IUCN

TECH 4ALL

IUCN Green List
Protected | Conserved Areas

Tech4Nature

Guidance for Effective and Equitable Area-based Conservation Technology and Innovation

Consultation Version 1.0

INTERNATIONAL UNION FOR CONSERVATION OF NATURE

About IUCN

IUCN is a membership Union uniquely composed of both government and civil society organisations. It provides public, private and non-governmental organisations with the knowledge and tools that enable human progress, economic development and nature conservation to take place together.

Created in 1948, IUCN is now the world's largest and most diverse environmental network, harnessing the knowledge, resources and reach of more than 1,600 Member organisations and around 19,000 experts. It is a leading provider of conservation data, assessments and analysis. Its broad membership enables IUCN to fill the role of incubator and trusted repository of best practices, tools and international standards.

IUCN provides a neutral space in which diverse stakeholders including governments, NGOs, scientists, businesses, local communities, Indigenous Peoples' Organisations and others can work together to forge and implement solutions to environmental challenges and achieve sustainable development.

Working with many partners and supporters, IUCN implements a large and diverse portfolio of conservation projects worldwide. Combining the latest science with the traditional knowledge of local communities, these projects work to reverse habitat loss, restore ecosystems and improve people's well-being.

www.iucn.org
https://x.com/IUCN/

Guidance for Effective and Equitable Area-based Conservation Technology and Innovation

Consultation Version 1.0

Published by: IUCN, Gland, Switzerland

Copyrights: © 2026 International Union for Conservation of Nature and Natural Resources

Reproduction of this publication for educational or other non-commercial purposes is authorised without prior written permission from the copyright holder provided the source is fully acknowledged.

Reproduction of this publication for resale or other commercial purposes is prohibited without prior written permission of the copyright holder. Images contained in this publication cannot be extracted, copied and re-used without obtaining prior written consent from the authors.

Recommended citation: McBreen, J. & Richmond-Coggan, L. (2026). *Guidance for Effective and Equitable Area-based Conservation Technology and Innovation: Consultation Version*, 1.0. Gland, Switzerland: IUCN.

Authors: James McBreen, Louisa Richmond-Coggan

Reviewers: Anusha Shivram, Camille Lau, Jennifer Kelleher, Martin Sneary, Muneeswaran Mariappan, Thierry Lefebvre, Tim Badman

Cover photo: Biodiversity monitoring with a drone at Dzilam de Bravo State Reserve, Tech4Nature Mexico © IUCN 2022

Layout by: Imre Sebestyén, jr. / Unit Graphics

Disclaimer: The designation of geographical entities in this book, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of IUCN or other participating organisations concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The views expressed in this publication do not necessarily reflect those of other participating organisations.

Available from: IUCN (International Union for Conservation of Nature)
Rue Mauverney 28
1196 Gland
Switzerland
Tel +41 22 999 0000 / Fax +41 22 999 0002

Contents

Executive Summary v
Acknowledgements viii
Purpose, Scope, and Audience ix
- Purpose of the Guidance Document ix
- Scope of Application ix
- Primary Audiences x
- Using the Framework xi
  - Modularity and Use Pathways xi
  - Core Themes xi
- Relationship to Other Frameworks, Standards, and Initiatives xii
- References xii

Introduction 1
- Understanding the Context 1
- Before You Begin: Is Technology the Right Fit? 1

Theme 1: Technology Selection and Readiness 5
- Framing and Relevance 5
- Key Questions for Practitioners 5
- Relevant Standards, Tools and Templates 36
- References 38

Theme 2: Inclusive Innovation and Co-Design 41
- Framing and Relevance 41
- This theme will help you 41
- Key Questions for Practitioners 41
- Relevant Standards, Tools and Templates 76
- References 79

Theme 3: Ethical Data Governance and Accountability 83
- Framing and Relevance 83
- Key Questions for Practitioners 84
- Relevant Standards, Tools and Templates 116
- References 118

Theme 4: Capacity Building and Learning Systems 121
- Framing and Relevance 121
- Key Questions for Practitioners 121
- Relevant Standards, Tools and Templates 157
- References 159

Theme 5: Monitoring, Evaluation, and Adaptive Planning **163**
Framing and Relevance 163
Key Questions for Practitioners 163
Technology Overview and Strategic Considerations 169
Relevant Standards, Tools and Templates 196
Resources 198
Theme 6: Financing Conservation Technology Sustainably **201**
Framing and Relevance 201
Key Questions for Practitioners 201
Relevant Standards, Tools and Templates 236
Resources 238
Theme 7: Greening Conservation Technology **241**
Framing and Relevance 241
Key Questions for Practitioners 242
Relevant Standards, Tools and Templates 278
References 280

Executive Summary

Purpose and Context

The Guidance for Effective and Equitable Area-based Conservation Technology provides place-based conservation decision-makers with clear, structured guidance to support the ethical, effective, and responsible use of technology. Developed through the Tech4Nature Partnership between IUCN and Huawei, the guidance responds to growing pressure on place-based conservation decision makers to scale effective and measurable conservation outcomes in the run-up to 2030, while ensuring that technology adoption strengthens governance, equity, rights, and long-term conservation outcomes rather than undermining them.

Across the conservation sector, digital tools and innovative approaches are increasingly promoted as solutions to complex challenges. However, many organisations face persistent difficulties translating technological potential into durable conservation impact. Common challenges include fragmented decision-making, donor-driven pilot projects that fail to scale, insufficient attention to governance and consent, weak data accountability, and technologies that sit outside established management and reporting systems. When poorly governed, technology adoption can introduce operational, reputational, and rights-based risks.

This guidance shifts the focus from technology-led experimentation to disciplined, standards-aligned decision-making. Rather than promoting specific technologies or prescribing a step-by-step pathway, it provides a structured guide to support decision-makers in Protected and Conserved Areas (PCAs) in asking the right questions, making assumptions explicit, and determining whether, when, and under what conditions technology is appropriate. It is designed to strengthen judgement, accountability, and clarity in complex, real-world contexts.

Across its seven themes, the guidance brings into view a consistent set of considerations that place-based conservation decision-makers are routinely required to navigate when adopting technology, including environmental impact, cultural appropriateness and compatibility with traditional knowledge, gender-responsiveness, cost-effectiveness and accessibility, long-term sustainability, and the conditions under which approaches can be responsibly scaled.

Alignment with Global Conservation Frameworks

The guidance is explicitly designed to operate across multiple, complementary global conservation standards and policy commitments. The Kunming–Montreal Global Biodiversity Framework provides the overarching strategic direction, particularly through Target 3, while also reinforcing broader objectives related to effective planning, inclusive governance, monitoring, and long-term sustainability (CBD, 2022).

These commitments are translated into operational guidance through established standards and guidance, including the IUCN Global Standard for Effective and Equitable

Protected and Conserved Areas (IUCN Global PCA Standard), guidance on Other Effective Area-based Conservation Measures (OECMs), and guidance on Indigenous Peoples' and local communities' conserved territories (Jonas and Woodley, 2024; Stevens et al., 2024; Woodley et al., 2026). Each plays a distinct role within the guidance document. The IUCN Global PCA Standard provides a management effectiveness and continuous improvement lens for PCAs. Guidance on OECMs ensures legitimacy across diverse governance models beyond formally designated protected areas. Guidance on Indigenous Peoples' and local communities' conserved territories safeguard rights, governance and authority, free, prior and informed consent (FPIC), and respect for traditional knowledge systems.

In addition, the guidance draws on a coherent set of IUCN and partner guidance addressing biodiversity monitoring and impact assessment, inclusive and equitable implementation of Target 3, and ecological connectivity ensuring that technology decisions are grounded in governance, evidence, equity, and long-term ecological coherence.

By embedding technology decision-making within this integrated architecture, the guidance document helps decision-makers situate technology choices within existing governance and accountability systems. It enables the holistic design, justification, documentation and reporting of technology decisions in ways that are consistent with global biodiversity commitments, while remaining appropriate to local governance, capacity, and ecological realities.

Structure and Design of the Framework

The guidance document is organised around seven Core Themes, each structured around five practitioner-facing questions, resulting in 35 questions in total. These questions reflect real decision points encountered by decision-makers when considering, deploying, or reviewing technology in area-based conservation contexts.

The seven Core Themes are:

1. **Technology Selection and Readiness**
2. **Inclusive Innovation and Co-Design**
3. **Ethical Data Governance and Accountability**
4. **Capacity Building and Learning Systems**
5. **Monitoring, Evaluation, and Adaptive Planning**
6. **Financing Conservation Technology Sustainably**
7. **Greening Conservation Technology**

For each question, the guidance document follows a consistent internal structure designed to support reflective and informed decision-making:

- An overview section explaining why the issue matters and how it relates to conservation outcomes, governance requirements, and global standards.
- An action section outlining practical considerations and approaches.
- A "Practitioners should" summary highlighting key points of attention and responsibility.
- A structured table presenting relevant technology categories and associated tools, showing how these relate to global frameworks and highlighting practical considerations for managers when assessing, selecting, and implementing technology.
- A curated reference list grounding each question in authoritative guidance, evidence, and recognised best practice.

At the end of each theme, the guidance document includes a dedicated "Relevant Standards, Tools and Templates" section that is specific to the topic of that theme. These sections signpost authoritative standards, guidance documents, tools, and reference resources that provide additional context and grounding for the issues explored in each theme. Used alongside the

thematic questions, they support informed interpretation, strengthen alignment with recognised frameworks, and help practitioners situate technology-related decisions within established bodies of knowledge, without prescribing implementation approaches or processes.

