deliver numerous outcomes including climate and disease mitigation, prevention of biodiversity and ecosystem loss and many more, making rangers essential planetary health professionals (Stolton et al. 2023).

The KM-GBF makes no mention of rangers, exposing a serious short-coming. As Rodríguez (2006, p. 1340) pointed out “...it makes little sense to create elaborate conservation investment plans for needy regions without considering who will implement them”. Workforce recognition within international policy texts is not merely a semantic preference, but a direct proxy for recognition, financial support and national planning. Because global frameworks like the CBD fail to mandate workforce integration, governments lack guidelines to incorporate human resources into their domestic action plans. This systemic oversight trickles down into domestic policy: if a workforce is not named, it cannot be planned for; if it is not planned for, it will not be funded.

By not explicitly recognising the workforce, international conventions risk creating aspirational targets without the framework for implementation. In classic economic theory, Smith (1776) postulates that the production, wealth and functional capacity of any nation or enterprise depend on the balanced integration of three parameters: land, capital and labour. In conservation governance, this foundational trinity has been decoupled. Policy documents track land (e.g. area coverage) and capital (e.g. resource mobilisation), while leaving the labour component largely invisible.

Current global ranger numbers fall far short of what will be needed if Target 3 is achieved, with an estimate of a 1.5-million-person shortfall (Appleton et al. 2022). In addition to numbers, the working conditions (Gray et al. 2024) and capacity (International Ranger Federation 2024a, b) of rangers remain low in many countries, which is identified as further reducing effectiveness (Leverington et al. 2010; Farhadinia, et al. 2023). Indigenous and community rangers in particular often manage high pressures on their territories with minimal training and equipment, a vulnerability underscored by successive State of the Ranger reports (International Ranger Federation 2024a, b).

Concern about the lack of attention paid to rangers in global conservation strategies is well known within the ranger community. However, evidence has been largely

anecdotal or based on individual experience (Varshney 2024; International Ranger Federation 2024a, b). The extent to which the ranger workforce is ignored by global decision-makers has never been systematically quantified. In the following paper, we analyse international policy and domestic implementation plans to provide a more quantitative assessment. Through an audit of finalised, English-language national biodiversity strategies and action plans (NBSAPs), this paper bridges the gap between macro-level governance and national-level operational reality. We show the global “ranger blindspot” replicated on the ground, leaving state-level targets vulnerable to implementation shortfalls. We establish the first empirical baseline of ranger visibility in environmental governance. Our results indicate a pervasive “ranger blindspot” and recommendations help address the integration of labour into policy and planning.

## MATERIALS AND METHODS

To evaluate conservation workforce visibility, we used computational text mining to analyse key documents. This established an empirical baseline of ranger recognition across global environmental governance.

### Macro-governance corpus selection

By mapping the roles of rangers as essential planetary health workers (Stolton et al. 2023), we selected 10 thematic domains representing the principle global frameworks that both are contributed to by ranger work and that shape conservation, climate and sustainable development priorities and funding that affect ranger work. Documents from organisations such as IUCN and conservation NGOs were not included because, while influential in providing technical guidance, their role is primarily to support global policy implementation, while the focus of this paper is on the development of policy and guidance.

Building on these 10 domains, we assembled a corpus of texts available in English. All key convention texts (seven) were incorporated, alongside the most recent strategic plans or guides (22) aiming to deliver the conventions and the latest identified progress reports (16) to provide the greatest visibility on ground-level implementation and therefore the greatest likelihood that rangers would be represented. These 45 macro-governance documents shaping policy and implementation across the 10 domains were identified through internet searches and discussion and agreed upon by all coauthors (Table 1).

**Table 1** The main corpus of macro-governance documents assessed, convention texts in orange cells, strategic plans or guides in blue cells and progress reports in purple cells (see supplementary material for the full set of references)

| <b>Domain 1: Biodiversity: CBD and related documents</b>                                                                                                                                                     | <b>Year</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| CBD Foundational Text                                                                                                                                                                                        | 1992        |
| Programme of Work on Protected Area Goals                                                                                                                                                                    | 2004        |
| Global Biodiversity Outlook (GBO) 2                                                                                                                                                                          | 2006        |
| GBO 3                                                                                                                                                                                                        | 2010        |
| GBO 4                                                                                                                                                                                                        | 2014        |
| GBO 5                                                                                                                                                                                                        | 2020        |
| Creating a Nature-Positive Future: The contribution of protected areas and other effective area-based conservation measures                                                                                  | 2021        |
| CBD Conference of Parties (COP) Decision 15/6 (Annex I): Guidance for revising or updating national biodiversity strategies and action plans to align with the KM-GBF                                        | 2022        |
| KM-GBF                                                                                                                                                                                                       | 2022        |
| CBD COP 16 Final Report                                                                                                                                                                                      | 2024        |
| United Nations (UN) Environment Programme World Conservation Monitoring Centre / Council for the Biodiversity-related Conventions Guidance Paper NBSAPs and Synergies among Biodiversity-related Conventions | 2024        |
| Protected Planet Report                                                                                                                                                                                      | 2024        |
| <b>Domain 2: Land use: United Nations Convention to Combat Desertification (UNCCD) related documents</b>                                                                                                     |             |
| UN Convention to Combat Desertification in those countries experiencing serious drought and/or desertification, particularly in Africa                                                                       | 1994        |
| UNCCD 2018–2030 Strategic Framework                                                                                                                                                                          | 2018        |
| Global Land Outlook 2nd edition                                                                                                                                                                              | 2022        |
| COP16 Multi-year workplan for the Convention institutions (2025–2028)                                                                                                                                        | 2024        |
| <b>Domain 3: Climate change: United Nations Framework Convention on Climate Change (UNFCCC) related documents</b>                                                                                            |             |
| United Nations Framework Convention on Climate Change (UNFCCC)                                                                                                                                               | 1992        |
| Kyoto Protocol                                                                                                                                                                                               | 1998        |
| Paris Agreement                                                                                                                                                                                              | 2015        |
| Glasgow Climate Pact                                                                                                                                                                                         | 2021        |
| Sharm el-Sheikh Implementation Plan                                                                                                                                                                          | 2022        |
| <b>Domain 4: Nature-based solutions: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and related documents</b>                                                      |             |
| IPBES Global Assessment Report Summary for Policymakers                                                                                                                                                      | 2019        |
| IPBES Global assessment report on biodiversity and ecosystem services                                                                                                                                        | 2019        |
| UNEA Resolution 5/5 on Nature-based Solutions                                                                                                                                                                | 2022        |
| <b>Domain 5: Resource use and health: Food and Agriculture Organization (FAO) related documents</b>                                                                                                          |             |