Together, the themes and their supporting resources form a governance-centred guide that prioritises conservation outcomes, legitimacy, equity, and durability over technological novelty.

Guidance for Decision-Makers in Protected and Conserved Areas

The guidance is primarily designed for place-based conservation decision-makers who hold responsibility for selecting, designing, deploying and governing technologies within PCAs. As a secondary audience, the framework supports other affected stakeholders to understand what responsible, rights-based and effective conservation technology adoption looks like in practice, enabling constructive dialogue and accountability around place-based technology decisions.

Across all audiences, the guidance emphasises inclusive approaches that recognise and empower women, youth, Indigenous Peoples, and local communities as rights-holders, knowledge-holders, and essential partners in effective and ethical conservation. It is relevant to site-based managers and conservation organisations, Indigenous Peoples and community governance bodies, policymakers and public agencies, technology developers and providers, donors and funding organisations, as well as researchers, capacity-building institutions, and cross-sector partners working in PCAs. Together, these actors form the enabling ecosystem required to ensure that technology adoption in area-based conservation is responsible, equitable, and aligned with global biodiversity goals.

The guidance is intentionally modular and non-linear. Practitioners are not expected to work through every theme or question, nor to follow a predefined sequence. Instead, the document can be used to inform internal discussions, guide programme design, review existing initiatives, or support justification and documentation of technology-related decisions.

In practice, practitioners engage with the guidance by selecting relevant themes or questions, reflecting on the contextual guidance provided, and using the tables and summaries to clarify assumptions, responsibilities, and constraints. Importantly, the guidance supports decisions about when technology should be adapted, delayed, or not used, enabling decision-makers to prioritise governance readiness, rights, consent, environmental sustainability, or institutional capacity over technological efficiency or speed when necessary.

Overall Contribution

The Guidance for Effective and Equitable Conservation Technology provides decision-makers with a robust, standards-aligned guide for making technology decisions that are ethical, defensible, and fit-for-purpose. By embedding technology adoption within established conservation frameworks and making governance, rights, and capacity conditions explicit, the framework enables practitioners to make clearer, more accountable decisions under real-world constraints. In doing so, it supports the responsible scaling of area-based conservation action while safeguarding rights, legitimacy, and long-term conservation outcomes.

Acknowledgements

We gratefully acknowledge the individuals, organisations and partners whose contributions informed the development of this Guidance for Effective and Equitable Area-based Conservation Technology and Innovation: Consultation Version 1.0.

This guidance document has been developed through a targeted process of dialogue, technical review and consultation with IUCN experts.

The guidance also draws on learning generated through Tech4Nature, a global collaboration between IUCN and Huawei that brings together conservation expertise, digital innovation and local leadership to support effective and equitable area-based conservation. Since 2020, Tech4Nature flagship and satellite initiatives have tested and applied a wide range of technologies across ecological and governance contexts. These experiences have informed the principles and recommendations presented throughout this guidance.

As a consultation document, Version 1.0 is intended to evolve through continued application, learning and feedback. We therefore extend our appreciation to the practitioners, partners and rights holders whose ongoing experience and insights will contribute to future iterations of this guidance.

Purpose, Scope, and Audience

Purpose of the Guidance Document

Across the conservation sector, technology and innovation are increasingly promoted as critical enablers of area-based conservation. However, despite this uptake, many place-based conservation actors have identified challenges in translating technological potential into long-term, equitable conservation outcomes (Speaker et al., 2021; Tabor et al., 2024). These challenges are magnified by growing pressure on place-based decision-makers to demonstrate results at scale by 2030. Without clear, structured guidance tailored to real governance contexts, there is a risk that technology adoption accelerates in ways that prioritise speed, visibility and innovation narratives over effectiveness, equity and long-term integrity.

A substantial body of work addresses effective area-based conservation management. This includes IUCN Standards and Guidance such as the IUCN Global Standard for Effective and Equitable Protected and Conserved Areas: Standard, Version 2.0 (IUCN Global PCA Standard) (Woodley et al., 2026) and the IUCN framework for monitoring biodiversity in protected areas and other effective area-based conservation measures (Dalton et al., 2024). Other available resources focus on the conservation technology tools and solutions available, highlighting innovative applications and their contexts. These include PANORAMA Solutions in Focus, Global Species Action Plan (GSAP) Species Conservation Knowledge, Information, Learning, Leverage and Sharing (SKILLS) platform Tech4Species page and WILDLABS. However, there remains a need for a single, coherent framework that brings together governance, rights, finance sustainability and learning specifically for conservation technology and innovation in Protected and Conserved Areas (PCAs).

The purpose of this document is to provide clear guidance for the ethical, effective, and responsible integration of digital tools, technologies, and innovations into place-based conservation efforts worldwide. It serves as a decision-making resource for practitioners in protected and conserved areas, helping them to make informed and context-sensitive choices when adopting technology.

At its core, the guidance document is committed to advancing effective area-based conservation outcomes while upholding traditional knowledge systems, respecting Indigenous rights and free, prior and informed consent (FPIC), promoting equity and inclusion, and fostering innovation that is transparent, accountable, and designed for long-term impact.

Scope of Application

This document is intended for use across a wide range of conservation settings and governance contexts grounded in area-based conservation. It applies to:

- PCAs: including national parks, nature reserves, community-conserved areas, and transboundary landscapes and seascapes.
- Other Effective Area-Based Conservation Measures (OECMs) and Indigenous and Traditional Territories (ITTs): recognising governance diversity and the importance of Indigenous stewardship.

- Species monitoring and conservation initiatives: particularly where these efforts are linked to or embedded within broader area-based conservation.
- Restoration and stewardship programmes: across both terrestrial and marine ecosystems.
- Cross-sector partnerships and technology ecosystems: where collaboration supports conservation outcomes.

The guidance applies across all governance types recognised in the IUCN Global PCA Standard (Woodley et al., 2026) and Kunming-Montreal Global Biodiversity Framework (KM-GBF) (CBD, 2022), including:

- Indigenous-led governance
- Collaborative governance
- Private protected areas
- Government-led protected areas
- Co-managed protected areas

In this guidance document, conservation technologies are understood broadly as digital, analytical or sensor-based tools and systems used to support conservation planning monitoring, decision-making, enforcement, participation and learning. This guidance addresses the full range of digital and technological domains relevant to conservation, including:

- Data collection and monitoring technologies such as remote sensing, artificial intelligence (AI)-enabled tools, and Internet of Things (IoT) devices.
- Data governance and ethical data use, with attention to equity and rights-based approaches.
- Emerging technologies including blockchain, digital identities, gamification, and smart contracts.
- Enabling environments that support the responsible adoption, scaling, and sustainability of technology.

Primary Audiences

The guidance is designed to support actors involved in conservation technology decision-making, implementation and governance within place-based conservation contexts, recognising that responsibility over conservation technology vary across governance arrangements.

Primary audiences are place-based conservation decision-makers who hold responsibility for selecting, designing, deploying and governing technologies within PCAs. Based on governance arrangements, these actors include:

- PCA managers and site-based staff responsible for day-to-day decision-making.
- Conservation non-government agencies (NGOs) and networks coordinating programmes and partnerships within PCAs.
- Indigenous Peoples and local communities, as rights-holders, governance actors (decision-makers), and knowledge-holders.
- National and sub-national policy-makers and agencies overseeing PCA governance.
- Technology developers, innovators, and providers working in or with conservation organisations.
- Donors, investors, and funding organisations supporting conservation and technology innovation.

As a secondary audience, the guidance supports other affected stakeholders to understand what responsible, rights-based and effective conservation technology adoption looks like in practice, enabling constructive dialogue and accountability around place-based technology decisions.

Across all audiences, the guidance emphasises inclusive approaches that empower women, youth, Indigenous Peoples, and local communities, recognising their vital contributions to effective, ethical conservation and responsible technology adoption.

Together, these audiences represent the spectrum of actors needed to ensure that technology adoption in PCAs is ethical, effective, and aligned with global biodiversity goals.

Using the Framework

Modularity and Use Pathways

The guidance document has been designed as a modular resource. Each thematic section can be used independently or in combination, depending on organisational priorities, user needs, and conservation contexts. This structure ensures flexibility and usability across diverse settings while maintaining coherence with global biodiversity targets and recognised best practice standards.

The guidance can be applied at different levels of action, from leadership and strategic planning to operational practice and field-level decision-making. It is also structured to feed directly into capacity-building platforms such as the GSAP SKILLS platform, ensuring that its content can be adapted into accessible training resources, learning modules, and practical tools for organisations and practitioners.

The guidance supports multiple pathways of use, including:

- Self-guided exploration and organisational reflection
- Integration into online learning modules and bite-sized courses on the GSAP SKILLS platform.
- Embedding within organisational policies, partnerships, and decision-making processes

By drawing on the guidance, users can:

- Support implementation of the KM-GBF, with emphasis on Targets 1–4 and an explicit focus on Target 3 (30x30).
- Address common challenges in PCAs, including governance, equity, adaptive management, and technology adoption, while aligning with the IUCN Global PCA Standard.
- Strengthen rights-based approaches to the governance and management of conservation technologies applied in OECMs and ITTs.
- Guide the ethical, responsible, and effective adoption of technology in alignment with global best practice and local contexts

Core Themes

The *Core Themes* of this guidance document are grounded in globally recognised principles of effective and equitable conservation practice. They reflect the values of inclusive governance, rights-based approaches, adaptive management, and ethical technology adoption. Together, they provide a foundation for planning, decision-making, governance, and community participation in the use of technology across diverse conservation contexts.

Each theme is designed to support structured thinking and informed decision-making about the use of technology in conservation. The guidance document provides guiding questions, insights, strategic actions, and case study examples to help users assess readiness, identify risks, recognise opportunities, and select context-appropriate pathways. The themes reinforce values of rights-based governance, equity and inclusion, and respect for Indigenous and local knowledge systems. They promote ethical and sustainable approaches to technology adoption that can be applied across diverse governance contexts.

The guidance is modular and does not require engagement with all seven Core Themes at once. Users can focus on the area's most relevant to their responsibilities while also encour-

aging cross-sector collaboration and holistic approaches. Some users may wish to follow the entire pathway, from initial technology selection through to long-term sustainability and impact. Others may prefer to focus on specific themes that address their immediate needs, expand to others over time and draw on complementary training and resources through the IUCN GSAP SKILLS Platform. The guidance is intended to be revisited, supporting adaptive use as contexts, challenges and opportunities evolve.

Relationship to Other Frameworks, Standards, and Initiatives

This guidance document is designed to complement and reinforce existing global commitments rather than duplicate them. It translates high-level standards into practical pathways for conservation technology adoption, helping practitioners connect global objectives with site-level realities. Its alignment with the KM-GBF is central, particularly Target 3 (30x30), while also supporting Targets 1–4 and broader rights-based and equitable governance goals. It is consistent with the IUCN Global PCA Standard (Woodley et al., 2026), the Nagoya Protocol on Access and Benefit-Sharing (CBD, 2011), and guidance on OECMs and territories and areas conserved by Indigenous Peoples and local communities (ICCAs) (Jonas and Woodley, 2024; Stevens et al., 2024), ensuring that technology adoption is firmly rooted in equity, legitimacy and rights.

The guidance also provides a bridge to delivery mechanisms such as the IUCN GSAP SKILLS Platform, where its modular content will be translated into accessible training and capacity-building resources. It further reflects Convention on Biological Diversity (CBD) voluntary guidelines and established best practice on ethical and responsible technology use. In this way, it ensures coherence with global standards while offering practitioners clear, context-sensitive guidance for implementation.

References

Convention on Biological Diversity (CBD) (2022) Kunming-Montreal Global Biodiversity Framework: Decision 15/4 CBD/COP/DEC/15/4 [online]. Montreal: Convention on Biological Diversity. Available at: https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf.

Dalton, D., Berger, V., Kirchmeir, H., Adams, V., Botha, J., Halloy, S., Hart, R., Švara, V., Torres Ribeiro, K., Chaudhary, S. & Jungmeier, M. (2024). A framework for monitoring biodiversity in protected areas and other effective area-based conservation measures: Concepts, methods and technologies. IUCN WCPA Technical Report Series No. 7, Gland, Switzerland: IUCN.

Jonas, H. D., Wood, P. & Woodley, S., Volume Editors (2024). Guidance on other effective area-based conservation measures (OECMs). IUCN WCPA Good Practice Series, No.36. Gland, Switzerland: IUCN.

Speaker, T., O'Donnell, S., Wittemyer, G., Bruyere, B., Loucks, C., Dancer, A., Carter, M., Fegraus, E., Palmer, J., Warren, E. & Solomon, J. (2022). A global community-sourced assessment of the state of conservation technology. Conservation Biology, vol. 36, article e13871.

Tabor, K.M., Stavros, N., Biehler, D., Castillo-Villamor, L.C., Mahmoudi, D., Moreno Amado, L.M. and Holland, M.B. (2024). 'Digital equity in a crowded tool space: Navigating opportunities and challenges for equitable implementation of conservation technologies', Conservation Science and Practice, 7, e13279.

Woodley, Stephen, Joanne Wilson, Jonas Geldmann, Marc Hockings, Charlotte Karibuhoye, Paola Mejia, Florence Palla, Petch Manopawitr and Nadine Seleem. (2026). IUCN Global Standard for Effective and Equitable Protected and Conserved Areas: Standard, Version 2.0.

Tech4Nature Brazil © IUCN 2025

Introduction

Understanding the Context

The adoption of technology in conservation does not occur in isolation. It is shaped by systemic, infrastructural, and cultural dynamics that determine whether digital tools can deliver on their promise. Recognising these dynamics is essential before introducing new systems, platforms, or devices.

Key challenges include:

- Limited infrastructure such as electricity, devices, and mobile networks, which continues to restrict access in remote or resource-constrained landscapes.
- Barriers of language, literacy, and cultural mismatch, where training formats and platform interfaces fail to reflect local users and lead to exclusion.
- Weak maintenance pathways, where devices are unsuited to harsh environmental conditions or lack local repair capacity.
- Governance misalignment, when technologies are deployed outside established decision-making processes in Protected and Conserved Areas (PCAs), Other Effective Area-Based Conservation Measures (OECMs), or Indigenous and Traditional Territories (ITTs), creating mistrust and community resistance.
- Donor and market pressures that favour novelty and rapid rollout over co-design, iteration, and the integration of traditional knowledge.
- Emerging risks in data governance, including lack of transparency, absence of informed consent, and inadequate benefit-sharing, which undermine trust and conflict with principles such as the Nagoya Protocol and the CARE Principles for Indigenous Data Governance.

Global standards consistently emphasise that technology must be applied in ways that are place-based, rights-based, and governance-appropriate. The Kunming–Montreal Global Biodiversity Framework (KM-GBF) highlights this in its call for equitable and effective governance of expanded conservation areas under Target 3 (30x30). This guidance document responds by offering principles and pathways that help practitioners navigate these dynamics and adapt technology adoption to local realities.

Before You Begin: Is Technology the Right Fit?

This guidance document is designed to support practitioners who are considering the use of technology in their work. However, not every conservation challenge requires a technological solution. Taking time to reflect before investing in new tools can prevent wasted resources and ensure that efforts remain aligned with conservation goals.

Start by asking yourself:

- What is the primary conservation objective you are trying to achieve?
- What specific challenges are preventing progress toward that objective?

- Are these challenges linked to communication, monitoring, data, transparency, participation, funding, or governance?
- Could technology provide a meaningful pathway to address these issues, or would efforts be better directed toward strengthening governance, partnerships, or ecological processes through non-digital means?

If the challenges are connected to areas where digital solutions can add value, this document provides structured guidance to help assess readiness and support ethical, effective, and context-appropriate adoption. If the challenges lie elsewhere, it may be more effective to focus on non-technological strategies before considering digital tools.

Once technology is identified as a potential enabler, the seven *Core Themes* provide step-by-step pathways to help practitioners plan, implement, and evaluate adoption in line with global standards. It is also important to consider how any new tools will connect with existing systems to avoid fragmentation and strengthen conservation strategies over the long term.

Tech4Nature Spain by Gemma Miralda © AP Content Services for Huawei 2026

Tech4Nature Brazil © IUCN 2025

Theme 6: Financing Conservation Technology Sustainably

Framing and Relevance

This theme provides practical guidance to help practitioners think clearly and strategically about how conservation technologies are financed over time. It moves beyond a focus on procurement to consider the full costs associated with technology use, including training, staffing, power, connectivity, data management, maintenance, upgrades, and eventual replacement or disposal. The theme encourages decision-makers to examine whether funding models support long-term management needs, or whether technology choices are being shaped by short-term funding cycles or innovation trends rather than conservation priorities.

The theme also highlights that sustainable financing depends on alignment, transparency, and equity. It guides organisations to consider how funding models, partnerships, and financing agreements recognise contributions, distribute costs and benefits, and support adaptation as contexts change. By drawing attention to governance processes, participatory decision-making, and clear financial arrangements, the theme supports financing approaches that are robust, credible, and fair. Applied across Protected and Conserved Areas (PCAs), Other Effective Area-Based Conservation Measures (OECMs), and Indigenous and Traditional Territories (ITTs), this guidance helps ensure that technology investments strengthen legitimacy and long-term sustainability. In doing so, it supports effective and equitable management under Kunming–Montreal Global Biodiversity Framework (KM-GBF) Target 3 and reinforces transparency and accountability in line with KM-GBF Target 19 and relevant IUCN Global Standard for Effective and Equitable Protected and Conserved Areas: Standard, Version 2.0 (IUCN Global PCA Standard) requirements (CBD, 2022; Woodley et al., 2026).

This theme will help you

- Reflect on the full lifecycle costs of technologies, including hidden and recurrent expenses.
- Consider how funding models align with conservation strategies, governance contexts, and community rights.
- Understand how costs, benefits, and responsibilities are shared among funders, partners, communities, and rights-holders.
- Explore financing approaches that balance innovation with continuity and allow technologies to evolve as conditions change.
- Promote transparent cost reporting and financing agreements that strengthen accountability and resilience.

Key Questions for Practitioners

1. What financial resources are available for this tool not just for purchase, but for long-term operation and maintenance?
2. Does your funding model align with your technology strategy?
3. What are the expected cost areas across the full lifecycle of this technology?
4. How can costs and benefits of conservation technologies be distributed fairly and transparently among funders, partners, and communities?
5. Are your funders and partners aligned with your long-term goals for technology sustainability and adaptation?