Table 1 continued

|                                                                                                                                           |      |
|-------------------------------------------------------------------------------------------------------------------------------------------|------|
| One health joint plan of action (2022–2026): working together for the health of humans, animals, plants and the environment               | 2022 |
| FAO State of the World's Forests                                                                                                          | 2024 |
| FAO The State of World Fisheries and Aquaculture                                                                                          | 2024 |
|                                                                                                                                           |      |
| <b>Domain 6: Conservation finance: BIOFIN related documents</b>                                                                           |      |
| BIOFIN 2024 Workbook                                                                                                                      | 2024 |
| Guidebook - 2024 Results-Based Budgeting for Biodiversity                                                                                 | 2024 |
| How Can Biodiversity Finance Plans Support NBSAPs?                                                                                        | 2024 |
|                                                                                                                                           |      |
| <b>Domain 7: Wildlife crime and enforcement: UN and Convention on International Trade in Endangered Species (CITES) related documents</b> |      |
| CITES Foundational Treaty Text                                                                                                            | 1973 |
| CITES Strategic Vision 2021–2030                                                                                                          | 2019 |
| UN General Assembly (UNGA) Resolution on Tackling Illicit Trafficking in Wildlife                                                         | 2021 |
| CITES World Wildlife Trade Report                                                                                                         | 2022 |
| UN Office on Drugs and Crime (UNODC) World Wildlife Crime Report                                                                          | 2024 |
| UNGA Resolution on Tackling illicit trafficking in wildlife                                                                               | 2025 |
|                                                                                                                                           |      |
| <b>Domain 8: Migratory species: Convention on the Conservation of Migratory Species of Wild Animals (CMS) documents</b>                   |      |
| Convention on the Conservation of Migratory Species of Wild Animals                                                                       | 1979 |
| The Samarkand Strategic Plan for Migratory Species 2024–2032 (2024)                                                                       | 2024 |
|                                                                                                                                           |      |
| <b>Domain 9: Sustainable development: Sustainable Development Goal (SDG) documents</b>                                                    |      |
| UNGA Resolution 70/1                                                                                                                      | 2015 |
| SDG Report 2023                                                                                                                           | 2023 |
| United Nations Secretary-General's SDG Stimulus to Deliver Agenda 2030                                                                    | 2024 |
| SDG Report 2025                                                                                                                           | 2025 |
|                                                                                                                                           |      |
| <b>Domain 10: World Heritage Convention (WHC): UN Educational, Scientific and Cultural Organization (UNESCO) and related documents</b>    |      |
| Convention Concerning the Protection of the World Cultural and Natural Heritage                                                           | 1972 |
| Strategy for World Heritage in Africa                                                                                                     | 2023 |
| Operational Guidelines for the Implementation of the World Heritage Convention                                                            | 2025 |

### Keyword matrix standardisation

The search architecture used a matrix of 30 English-language occupational terms for Rangers (including “guardian”, “warden”, “patroller”, etc.), derived from the IRF (IRF 2021). For comparison, additional lists of 23 Area

terms (including “hectare”, “footprint”, “protected area”, etc.) and 19 Finance terms (including “funding”, “expense”, “revenue”, etc.) were compiled (see supplementary material).

Wildcard characters (\*) were appended to the root strings to capture plurals, possessives and derivative

phrasing (e.g. ranger\* captures *ranger*, *rangers* and *ranger-led*). For short terms that could have formed part of larger words (e.g. *ha* could also have captured *habitat* or *hazard*), the instruction (standalone only) was inserted to ensure larger words were not flagged. Search strings were bound by explicit word boundaries (\b) and case-insensitive modifiers.

Given our focus on rangers, words like “manager” and “director” were not included, because they might refer to people in occupations other than protected areas, risking false readings.

### Text extraction and processing

We deployed a layout-aware, Python-based computational text-mining pipeline (pdfplumber v0.11.0) to perform sequential term harvesting, calculating absolute counts into a comparable density metric per 10 000 words to control for document length.

For each document in the corpus, the pipeline recorded:

1. The total document word count
2. The absolute number of matches across the three core umbrella terms: Rangers, Area and Finance
3. The frequency of Rangers, Area and Finance terms per 10 000 words

### National-level policy extension: NBSAP audit

A secondary audit evaluated NBSAPs derived from the CBD Online Reporting Tool. This focused on finalised, English-language NBSAPs, applying the same text extraction and keyword density calculations used for the main corpus, establishing an empirical bridge between macro-governance and national operations. NBSAPs meeting the criteria were from: Afghanistan; Aruba; Austria; Belgium; Bhutan; Cambodia; Denmark; Eritrea; Ethiopia; Indonesia; Lebanon; Lesotho; Libya; Netherlands; Nigeria; Norway; Palestine; Rwanda; Sudan; Tonga and Vanuatu (see supplementary material for full references).

### Qualitative deepdives

Publications from the macro-governance corpus which included Ranger matches (see Table 2) were reviewed. To assess whether mentions related specifically to policy, an analysis of the Ranger terms’ usage was made for documents against the following three standards:

- Gold standard: Recognition of rangers as a workforce in policy

- Silver standard: Recognition as a workforce but with no policy-related advocacy or planning
- Bronze standard: Incidental reference (e.g. in a case study or picture caption, etc.)

And for NBSAPs as:

- Gold standard: Rangers integrated into planning of the next NBSAP period
- Silver standard: Recognition in progress of the last NBSAP period
- Bronze standard: Incidental reference (e.g. in a case study or picture caption, etc.)

### Crosschecking and reducing limitations in the methodology

All Ranger matches were crosschecked through the deepdives. Three false matches for Rangers were removed out of 215 original matches (across main corpus and NBSAPs), giving a possible error of 1.4%. As matches were not crosschecked for all Area and Finance terms, it is likely that our search may inadvertently capture some words out of context. However, far fewer terms for Area and Finance were mined than for Rangers, giving Rangers a larger net. Thus, we accept a smaller margin of error for the Area and Finance terms.

Terminology for frontline conservation personnel varies across governance systems, regions and institutional context. As noted above, we tried to account for this by using 30 different terms for Rangers, but the list cannot be exhaustive and we acknowledge some limitations in this respect.

## RESULTS

### Comparison of all terms against full corpus

In total, Ranger terms had the lowest density throughout the corpus at just 0.46 words per 10 000 words. By comparison, the densities of terms relating to Area and Finance were 32.15 and 37.88, respectively. Only twelve of the 45 texts included references to Ranger terminology (see Table 2).

Rangers were referenced exactly 100 times, Area 6990 and Finance 8236 times (Fig. 1).

The UNGA Resolution on Tackling Illicit Trafficking in Wildlife (2025) had the highest density of Ranger terms at 6.52 words per 10 000 (Fig. 2). This was still a fraction of the density of Finance terms (57.09)

**Table 2** A comparison of the absolute Ranger matches and the Ranger, Area and Finance match densities across the 12 documents that did reference rangers (convention texts in orange cells, strategic plans or guides in blue and progress reports in purple)

| Document name                                                                        | Absolute Ranger matches | Ranger match density (per 10k words) | Area match density (per 10k words) | Finance match density (per 10k words) |
|--------------------------------------------------------------------------------------|-------------------------|--------------------------------------|------------------------------------|---------------------------------------|
| UNODC World Wildlife Crime Report (2024)                                             | 34                      | 3.48                                 | 18.11                              | 24.15                                 |
| Global Land Outlook 2nd edition (2022)                                               | 19                      | 1.76                                 | 75.22                              | 56.93                                 |
| Global assessment report on biodiversity and ecosystem services of the IPBES (2019b) | 16                      | 0.2                                  | 21.97                              | 16.23                                 |
| CITES World Wildlife Trade Report (2022)                                             | 6                       | 1.57                                 | 19.67                              | 20.98                                 |
| Guidebook - Results-Based Budgeting for Biodiversity (2024)                          | 5                       | 1.64                                 | 41.98                              | 375.89                                |
| UNGA Resolution on Tackling illicit trafficking in wildlife (2025)                   | 4                       | 6.52                                 | 3.26                               | 57.09                                 |
| GBO 5 (2020)                                                                         | 4                       | 0.4                                  | 66.08                              | 22.62                                 |
| GBO 4 (2014)                                                                         | 4                       | 0.68                                 | 34.48                              | 23.05                                 |
| UNGA Resolution on Tackling Illicit Trafficking in Wildlife (2021)                   | 3                       | 5.51                                 | 3.67                               | 51.4                                  |
| FAO State of the World's Forests (2024)                                              | 3                       | 0.57                                 | 49.78                              | 56.24                                 |
| Protected Planet Report (2024)                                                       | 1                       | 0.23                                 | 163.6                              | 5.04                                  |
| BIOFIN Workbook (2024)                                                               | 1                       | 0.31                                 | 33.19                              | 319.71                                |

### Comparison to global health frameworks

For contrast, we ran a non-comprehensive audit on the World Health Organization and the United Nations Children's Fund's Operational Framework for Primary Health Care (2020), a key document for global public health. A search for the terms “health worker”, “nurse”, “midwives”, “midwife”, “doctor”, “surgeon”, “paramedic”, “medic”, “human resources” resulted in a total of 88 matches at a density of 22.19 per 10 000 words.

### Breakdown by type of document

None of the convention texts mentioned rangers. Progress reports and strategic plans or guides featured rangers more frequently at 0.49 and 0.42 Ranger terms per 10 000 words, respectively. As Fig. 3 demonstrates, the frequency of Ranger terms is a fraction of the frequency of Area and

Finance terms at 32.07 and 26.59, respectively, for progress reports and 36.89 and 100.64, respectively, for strategic plans or guides (see Table 3).