> ***Question 1: What financial resources are available for this tool not just for purchase, but for long-term operation and maintenance?***

Overview

Conservation technologies are often introduced with strong enthusiasm but without adequate financial planning for their long-term use. Many budgets stop at procurement, covering the initial purchase of hardware or software while leaving out recurring costs such as power supply, training, data management, connectivity, repairs, licence renewals, and eventual disposal. Without lifecycle planning, technologies become stranded investments. Underfunded maintenance, limited operational budgets, and weak capacity investment constrain effective use of conservation technologies and reduce overall management effectiveness (IUCN ESARO, 2020).

The financial challenge is particularly acute in protected and conserved areas, OECMs, and ITTs, where budgets are often constrained and supporting infrastructure is limited. Conservation technologies such as drones, camera traps, and sensor networks require sustained investment beyond initial purchase, including funding for spare parts, reliable power supply, data management, and skilled personnel. In practice, technology performance often declines over time when these long-term operational and maintenance needs are not fully anticipated at the planning stage. While external funding commonly supports initial procurement, recurrent costs such as consumables, repairs, software updates, and staff training are frequently overlooked or under-resourced, creating vulnerabilities that can limit sustained use and effectiveness.

Financial sustainability is not only about covering bills, but also about resilience. Technologies that are open-source, modular, or locally repairable reduce dependency on external vendors and lower lifetime costs, while proprietary systems with high licensing fees or closed repair systems can lock organisations into unsustainable dependency cycles. The IUCN Global Standard for Nature-based Solutions requires that economic viability is assessed as part of intervention design (IUCN, 2020), while the CMP Open Standards emphasise the importance of assessing financial feasibility and long-term sustainability as integral components of conservation planning, alongside ecological objectives and monitoring (CMP, 2025). Without these provisions, organisations risk undermining both biodiversity and finance mechanisms such as carbon credits or payments for ecosystem services, which depend on reliable technology verification.

Limited financial transparency further compounds these challenges. Many conservation initiatives do not clearly document or communicate the full lifecycle costs associated with technology deployment, particularly ongoing operational and maintenance expenditures. Where these costs are not made explicit, managers and funders face difficulties in assessing long-term affordability, cost-effectiveness, and financial sustainability. This lack of clarity weakens accountability to both communities and donors and reduces opportunities for learning and informed decision-making across projects and programmes. The KM-GBF Target 19 emphasises transparent and accountable mobilisation of biodiversity finance (CBD, 2022), while

the Planning-Monitoring-Reporting-Review (PMRR) cycle reinforces the importance of linking planning, monitoring, reporting, and review. Transparent financial planning helps organisations make informed decisions, demonstrate accountability and reduce the risk of technologies failing because ongoing costs were not anticipated.

Finally, international frameworks underline that financial planning must also account for environmental costs. Digital systems often carry hidden ecological and financial burdens across their full lifecycle, including impacts associated with rare earth mineral extraction, energy intensive data processing, and end of life disposal and electronic waste (e-waste) management. Recognising and planning for these costs ensures that technology investments remain environmentally responsible as well as financially viable over time. Lifecycle assessments are therefore recommended to capture these costs and ensure technologies are both financially and environmentally sustainable. Aligning with these requirements demonstrates that conservation organisations are not only accountable to funders but also to the ecosystems and communities who bear the externalities of poorly planned technology use.

Action

1. Conduct lifecycle costing and plan for long-term financial needs

Lifecycle costing must be standard practice for every conservation technology project. Plan for modular, locally repairable builds and renewable power from day one, as field trials of low-cost Internet of Things (IoT) sensor networks demonstrate that solar-powered, off-the-shelf designs can operate autonomously in remote sites while reducing reliance on frequent site visits and external power infrastructure, supporting more cost-efficient long-term monitoring (Mitchell et al., 2024). This means accounting for procurement, staffing, energy, connectivity, maintenance, training, upgrades, licences, repairs, and disposal.

Templates from the UNDP Biodiversity Finance Initiative (BIOFIN) provide structured tools for identifying one-time and recurring costs and for projecting financial needs over multi-year planning periods, reducing the risk that long-term obligations are overlooked during budgeting and planning processes (Cruz-Trinidad et al., 2024). Consistent with the CMP Open Standards, considerations of financial feasibility and long-term resource requirements should be integrated into conservation planning and revisited through ongoing monitoring, learning, and adaptation (CMP, 2025). For OECMs and similar contexts, check coverage against a simple cost set that includes establishment, operational, core institutional, opportunity, damage, and transactional costs, and keep the analysis on file linked to IUCN Global PCA Standard evidence folders. Place cost commitments and lifecycle budgets under IUCN Global PCA Standard Criterion 3.1 to demonstrate planning and resource adequacy and convert the main cost drivers into indicators tracked under Criterion 3.7. Use the IUCN Biodiversity Monitoring Framework Sections 7.2 and 6.5 to structure indicator selection, assign responsibilities, and guide the review cycle so financial and maintenance performance can be tracked consistently over time. Record how rights-holders and stakeholders informed technology costing and priorities under IUCN Global PCA Standard Criteria 1.1 and 1.2, and document related socio-economic considerations and trade-offs under Criterion 2.1.

2. Integrate technology costs into operational budgets and financial reporting

Technology costs should be embedded within organisational budgets and donor proposals as core operational expenditure, rather than treated as optional or one-off additions. WWF Nepal's tiger monitoring programme illustrates how conservation technologies can be sustained when they are integrated into ongoing programme budgets that support ranger operations, monitoring activities, and capacity building, rather than relying solely on initial donor-funded equipment purchases (WWF Nepal, 2020).

As with salaries or vehicle maintenance, technology should be planned as part of the oper-

ational backbone of conservation. Transparent reporting of these costs ensures credibility and aligns with KM-GBF Target 19 on resource mobilisation and financial transparency, and Target 20 on capacity-building, knowledge transfer, and technology cooperation, which together call for sustained, transparent, and well-resourced financing systems that strengthen conservation capacity (CBD, 2022). IUCN Global PCA Standard Criterion 3.1 requires evidence of adequate financial resources to maintain management functions, with ongoing performance and financial continuity tracked under Criterion 3.7, ensuring financial transparency and accountability consistent with Criterion 1.3 (Woodley et al., 2026).

Maintain an evidence file that includes supplier costed offers or lifecycle assessments, signed extended producer responsibility and take-back clauses, budget lines for operations, maintenance, and refresh cycles, training records, procurement policy excerpts, quarterly spend-versus-plan reports, and indicator dashboards linked to IUCN Global PCA Standard Criteria 3.1 and 3.7. Doing so strengthens the implementation focus described in the Target 3 '30x30' Guide by linking technology finance to the adequate resourcing, effective management, and routine reporting required for achieving equitable implementation of KM-GBF Target 3 (WWF and IUCN WCPA, 2023).

3. Use procurement to improve long-term affordability and resilience

Procurement choices also shape long-term financial sustainability. Open-source, modular, and locally repairable systems lower total costs and reduce vendor lock-in, while energy-efficient or solar-powered tools reduce dependence on costly or unreliable infrastructure. The IUCN Global Standard for Nature-based Solutions (NbS) requires that economic viability is assessed as part of the design of NbS, reinforcing the principle that interventions should be economically as well as ecologically sustainable (IUCN, 2020). Aligning procurement with these principles helps prevent stranded investments.

Organisations should document how procurement supports capacity, such as availability of spares, local repair skills, and training, and how it supports enabling infrastructure such as power and connectivity, within their IUCN Global PCA Standard dossier under Criterion 3.1 and reflect any social or economic implications such as local service contracts in Criterion 2.1.

Establish a contingency reserve and refresh triggers for critical technologies and record the rules and amounts under IUCN Global PCA Standard Criterion 3.1 so funding is available before failure. This aligns with the Target 3 '30x30' Guide, which expects sites to be adequately resourced and managed through participatory and transparent processes to ensure equitable implementation of KM-GBF Target 3 (WWF and IUCN WCPA, 2023).

4. Secure long-term financing and engage funders in lifecycle thinking

Donors and funders must also be engaged differently. Many underestimate the full cost of technology and focus only on purchase. Experience from projects supported by Brazil's Amazon Fund shows how donor financing frameworks can support longer-term technology use when funding provisions explicitly allow for operational capacity, training, monitoring systems, and sustained implementation beyond initial procurement (BNDES, 2021).

Practitioners should provide detailed cost frameworks to secure recognition that operation, training, and maintenance are legitimate expenses. Conservation trust funds and other long-term financing mechanisms can be structured to support ongoing operational and management costs, including monitoring and reporting functions, helping safeguard conservation capacity over time (Bath et al., 2020). Ensure that multi-year agreements cover refresh cycles to avoid reliance on one-off injections of funding.

Use KM-GBF Target 19 and Target 20 to justify multi-year agreements that cover refresh cycles and operations and maintenance, then log those agreements and allocations as adequacy evidence under IUCN Global PCA Standard Criterion 3.1. If funding interruptions create serious operational or management risks, re-

cord those as threats under IUCN Global PCA Standard Criterion 2.4 to ensure they are visible in risk registers and mitigated through planning and resourcing under Criterion 3.1. The Target 3 '30x30' Guide highlights the scale and duration of finance required for equitable implementation of KM-GBF Target 3, requiring that finance that is sustained over long timeframes. (WWF and IUCN WCPA, 2023) Long-term financing mechanisms such as conservation trust funds are designed to provide this continuity and are therefore well suited to meeting these needs (Bath et al., 2020).

5. Manage environmental costs, financial risks and accountability

Financial planning should account for the full environmental and lifecycle impacts of technology. Apply lifecycle thinking when procuring and operating digital infrastructure so that energy use, storage requirements, and end-of-life impacts are considered from the outset. Guidance such as the United Nations Environment Programme's sustainable procurement framework for data centres and servers supports assessment of environmental impacts across the full lifecycle, helping organisations identify sustainability risks and resource implications that may otherwise be overlooked (UNEP, 2025). Record technology pressures such as rising energy costs, frequent battery replacement, and e-waste handling in the threats register so they are visible in risk management under IUCN Global PCA Standard Criterion 2.4, but only where these environmental or operational pressures pose genuine threats to the site's major values or management continuity. Resource the response in budgets and staffing under IUCN Global PCA Standard Criterion 3.1 to ensure adequate capacity for mitigation, link those resources to concrete management actions under Criterion 3.3 so threats are actively addressed, and make progress transparent and auditable by tracking a focused set of performance indicators under Criterion 3.7 through the site's monitoring and evaluation system. Use the IUCN Biodiversity Monitoring Framework Sections 7.2 and 6.5 to select a small set of finance and maintenance indicators and schedule regular reviews so time-series data are maintained and trade-offs between cost, performance, and sustainability can be reassessed (Dalton et al., 2024).

Uphold equity and accountability in how funds are planned and spent. Make budgets gender-responsive and ensure that financial plans do not place disproportionate burdens on communities, consistent with KM-GBF Targets 22 and 23 on inclusive participation, gender equality, and social inclusion (CBD, 2022). Demonstrate inclusive and legitimate decision-making under IUCN Global PCA Standard Criteria 1.1 and 1.2 and provide an accessible grievance pathway and clear public information consistent with Criterion 1.3 to ensure transparency and accountability (Woodley et al., 2026). Ensure budgets are adequately resourced and sustainable consistent with IUCN Global PCA Standard Criterion 3.1 so that financial commitments can be maintained over time. Record environmental cost pressures alongside finance risks under IUCN Global PCA Standard Criterion 2.4 only where these pose genuine threats to management or conservation outcomes, so accountability extends to ecosystems and communities that may bear externalities. Together, these provisions ensure that environmental and financial risks captured under IUCN Global PCA Standard Criterion 2.4 are not treated in isolation but are integrated with social and economic considerations under Criteria 2.1, demonstrating that procurement and financial planning sustain both ecological integrity and community wellbeing over time. Publish links in the management plan and on the site website and provide a plain language summary of technology budgets and decision makers so stakeholders can understand and question spending decisions. Include concrete indicators such as planned versus actual operations and maintenance spend and mean time to repair and set review dates in advance. Record environmental cost pressures alongside finance risks so accountability extends to ecosystems and to communities that may bear externalities.

Relevant standards and guidance:

KM-GBF Target 3 (*Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, coastal and marine areas are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures*), Target 19 (*Mobilise financial resources from all sources in an effective, timely and easily accessible manner*), Target 20 (*Strengthen capacity-building, technology cooperation, scientific and technical cooperation and knowledge transfer*), Target 22 (*Ensure participation in decision-making and access to justice and information related to biodiversity for all*), and Target 23 (*Ensure gender equality and a gender-responsive approach for biodiversity action*); KM-GBF Planning-Monitoring-Reporting-Review (PMRR) cycle (Section J, paragraph 16); IUCN Global PCA Standard Criterion 1.1 (*Demonstrate supportive legal, policy or customary framework*), Criterion 1.2 (*Ensure legitimacy and voice*), Criterion 1.3 (*Achieve transparency and accountability*), Criterion 2.4 (*Understand threats and challenges to major site values*), Criterion 2.1 (*Understand ecological, social and economic context*), Criterion 3.1 (*Develop a long-term management strategy*), Criterion 3.3 (*Implement management strategies to maintain and restore site values*), and Criterion 3.7 *(Implement monitoring, evaluation and adaptive management*); IUCN Biodiversity Monitoring Framework Section 6.5 (*Continuity risks*) and Section 7.2 (*Toolkit: Overview of the indicators*); IUCN Global Standard for Nature-based Solutions; CMP Open Standards for the Practice of Conservation; Target 3 '30x30' Guide; UNDP Biodiversity Finance Initiative (BIOFIN); and United Nations Environment Programme Sustainable Procurement Guidance for Data Centres and Servers.

Tech4Nature Türkiye © IUCN 2026

Practitioners should:

- [ ] Identify and document all costs across the full lifecycle of the technology, not just the purchase price. This includes power, connectivity, staffing, training, maintenance, upgrades, and disposal.
- [ ] Treat technology costs as core operational expenses, similar to vehicles, salaries, or field equipment, rather than as optional or short-term add-ons.
- [ ] Build multi-year budgets that cover operation, maintenance, and replacement cycles, and ensure these are reflected in management plans and funding proposals.
- [ ] Choose technologies that are energy-efficient, modular, open-source, or locally repairable to reduce long-term costs and reliance on external suppliers.
- [ ] Ensure budgets include dedicated funding for training, so staff and partners can use, maintain, and adapt technologies over time.
- [ ] Make technology costs and financial assumptions transparent and clearly documented, so managers, funders, and communities can understand long-term affordability and trade-offs.
- [ ] Track key financial and maintenance indicators, such as planned versus actual spending, downtime, and repair times, and review these regularly.
- [ ] Plan for environmental costs linked to technology use, including energy demand, battery replacement, and end-of-life disposal, alongside financial costs.
- [ ] Engage rights-holders and stakeholders when setting priorities and budgets, ensuring financial plans do not shift hidden costs or burdens onto communities.
- [ ] Secure funding arrangements that explicitly allow for ongoing operation and maintenance and record financial gaps or risks early so they can be addressed before technology use declines.

Technology Overview and Strategic Considerations

Table 6.1. A structured overview of key technology categories and associated tools that outlines how each aligns with relevant global frameworks and highlights practical considerations for managers when assessing, selecting, and implementing technology within conservation contexts.

Category	Technologies	How the technology aligns with global frameworks	Considerations for managers
Cloud hosting & data management	Google Cloud; Amazon Web Services	The IUCN Biodiversity Monitoring Framework (Section 5.2) highlights planning for storage, access, and documentation. The IUCN Global PCA Standard Criteria 2.1 and 3.1 require planning and resourcing for ongoing operations, maintenance, and staff capacity to manage information systems effectively. The KM-GBF requires sustained capacities under Section J (16) to maintain long-term data storage, access, and reporting systems.	Budget for recurring hosting, storage, access control and support; define roles, metadata standards and retention so monitoring and reporting obligations can be maintained over time.
In-situ sensor networks (O&M)	IoT Sensor Networks	The IUCN Biodiversity Monitoring Framework (Section 7.3) notes power, connectivity, and maintenance requirements for sensor deployments. The IUCN Global PCA Standard Criteria 3.1 and 3.7 require ongoing financial and technical support for reliable monitoring and for reviewing system performance over time. The KM-GBF calls for reliable monitoring systems under Section J (16) supported by ongoing financial and technical resourcing.	Cost for power, spares, servicing cycles, connectivity and field support; include replacement schedules and technician time in multi-year budgets.
Camera-based biodiversity monitoring	Camera Traps	The IUCN Biodiversity Monitoring Framework (Section 7.3) recommends camera traps with method-specific design and servicing. The IUCN Global PCA Standard Criteria 3.1 and 3.7 require adequate resources and budgeting for long-term operation and replacement cycles, supported by periodic review of monitoring performance. The KM-GBF Target 4 anchors species indicators and calls for adequate and sustained resourcing of biodiversity monitoring systems.	Include batteries, memory cards, mounts, theft mitigation, data processing time and periodic replacements in lifecycle costs.

Category	Technologies	How the technology aligns with global frameworks	Considerations for managers
Aerial survey platforms	Drones	The IUCN Biodiversity Monitoring Framework (Section 7.3) recognises drones and associated operator, safety, and regulatory requirements. The IUCN Global PCA Standard Criteria 2.1 and 3.1 require planning, capacity, and staff competence to operate technologies safely and sustainably within budgeted maintenance cycles. The KM-GBF Target 4 supports safe and sustainable use of technology for species and habitat monitoring.	Budget for pilot training, permissions, batteries, repairs and software; plan for refresh cycles and insurance.
Bioacoustic detection	Acoustic Sensors	The IUCN Biodiversity Monitoring Framework (Section 7.3) lists acoustic sensors and emphasises servicing and power. The IUCN Global PCA Standard Criteria 3.1 and 3.7 require financial and technical resourcing to maintain reliable monitoring systems and to periodically evaluate equipment and data quality standards. The KM-GBF Target 4 links biodiversity and species monitoring to sustained data quality and maintenance standards.	Cost for microphones, housings, power packs, servicing and analysis time; plan for periodic calibration and replacements

Question 2: Does your funding model align with your technology strategy?