### Comparison across domains

The Wildlife crime and enforcement domain documents reference Rangers most often (2.99), followed by Land use (1.45) and Conservation finance (0.92) domains. Land use documents reference Rangers eight times more than the Biodiversity (0.17) documents: only three of the CBD documents mention rangers at all. No Migratory Species, Sustainable Development or WHC documents reference Rangers, which is particularly striking for the WHC given its focus on area-based conservation (Fig. 4).

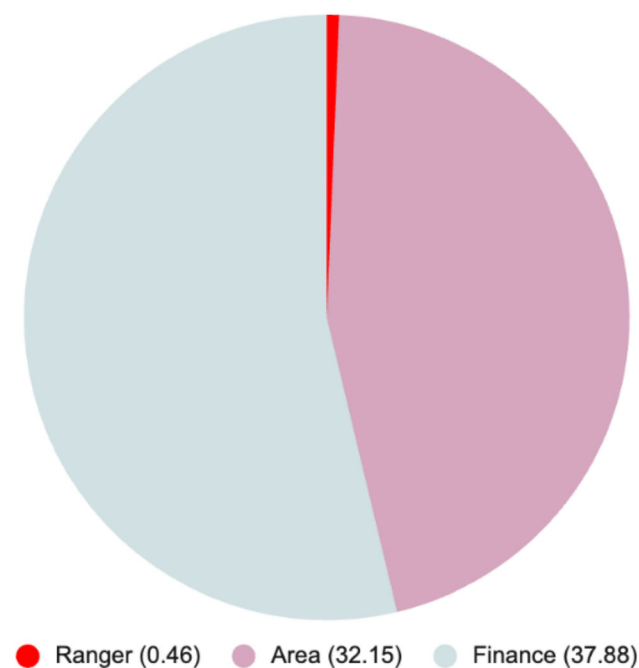


**Fig. 1** Number of matches per 10 000 words for Ranger, Area and Finance terms

### Trends over time

We analysed the cumulative absolute number of Ranger, Area and Finance terms matched in the corpus over time (Fig. 5). Prior to 2014, none of the texts included Ranger matches. The first match was in the GBO 4, which refers to Rangers four times. Since then, references to Rangers have been increasing modestly but are still a fraction of references to Area and Finance terms.

### NBSAPs audit

In total, 12 of the 21 NBSAPs mentioned Rangers: Aruba, Bhutan, Cambodia, Eritrea, Indonesia, Lebanon, Netherlands, Nigeria, Palestine, Rwanda, Sudan and Tonga. These NBSAPs had a total of 112 matches and an average density of 0.82 (see Fig. 6). However, this was still a fraction of the density of Area and Finance matches at 26.85 and 56.1, respectively.

### Qualitative deepdives

Matches for Ranger terms were found in 12 out of the 45 documents in the main corpus (see supplementary material). These were three progress reports from the Biodiversity Domain, one progress report from Land use, one progress report from Nature-based solutions, one progress report from Resource use and health, two strategic plans from Conservation finance and two strategic plans and two progress reports from Wildlife crime and enforcement. Only two of these

documents reached the Gold standard of referencing: the 2021 and 2025 UNGA Resolutions on Tackling illicit trafficking in wildlife. These documents called “... upon Member States to recognise and support the crucial role played by rangers and guards, across the world, in the fight against illicit wildlife trafficking, in often very challenging conditions, to bolster and monitor ranger safety and activity in protected areas, to improve rangers’ working conditions and welfare and to provide them with decent wages, necessary training, equipment and institutional support.” While the UNODC World Wildlife Crime Report (2024) had the highest number of Ranger matches (34) and recognised rangers as a workforce, it did not call for policy integration of rangers. Similarly, the Global Land Outlook 2nd edition and Global assessment report on biodiversity and ecosystem services of the IPBES also had high numbers of Ranger matches (19 and 16, respectively); these were incidental featuring in examples and reference lists (see supplementary material).

A deep dive analysis was conducted into the NBSAPs matches to qualitatively check results. Out of the 21 total NBSAPs, 12 referenced rangers, of these 9 reached the Gold standard, 2 Silver, and 1 Bronze (see supplementary material). The Cambodia and Lebanon NBSAPs frequently reference rangers in their targets, plans, indicators, legislation, challenges, and in the case of Cambodia, planned for greater inclusivity in the workforce.

## DISCUSSION

To summarise, this audit reveals a systemic asymmetry in global environmental governance. Some wildlife crime and enforcement frameworks (e.g. CITES, UNODC) texts do recognise rangers, for example, the UNGA Resolutions on Tackling Illicit Trafficking in Wildlife (2021, 2025) advocates for the ranger workforce in policy and for member states to recognise and better support rangers. However, biodiversity, sustainable development, climate change and desertification and World Heritage frameworks exhibit a workforce blindspot—calculating geographical boundaries and mobilising capital investments, while overlooking the human infrastructure critical for effectively protecting these spaces (Leverington et al. 2010; Farhadinia et al. 2023). In doing so, they treat area-based conservation as abstract policy to be managed through the generation of funding and expansion of areas alone and risk trickle-down planning to implement with no workforce.

### The macro-economic fallacy: Reaching 30 × 30 with no people

A system’s capacity relies on the integration of land, capital and labour (Smith 1776). The international



**Fig. 2** Density of terms for each of the corpus documents

environmental governance system has decoupled labour from this trinity. Without rangers, this system has hectares and dollars but no one to conduct the monitoring, patrol for threats to the area, raise awareness with communities, mitigate human–wildlife conflict, restore areas, support community development and regenerative economies with an ecological lens and so on (Stolton et al. 2023).

None of the convention texts mentioned rangers, this is perhaps unsurprising given these texts are not intended to be operational. Strategic plans or guides featured rangers more frequently (0.42), but a comparable document for global public health (World Health Organization and the United Nations Children’s Fund’s Operational Framework

for Primary Health Care 2020) references the equivalent workforce almost 53 times more often (22.19 match density). This illustrates clearly how the global healthcare sector recognises their workforce as the primary drivers of delivery; without doctors, nurses and paramedics, hospitals and health agendas do not function. Expanding spatial and effectiveness commitments without codifying workforce targets passes down an unfunded and unstaffed mandate to member states. This risks an unplanned and massive expansion of responsibilities expected to be absorbed by existing personnel and a resultant proliferation of paper parks lacking the workforce required to manage them (Stewart et al. 2026).

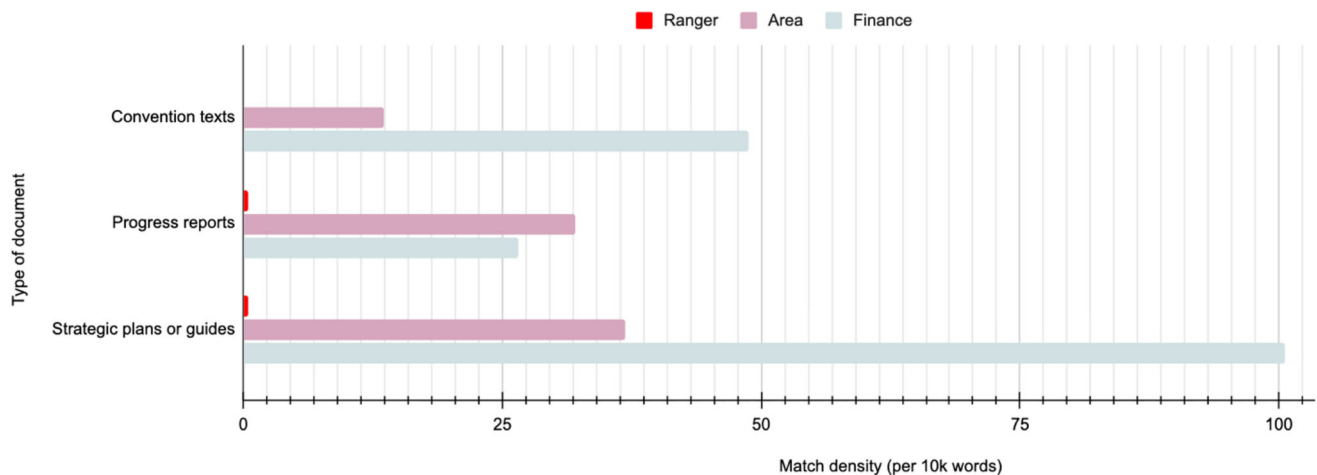


**Fig. 3** Density of terms for each of the three types of documents

Three quarters of biodiversity domain texts, the framework pertaining to Targets 3 and 20, contained no Ranger matches. Yet, spatial expansion requires a concomitant workforce expansion (Appleton et al. 2022) and management effectiveness, another core component of Target 3, is strongly correlated to adequacy of staff numbers, capacity and training (Leverington et al. 2010; Farhadinia, et al. 2023).

State-employed rangers are not alone in needing greater visibility in policies influencing funding (Appleton et al. 2022); a lack of semantic inclusivity is particularly damaging for non-state rangers (NSRs, e.g. community scouts, wildlife monitors, forest watchers, etc.), whose legal rights, operational safety and financial security are completely overlooked when frameworks assume a default state-employed labour model (Timmins et al. 2026). Overlooking NSRs in international policy risks excluding a significant population of rangers and will continue to create challenges in tracking conservation equity metrics, providing labour protections and monitoring operations across diverse governance types.

### Domestic replication: The trickle-down blindspot in NBSAPs

The secondary audit of the 21 NBSAPs demonstrates that the global “ranger blindspot” is directly replicated within domestic policy with state actors modelling their national strategies around the CBD framework and consequently failing to quantify the labour required to implement. The average density of Ranger terms across the NBSAPs sits at 0.82, contrasting with Area (26.85) and Finance terms (56.10).

CBD Articles 6, 10 and 26 make NBSAPs one of the few strongly legal obligations of the Convention (i.e. one of the few provisions that are not qualified by terms such as

‘as far as possible’, ‘subject to national legislation’, etc.). Without guidance that requires planning for human resources, states’ ranger planning is unstandardised, ad hoc and patchy. Yet, the qualitative deep dive into the 12 NBSAPs that did reference rangers reveals a notable point of deviation from the global corpus. Unlike the macro-level documents—where ranger mentions are almost purely incidental—three quarters of national documents containing Ranger terms successfully meet a Gold standard of integrating rangers directly into future planning. This suggests that without any guidance these nine states understood rangers to be a key component of their strategies and are voluntarily reporting on various aspects of the workforce.