Overview

Conservation organisations often pursue whatever funding is available rather than seeking financing that aligns with their conservation or technology priorities. This opportunistic approach risks making adoption donor-driven rather than needs-driven, resulting in technologies that cannot be integrated or sustained. When funding and technology strategies are disconnected, organisations inherit mismatched systems that drain resources, create fragmentation, and ultimately fail to deliver meaningful conservation impact. Technologies are frequently introduced because they are fashionable, incentivised, or bundled into donor priorities rather than because they fit local context. This leads to duplication, sidelining of effective systems, and inefficiencies that weaken credibility with communities and partners. A well-aligned model, by contrast, enables organisations to select technologies that are modular, scalable, and embedded into management plans. Funders increasingly favour approaches that reduce duplication and strengthen wider systems. The KM-GBF Target 19 emphasises the importance of requiring transparent, accountable, and adequate mobilisation of financial resources to deliver sustainable conservation outcomes (CBD, 2022). The Target 3 '30x30' Guide frames delivery of KM-GBF Target 3 as dependent on effective management supported by adequate and appropriate resources established through participatory and transparent processes, meaning funding choices should align with the technology strategy rather than opportunistic availability (WWF and IUCN WCPA, 2023).

Short-term, opportunistic finance also undermines resilience. Projects that adopt tools without multi-year support often collapse once initial grants end, leaving staff without capacity and communities without functioning systems. Evidence from African protected areas shows that protection and monitoring systems weaken when they are not supported by sustained resourcing over time, highlighting how short-term or inconsistent finance can undermine long-term effectiveness (Caro and Scholte, 2007). Opportunistic cycles can also damage trust with rights-holders who see tools introduced and then abandoned. Consistent with the CMP Open Standards' emphasis on financial feasibility and long-term sustainability, aligning resource planning with anticipated needs over appropriate time horizons supports continuity of capacity, infrastructure, and partnerships across conservation initiatives (CMP, 2025). This approach underscores the importance of selecting financing instruments that align with long term strategic objectives, rather than being driven by short term funding availability.

Global frameworks and tools provide guidance for aligning funding models with technology strategies. Funding models should be designed to support the technologies they rely on, rather than treating technology as a standalone investment. The UNDP Biodiversity Finance Initiative (BIOFIN) methodology provides practical templates to link financial planning directly to conservation objectives, helping organisations cost and resource priority actions so that technology investments support strategic goals rather than operating in isolation (Cruz-Trinidad et al., 2024). The CMP Open Standards (CMP, 2025) emphasise the importance of assessing financial feasibility and long-term sustainability as integral components of conservation planning and adaptive management, while the IUCN Global PCA Standard Criterion 3.1 requires credible alignment of financial and human resources with site management objectives, with contextual understanding provided under Criterion 2.1 and performance tracking under Criterion 3.7 (Woodley et al., 2026). Together, these frameworks make clear that funding must not be an afterthought but an enabler of coherent and sustainable technology strategies. To situate funding choices in their social and economic context, the KM-GBF adds an equity dimension through Targets 22 and 23, which call for inclusive participation, gender equality, and social inclusion, ensuring that budgeting and funding models are gender-responsive and do not place disproportionate burdens on communities or Indigenous Peoples (CBD, 2022).

Action

1. Develop a technology roadmap linked to conservation objectives

Developing a technology roadmap provides a practical foundation for aligning finance with conservation priorities. Proposals and partner agreements should be linked to this roadmap and supported by a BIOFIN style budget architecture that enables multi-year funding for the full range of costs needed to sustain technology use, including training, connectivity, maintenance, and periodic upgrades (Cruz-Trinidad et al., 2024). Consistent with the CMP Open Standards' emphasis on clear objectives, alignment of actions and resources, and long-term feasibility, technology roadmaps should clearly set out objectives, timelines, and links to wider organisational strategies (CMP, 2025). Technology roadmaps should also inform resource planning so that funding and partnerships support approaches that can be embedded in organisational practice and sustained over time. Budgets should be designed in modular ways, allowing projects to start small and expand as needs evolve. This prevents stranded investments and ensures that resources match delivery capacities.

File the roadmap and budget architecture under IUCN Global PCA Standard Criterion 3.1 to demonstrate planning and resource adequacy, record any critical funding risks that could disrupt essential operations or conservation delivery under Criterion 2.4 and define two to four alignment indicators under Criterion 3.7 using the IUCN Biodiversity Monitoring Framework Section 7.2 and Section 6.5 to protect time series and set review cadence (Dalton et al., 2024). Suitable indicators include the share of funding tied to the roadmap, the proportion of flexible versus restricted funds, the coverage of operations and maintenance by secure finance, and the duration match between funding and technology life.

2. Select financing mechanisms that support long-term implementation

Choosing the right financing instruments is equally critical. Conservation trust funds can provide stable, multi-year financing for long-term conservation delivery (Bath et al., 2020). Other mechanisms, such as blended finance and outcome-based contracts, may also support adaptive technology adoption when designed to cover multi-year operational needs. In Kafue National Park, multi-year financing arrangements supported law enforcement, monitoring technologies such as the Spatial Monitoring and Reporting Tool (SMART), EarthRanger, and camera traps, and the staffing required to operate them, illustrating how sustained financing instruments can reinforce accountability, coordination, and operational continuity rather than short term deployment (African Parks et al., 2022). Opportunistic grants that cover only procurement but not maintenance or training should be avoided, as they create stranded technologies and disillusioned partners.

Aligning funder choices with the technology roadmap ensures that financing strengthens organisational capacity and long-term outcomes rather than fuelling cycles of dependency. Document instrument selection criteria and the reasons for acceptance or rejection in the management plan and funding proposals and place these records in the IUCN Global PCA Standard dossier under Criterion 3.1. Where detailed threat information is needed, for example the location or severity of funding gaps that would halt critical monitoring, use Criterion 2.4 to ensure that these risks are formally recognised and linked to management responses under Criterion 3.1. Reference the Target 3 '30x30' Guide to show how technology and instrument choices support effective, well-resourced management for equitable implementation of KM-GBF Target 3 rather than one-off purchases.

3. Communicate the link between funding decisions and technology choices

Clear communication with funders is essential to maintaining alignment between finance and technology decisions. Explaining why particular technologies were selected, how they integrate with existing systems, and how they contribute to agreed conservation priorities helps build confidence and long-term support. Tools developed through the UNDP BIOFIN can

be used to show how conservation objectives, biodiversity finance flows, and planned actions are connected, making the role of technology within broader investment strategies more transparent (Cruz-Trinidad et al., 2024).

4. Monitor and review funding alignment over time

Embedding these choices within budgets, management plans, and reporting processes ensures that governance, finance, and technology decisions remain mutually reinforcing over time. Linking explicitly to KM-GBF Target 19, alongside relevant IUCN Global PCA Standard Criteria, provides external validation that organisations are meeting international expectations while serving local priorities. Publish a simple summary of technology funding allocations and decision makers consistent with IUCN Global PCA Standard Criterion 1.3. Maintain a grievance pathway for concerns about funding choices that create operational risk. Record stakeholder consultations on funding priorities under IUCN Global PCA Standard Criteria 1.1, 1.2, and 2.1 so that alignment is participatory, transparent, and context aware. Where funding alignment directly affects community livelihoods or local service delivery, include Criterion 2.1 to demonstrate that financial and technological management decisions operate within the site's social and economic context.

Relevant standards and guidance:

KM-GBF Target 19 (*Mobilise financial resources from all sources in an effective, timely and easily accessible manner*), Target 20 (*Strengthen capacity-building, technology cooperation, scientific and technical cooperation and knowledge transfer*), Target 22 (*Ensure participation in decision-making and access to justice and information related to biodiversity for all*), and Target 23 (*Ensure gender equality and a gender-responsive approach for biodiversity action*); IUCN Global PCA Standard Criterion 1.1 (*Demonstrate supportive legal, policy or customary framework*), Criterion 1.2 (*Ensure legitimacy and voice*), Criterion 1.3 (*Achieve transparency and accountability*), Criterion 2.4 (*Understand threats and challenges to major site values*), Criterion 2.1 (*Understand ecological, social and economic context*), Criterion 3.1 (*Develop a long-term management strategy*), and Criterion 3.7 (*Implement monitoring, evaluation and adaptive management*); IUCN Biodiversity Monitoring Framework Section 6.5 (*Continuity risks*) and Section 7.2 (*Toolkit: Overview of the indicators*); CMP Open Standards for the Practice of Conservation; Target 3 '30x30' Guide; UNDP Biodiversity Finance Initiative (BIOFIN); and Conservation Trust Funds guidance (Bath et al., 2020).

Practitioners should:

- ☐ Set out a simple technology plan that explains which tools are needed, when they will be used, and how they support wider conservation and management goals.
- ☐ Check that current and proposed funding matches this technology plan, rather than accepting funding just because it is available.
- ☐ Make sure budgets cover how long the technology will actually be used, including training, day-to-day operation, maintenance, updates, and staff time, not only purchase.
- ☐ Be cautious of funding that only supports short-term use, as this can leave technologies unused or broken once the project ends.
- ☐ Where possible, use funding arrangements that provide support over several years, especially for technologies that need ongoing care and operation.
- ☐ Choose funding that allows technologies to work with existing systems, rather than creating separate or duplicate tools that increase workload and costs.
- ☐ Clearly record why certain funding was accepted or declined, and how these decisions support both conservation goals and technology needs.
- ☐ Keep track of a few simple checks, such as whether funding lasts as long as the technology, whether running costs are covered, and whether funding follows the agreed plan.
- ☐ Explain funding and technology choices clearly to funders, including why the tool was chosen, how it fits local needs, and what it costs to keep it working.
- ☐ Include rights-holders and other stakeholders in funding decisions where technology affects daily work or local services, and make sure decisions are open, clear, and fair.