For instance, Cambodia (35 matches) and Lebanon (25 matches) display robust workforce planning by explicitly embedding rangers within national targets, action plans, performance indicators and legal frameworks, alongside outlining current operational challenges. Similarly, Bhutan, Eritrea, Sudan, Nigeria and Indonesia reference rangers in capacity-building initiatives and indicators. The Netherlands references ranger inclusivity targets, while Aruba notes the strengthening of rangers’ legal authority.

Conversely, the remaining 12 countries either only track historical progress or challenges rather than planning for future recruitment, reference rangers purely incidentally or omit rangers entirely. This variance highlights an inconsistent patchwork of national inclusion of rangers. While select nations are beginning to realise that spatial targets are unachievable without workforce planning, the vast majority of country-level strategies remain heavily focused on dollars and hectares. Supporting countries with guidance on how to incorporate workforce in planning could be especially helpful and future research could assess whether countries that plan for and report on rangers are more successful in meeting their targets.

**Table 3** Density of terms for each of the three types of documents (convention texts in orange cells, strategic plans or guides in blue and progress reports in purple)

| Type of document          | Ranger Density (per 10k) | Area Density (per 10k) | Finance Density (per 10k) |
|---------------------------|--------------------------|------------------------|---------------------------|
| Convention texts          | 0.00                     | 13.57                  | 48.75                     |
| Progress reports          | 0.49                     | 32.07                  | 26.59                     |
| Strategic plans or guides | 0.42                     | 36.89                  | 100.64                    |

aim to formalise the ranger agenda within the International Labour Organization and the CBD, while a comprehensive set of guidelines and standards provide a sector-defined pathway to establishing effective, professional ranger workforces.

Ranger-positive measures in some NBSAPs and recognition of rangers in the IUCN's 2026–2029 Programme (2025) indicate an accelerating trend towards recognising the ranger workforce as a legitimate, essential stakeholder in global PCA governance. However, the lack of formal integration of rangers into international policy continues to hamper the necessary systematic adoption of measures to strengthen the ranger workforce.

### Ranger advocacy and growing recognition

The ranger sector has made considerable efforts to overcome its virtual exclusion from global conservation policy. The IRF's Chitwan Declaration (2019) defined a pathway to ranger professionalisation, international support and recognition. Events with international organisations and major donors in Brussels (2023), Washington DC (2024) and London (2025) built high-level awareness of ranger issues, while multiple ranger-related events at CBD COP 15 in Montreal (2022) and COP 16 in Cali (2024a) attracted widespread attention. The IRF's Hyères Ranger Declaration (2024b) and World Ranger Action Plan (2025)

### CONCLUSIONS AND RECOMMENDATIONS

Global conservation commitments are compromised by failure to name, budget for and protect the workforce required to execute them. The next few years (2026–2030) represent an invaluable window to correct this failure; as the current targets under the KM-GBF and SDGs move towards their 2030 deadlines and state actors are actively translating global goals into operational plans. We propose five immediate adjustments to reduce the “ranger blindspot”:

1. **A Unified Post-2030 Roadmap:** Looking towards post-2030 governance frameworks, we recommend

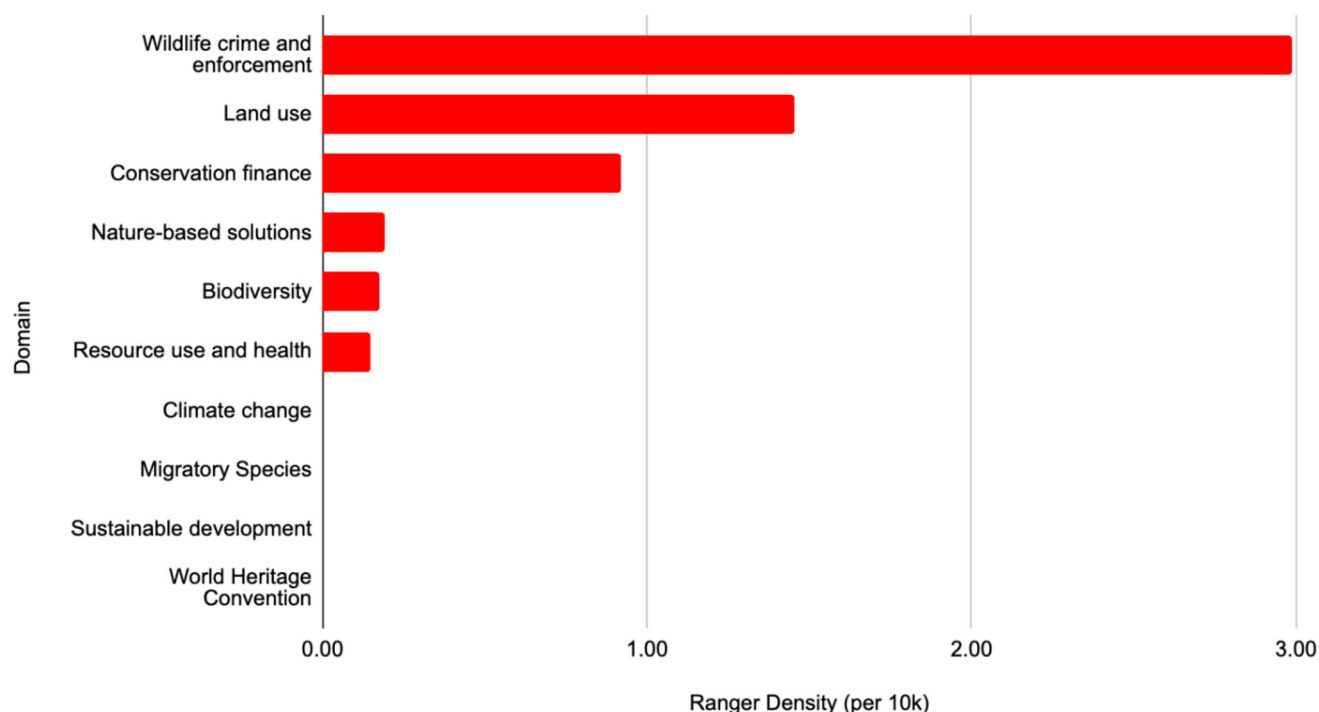


**Fig. 4** Ranger term density by domain

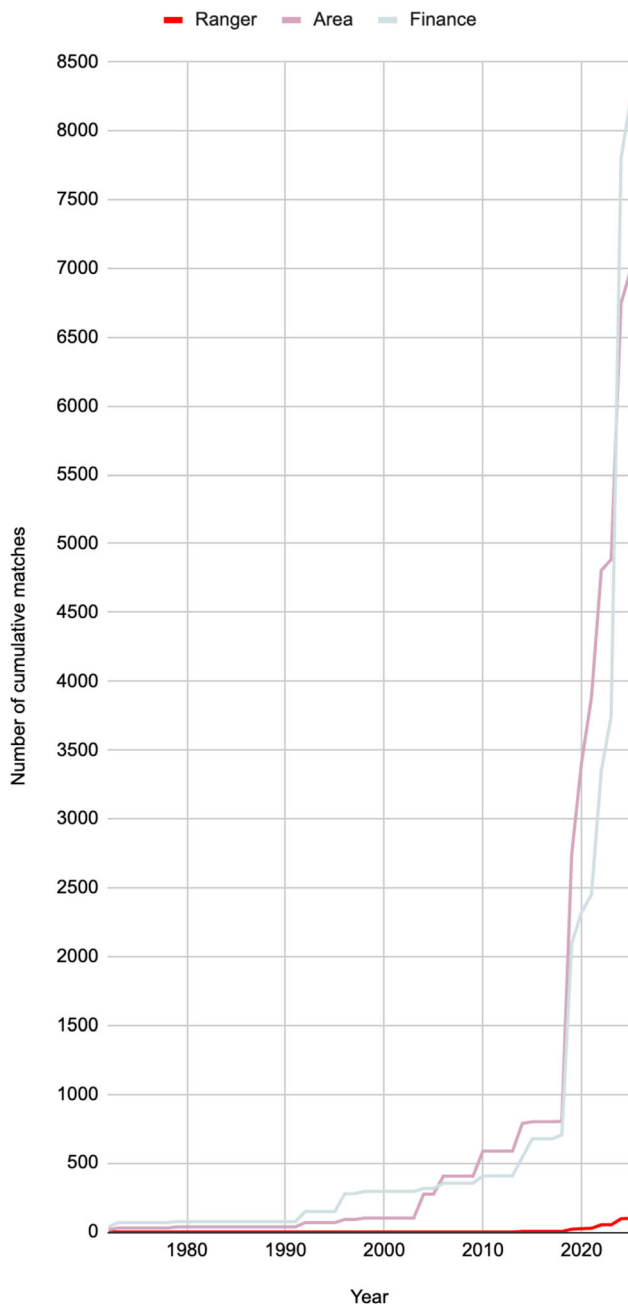


**Fig. 5** The cumulative number of absolute Ranger, Area and Finance term matches in corpus by year

negotiators recognise that environmental goals cannot succeed without dedicated people (Leverington et al. 2010; Appleton, et al. 2022; Farhadinia, et al. 2023;). Future environmental policy documents must formally codify global labour targets, ensuring that these essential planetary health workers (Stolton et al. 2023) are legally protected, equitably compensated, recognised and structurally visible. The ongoing review of the Programme of Work on Protected Areas provides an opportunity to consider how workforce

could be more explicitly reflected in the implementation of area-based conservation and supported through internationally accepted standards (IRF and Universal Ranger Support Alliance 2023).

2. **Codifying the Gold standard in national planning:** The systematic omission of rangers from high-level convention texts, contrasted with their sparse but highly practical integration in pioneering national NBSAPs, proves that the operational need for rangers is often understood on the ground but ignored at policy level. As the international community prepares for the conclusion of the current SDG and KM-GBF decadal cycles in 2030, we recommend negotiators treat the workforce as a core, measurable tenant of global environmental agreements. For example, future frameworks could explicitly declare that national spatial and financial milestones are invalid unless accompanied by labour planning.
3. **Integrating rangers into updating NBSAPs:** Before ranger planning is set as a mandatory reporting target, we recommend governments look to Gold standard examples set by Cambodia and Lebanon to guide their planning for ranger recruitment and capacity-building programmes (IRF 2025).
4. **Including non-state rangers:** We recommend environmental governance and implementation plans also recognise and incorporate NSRs (Timmins et al. 2026) and that negotiators and governments plan for international funding allocations, legal authority provisions, occupational safety standards and capacity-building resources to be accessible for personnel of all protected and conserved area governance categories.
5. **Innovative finance:** Rangers are largely absent from emerging and innovative finance mechanisms such as carbon standards, biodiversity credits, impact bonds and related instruments that are increasingly promoted to address global biodiversity funding gaps. However, as the workforce responsible for implementing conservation outcomes on the ground, we recommend rangers are placed at the centre of these financing frameworks, not at their margins.