Technology Overview and Strategic Considerations

Table 6.2. A structured overview of key technology categories and associated tools that outlines how each aligns with relevant global frameworks and highlights practical considerations for managers when assessing, selecting, and implementing technology within conservation contexts.

Category	Technologies	How the technology aligns with global frameworks	Considerations for managers
Decision-support for strategy & trade-offs	Miradi; InVEST; TESSA	The IUCN Biodiversity Monitoring Framework (Section 2.4) links the use of decision-support tools to the planning cycle, ensuring monitoring and financial considerations are integrated from scoping through implementation and evaluation. The KM-GBF Target 1 requires integrated planning and evidence-based financial decision-making to align technology and strategy. The IUCN Global PCA Standard Criteria 2.4, 3.1 and 3.7 require that management planning, resource capacity, and adaptive financial review are integrated to ensure credible, evidence-based implementation.	Use the tools to define objectives, indicators, scenarios, and evidence so financing choices can be tied to planned results and reporting cycles.
Ecosystem services costing & scenarios	Costing Nature	The IUCN Biodiversity Monitoring Framework (Section 2.4) highlights the role of analytical and decision-support tools in evaluating management options and trade-offs, linking financial and technical planning to evidence-based decision-making. The KM-GBF Target 1 promotes evidence-based planning and financial alignment to support biodiversity outcomes. The IUCN Global PCA Standard Criteria 2.4 and 3.1 require that financial planning and costing scenarios are explicitly linked to management objectives and implementation capacity to maintain operational feasibility and accountability.	Document assumptions and costed scenarios; show how selected financing supports the chosen option set and indicators.

Category	Technologies	How the technology aligns with global frameworks	Considerations for managers
PAME for resourcing alignment	IMET	The OECMs Guidance recognises PAME tools such as IMET for tracking site management effectiveness and aligning performance with available capacity and resources. The IUCN Global PCA Standard Criteria 2.4, 3.1 and 3.7 require that management planning, resource mobilisation, and adaptive monitoring cycles are maintained to align finance with performance outcomes. The KM-GBF Target 19 calls for mobilising and aligning finance with management effectiveness and conservation performance.	Link budgets to gaps identified by IMET; use outputs to justify capacity and monitoring resources required by IUCN Global PCA Standard and KM-GBF plans.
PAME for resourcing alignment	METT	The OECMs Guidance references METT as a PAME tool for assessing management effectiveness and aligning resourcing with performance outcomes. The IUCN Global PCA Standard Criteria 2.4, 3.1 and 3.7 require that management planning, resource capacity, and operational monitoring are coordinated to support adaptive financial management. The KM-GBF Target 19 reinforces finance mobilisation and alignment with adaptive management priorities.	Tie funding lines to METT findings; schedule periodic reviews so finance follows management priorities and reporting needs.

Question 3: What are the expected cost areas across the full lifecycle of this technology?

Overview

Planning for technology costs requires more than listing the purchase price. The lifecycle of any tool includes procurement, installation, training, operation, maintenance, upgrades, and disposal. When budgets cover only procurement, financial gaps inevitably emerge, leading to stalled projects, broken equipment, and staff unable to carry out core functions. Conservation technologies should be viewed as long term management assets rather than short term purchases, and that cost sufficiency is demonstrable and monitored over time.

Understanding the full lifecycle cost of conservation technologies is essential because many resource requirements extend well beyond initial procurement. European Commission cost estimation guidelines emphasise the need for full lifecycle costing to ensure that operating, replacement, and end-of-life costs such as energy, connectivity, technical support, and decommissioning are identified and planned from the outset, rather than overlooked at the design stage (CSIL, 2019). Evidence from Kafue National Park shows that effective camera trap and patrol-based monitoring depended not only on equipment purchase but on sustained investment in staffing, patrol operations, data management, coordination platforms, and logistical support, illustrating how lifecycle costs extend well beyond procurement and must be planned over multiple years to maintain continuity (African Parks et al., 2022). Failing to plan for these categories leaves organisations unprepared when systems reach the end of their usable life.

Weak financial planning undermines both credibility and sustainability, particularly in PCAs, OECMs, and ITTs, where recurring resources are already constrained. The KM-GBF Target 19 reinforces the need for transparent reporting of all biodiversity-related expenditures, while the Target 3 '30x30' Guide highlights the importance of adequate and appropriate resourcing for effective and equitable conservation management (CBD, 2022; WWF and IUCN WCPA, 2023).

Lifecycle costs are not static; they evolve over time. Over time, costs associated with capacity building, licensing, subscriptions, and connectivity may change, and these assumptions should be revisited through ongoing planning and learning processes, consistent with the CMP Open Standards' emphasis on feasibility and adaptation (CMP, 2025). If financial plans do not anticipate these changes, organisations risk losing capacity just as technologies should be delivering the greatest value. The CMP Open Standards emphasise that considerations of financial feasibility and long-term sustainability should be integrated into adaptive management, with cost and resource assumptions revisited alongside ecological evidence as part of ongoing learning and decision-making (CMP, 2025).

Environmental costs are equally important. Hidden financial and ecological costs can accumulate across the digital lifecycle, from mineral extraction and energy use to end of life disposal and e-waste management. The IUCN Global Standard for NbS requires that NbS deliver both ecological integrity and economic viability (IUCN, 2020). Taken together, these principles support the consideration of environmental and financial costs over time when selecting and deploying technologies. Where these are ignored, conservation risks being undermined by the very tools meant to strengthen it.

Finally, transparency in lifecycle costing is a credibility issue. A 2022 review found that most conservation projects do not publish clear information on how much they cost (White et al., 2022). This makes it difficult for others to learn from these projects, compare approaches, or judge whether investments are good value for money. The Target 3 '30x30' Guide stresses that cost-effectiveness and sustainability must be demonstrated in reporting to funders and partners as part of equitable and accountable implementation of KM-GBF Target 3 (WWF and IUCN WCPA, 2023). Clear, transparent costing helps practitioners secure sustained support, avoid disputes, and ensure that conservation

finance flows are based on realistic long-term commitments. IUCN Global PCA Standard expects participation and transparency in governance under Criteria 1.1, 1.2, and 1.3 (Woodley et al., 2026). This means that decisions about cost coverage and procedures for handling complaints should be visible to stakeholders.

Action

1. Identify and document all lifecycle cost categories

Lifecycle costing begins with mapping all areas of expenditure, both visible and hidden. Use whole-life costing templates to surface hidden spend, long-term camera-trap programmes report that storage, power, spares, and device replacement can absorb nearly half of total costs within five years, which must be budgeted alongside procurement. Practitioners must identify purchase, licences, and installation costs alongside energy, connectivity, staff training, spare parts, technical support, and waste management.

European Commission cost estimation guidance provides structured frameworks and categories to ensure that operating, replacement, and end-of-life costs are identified rather than overlooked at the planning stage (CSIL, 2019). The UNDP BIOFIN methodologies complement this by offering practical tools for linking these cost categories to organisational budgets and longer-term financial planning processes (Cruz-Trinidad et al., 2024).

IUCN Global PCA Standard Criterion 3.1 requires detailed financial planning that demonstrates sufficiency of resources for site management, with performance and continuity tracked under Criterion 3.7 (Woodley et al., 2026). The full cost map should be recorded in the IUCN Global PCA Standard dossier, showing how commitments and allocations are organised under Criterion 3.1. Any significant financial pressures or cost risks that could disrupt operations or threaten conservation outcomes should be noted under IUCN Global PCA Standard Criterion 2.4 so that they are visible within the site's risk picture and can be addressed through management planning. Two to four performance indicators can then be defined under IUCN Global PCA Standard Criterion 3.7 using the IUCN Biodiversity Monitoring Framework Sections 7.2 and 6.5 to guide regular review and demonstrate that financial continuity is being maintained over time (Dalton et al., 2024; Woodley et al., 2026). Where useful, practitioners can refer to the six recognised categories of costs associated with OECMs, namely establishment, operational, core institutional, opportunity, damage and transactional costs, to support transparent financial planning and ensure that long term management and monitoring needs are properly considered (Jonas and Woodley, 2024).

2. Integrate lifecycle costs into budgets, management plans and financing strategies

Once identified, lifecycle costs should be integrated into budgets, donor proposals, and site management plans. Treating technology as part of essential infrastructure like vehicles or ranger salaries ensures it is not sidelined as an add-on. The IUCN Global Standard for NbS requires that interventions demonstrate economic viability, including identification of costs and benefits over time and justification of cost-effectiveness relative to alternative solutions, in order to support durable outcomes and long-term sustainability (IUCN, 2020). Similarly, the CMP Open Standards emphasise the importance of assessing financial feasibility and long-term sustainability as integral components of conservation planning and adaptive management (CMP, 2025). Integration ensures that financial commitments are visible and linked to conservation outcomes, strengthening accountability to funders and partners. Place these financial commitments and the cost benefit rationale under IUCN Global PCA Standard Criterion 3.1. Prepare a clear public summary of technology budgets and decision makers consistent with IUCN Global PCA Standard Criterion 1.3 so that stakeholders can understand and question spending decisions.