Translating ambitious global goals on biodiversity, climate and human well-being into tangible outcomes requires explicit planning, budgeting for and supporting of rangers, our essential planetary health workers. We recommend global negotiators and national planners recognise, elevate, adequately fund and legally protect both state and non-state rangers. Global targets, such as 30 x 30, cannot succeed on spatial and financial objectives alone; the system's capacity (including effectiveness and spatial expansion) is intrinsically linked to staff

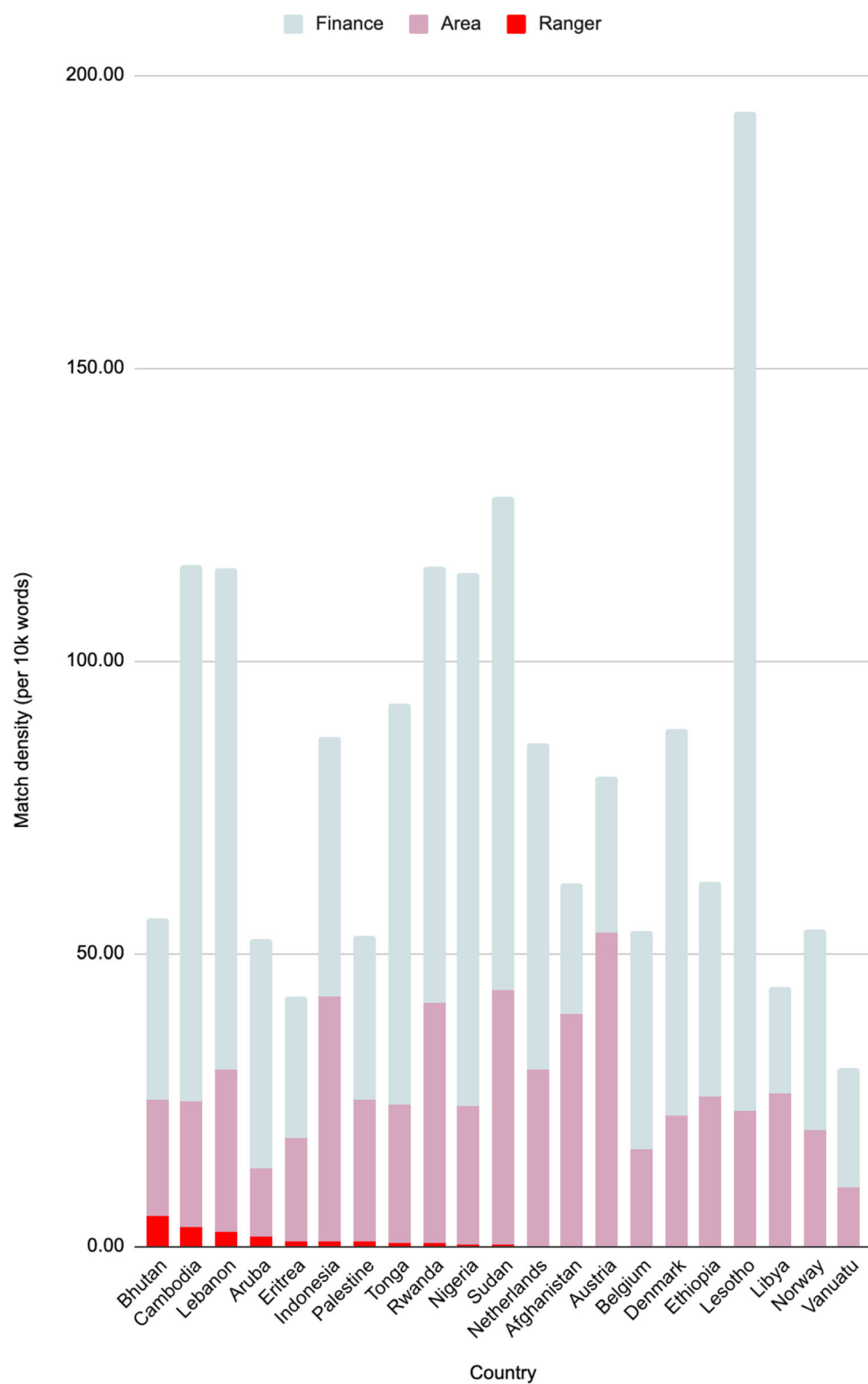


**Fig. 6** The density of Finance, Area and Ranger matches in different NBSAPs

capacity. By demonstrating the “ranger blindspot” across international governance frameworks and domestic planning, our findings expose a structural flaw:

environmental policy routinely decouples area and capital commitments from the human workforce required to implement it.

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**Data availability** The complete corpus of 45 global environmental macro-governance documents analysed during the current study is available through official United Nations, CBD and other institutional open-access repositories. The national-level cohort of 21 finalised National Biodiversity Strategies and Action Plans (NBSAPs) is publicly hosted on the official Convention on Biological Diversity Online Reporting Tool (ORT) platform. The primary spreadsheet records detailing absolute search match counts, word counts, and derived relative density metrics across all evaluated operational parameters, are available from the corresponding author upon reasonable request.

## Declarations

**Conflict of interest** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. While the text-mining pipeline and drafting processes received financial support via a research grant from WWF, the funder had no role in the design of the quantitative search matrices, the automated computational execution of the text-mining pipeline or the evaluation of the qualitative coding standards.

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