3. Plan for changing costs and long-term operational requirements

Plan technology budgets as dynamic, multi-year commitments rather than fixed pilot

costs. Anticipate that training will need to be repeated as staff rotate, that operational support and coordination requirements will grow as systems scale, and that technologies will require ongoing maintenance and integration over time. Experience from large, multi-partner protected areas shows that tools such as SMART patrol systems, camera trap monitoring, and real-time coordination platforms only remain effective when financial planning explicitly covers recurring staffing, training, and operational support beyond initial deployment (African Parks et al., 2022). The CMP Open Standards emphasise revisiting assumptions about costs, resources, and feasibility through adaptive management processes, alongside ecological performance data, so that learning and decision-making remain responsive over time (CMP, 2025). Aligning these projections with KM-GBF Target 19 ensures that reporting captures not only upfront expenditure but also the evolving financial needs across the technology lifecycle, consistent with the requirement for long-term and transparent resource mobilisation. Define clear triggers for refresh and contingency release and document them in budgets and procedures under IUCN Global PCA Standard Criterion 3.1. File consultations with rights holders and stakeholders that informed these decisions under Criteria 1.1, 1.2 and 2.1 so that affordability, equity, and context are properly reflected.

4. Include environmental costs and lifecycle sustainability considerations

Environmental costs should be included as standard. Lifecycle assessment approaches can help organisations identify the often-overlooked environmental costs associated with energy consumption, raw material use, and end-of-life disposal of technologies. Applying these approaches supports more informed decision-making by anticipating ecological risks, reducing the likelihood of e-waste accumulation, and informing more sustainable procurement choices. While the IUCN Global Standard for NbS does not prescribe lifecycle assessment as a specific method, it requires that interventions demonstrate economic viability and avoid undermining ecosystem integrity by identifying costs, benefits, and risks over time and managing unintended environmental impacts (IUCN, 2020). Integrating environmental cost considerations into planning and budgeting also aligns with KM-GBF Target 19, demonstrating viability in both ecological and financial terms (CBD, 2022). Sites should document environmental cost pressures such as rising energy use, frequent battery replacement, and disposal needs within their threat and risk assessments, consistent with IUCN Global PCA Standard Criterion 2.4 (Woodley et al., 2026). Financial and staffing plans should then allocate resources to address these pressures, reflecting the expectations of IUCN Global PCA Standard Criterion 3.1. Managers should ensure that mitigation actions, such as energy efficiency measures, recycling systems, or responsible procurement, are embedded within operational management in line with IUCN Global PCA Standard Criterion 3.3 so that environmental and financial sustainability are advanced together. Progress should be tracked over time to demonstrate that mitigation is effective and that cost efficiencies are being realised, consistent with the performance requirements of IUCN Global PCA Standard Criterion 3.7. To maintain accountability and trust, sites should provide accessible grievance pathways, publish plain language information about how environmental costs are managed, and make these records publicly available in accordance with IUCN Global PCA Standard Criterion 1.3.

5. Report lifecycle costs transparently and support learning

Finally, lifecycle costing must be transparent. Reporting frameworks should include clear cost information so funders and partners can see how resources are used and compare different approaches. Publishing cost data supports learning and better decision-making across conservation projects (White et al., 2022). The Target 3 '30x30' Guide stresses that visibility of cost flows is essential for scaling up conservation finance and ensuring equitable, well-resourced implementation of KM-GBF Target 3 (WWF and IUCN WCPA, 2023). By providing transparent, detailed lifecycle budgets, organisations strengthen trust and secure the long-term partnerships required for sustained conservation outcomes. Reference the Target

3 '30x30' Guide in donor reports to show that cost visibility and sufficiency underpin effective management for KM-GBF Target 3. Maintain a supporting evidence file containing supplier offers, lifecycle assessments, extended producer responsibility clauses, budget lines, training records, quarterly spend-versus-plan data, and indicator dashboards to verify alignment with IUCN Global PCA Standard Criteria 3.1 and 3.7.

Relevant standards and guidance:

KM-GBF Target 19 (*Mobilise financial resources from all sources in an effective, timely and easily accessible manner*); IUCN Global PCA Standard Criterion 1.1 (*Demonstrate supportive legal, policy or customary framework*), Criterion 1.2 (*Ensure legitimacy and voice*), Criterion 1.3 (*Achieve transparency and accountability*), Criterion 2.4 (*Understand threats and challenges to major site values*), Criterion 2.1 (*Understand ecological, social and economic context*), Criterion 3.1 (*Develop a long-term management strategy*), Criterion 3.3 (*Implement management strategies to maintain and restore site values*), and Criterion 3.7 (*Implement monitoring, evaluation and adaptive management*); IUCN Biodiversity Monitoring Framework Section 6.5 (*Continuity risks*) and Section 7.2 (*Toolkit: Overview of the indicators*); OECMs Guidance; IUCN Global Standard for Nature-based Solutions; CMP Open Standards for the Practice of Conservation; Target 3 '30x30' Guide; European Commission Guidelines on Cost Estimation of Research Infrastructures (CSIL, 2019); and UNDP Biodiversity Finance Initiative (BIOFIN).

Tech4Nature Türkiye © IUCN 2026

Practitioners should:

- ☐ List all costs across the full life of the technology, not just the purchase price, including installation, training, daily use, maintenance, upgrades, and disposal.
- ☐ Include hidden and less visible costs, such as energy use, data storage, connectivity, spare parts, licences, and technical support.
- ☐ Plan for ongoing staff costs, including training new staff when roles change or turnover occurs.
- ☐ Expect costs to change over time, for example as systems scale, licences renew, or connectivity needs increase, and review these assumptions regularly.
- ☐ Treat technology as a long-term management asset, similar to vehicles or patrol equipment, rather than as a short-term project input.
- ☐ Build lifecycle costs into budgets, donor proposals, and management plans so long-term needs are clearly recognised and funded.
- ☐ Identify cost risks early, such as rising energy use or equipment failure, and record them so they can be addressed before they disrupt operations.
- ☐ Include environmental costs in planning, such as energy demand, battery replacement, and e-waste handling, alongside financial costs.
- ☐ Share clear and simple information on what the technology costs over time, so funders, partners, and stakeholders understand commitments and trade-offs.
- ☐ Review lifecycle costs regularly and adjust plans as needed, so technologies remain affordable, functional, and useful throughout their lifespan.

Technology Overview and Strategic Considerations

Table 6.3. A structured overview of key technology categories and associated tools that outlines how each aligns with relevant global frameworks and highlights practical considerations for managers when assessing, selecting, and implementing technology within conservation contexts.

Category	Technologies	How the technology aligns with global frameworks	Considerations for managers
Decentralised finance infrastructure	Blockchain	The IUCN WCPA Impact Report promotes accountability, transparency, and equitable governance, creating an enabling context for the responsible use of emerging tools in conservation finance and reporting. The KM-GBF establishes transparent and effective conservation finance mechanisms under Target 19 and Section J (16) to strengthen accountability and traceability. The IUCN Global PCA Standard Criteria 1.3 and 3.7 require transparent governance, verifiable reporting, and periodic review of financial systems to ensure accountability and stakeholder trust.	Where appropriate, use blockchain to record verifiable transactions or benefit-sharing events; define governance of keys/permissions and what is written on-chain to meet transparency expectations.

Question 4: How can costs and benefits of conservation technologies be distributed fairly and transparently among funders, partners, and communities?

Overview

The distribution of costs and benefits is central to whether conservation technologies can be sustained. When contributions are formally recognised and benefits are shared transparently, partnerships are durable, tools are maintained, and outcomes remain legitimate. Namibia's community conservancy system illustrates this through routine financial reporting and benefit distribution processes, which allow members to see who contributes, who benefits, and how resources are allocated as part of normal governance practice rather than informal promises (MEFT and NACSO, 2023).

Where responsibilities are unbalanced, local actors may be left carrying unfunded burdens, while external partners capture financial or reputational gains. This undermines both trust and long-term effectiveness. The IUCN Global PCA Standard clarifies why this balance matters for durability, emphasising that such imbalances can undermine trust, create resentment and weaken the long-term effectiveness of conservation initiatives (Woodley et al., 2026).

Within the IUCN Global PCA Standard Standards, fairness is not treated as a single criterion but as a principle woven throughout the framework (Woodley et al., 2026). Legitimacy and voice under Criteria 1.1 and 1.2 determine who participates in shaping what fairness looks like in practice. Transparency and access to grievance processes under Criterion 1.3 ensures that people can see and challenge decisions that affect them. The social and economic context described in Criterion 2.1 provides the basis for judging what is equitable in different settings, while Criterion 2.4 makes it clear that unfunded or disproportionate burdens must be recognised as pressures that can threaten conservation outcomes. Adequate and predictable resourcing, required under Criterion 3.1, links fairness to credible management, and ongoing monitoring and reporting under Criterion 3.7 ensure that the distribution of costs and benefits remains visible, balanced, and trustworthy over time.

Global agreements reinforce the importance of fair and transparent benefit-sharing. The Nagoya Protocol (CBD, 2011) establishes that benefits arising from the utilisation of genetic resources and associated traditional knowledge must be shared fairly and equitably with providers. For conservation technologies that directly involve genetic material, such as eDNA, these obligations are directly relevant and must be reflected in project design, consent processes, and benefit-sharing arrangements. The Collective benefit, Authority to control, Responsibility, and Ethics (CARE) Principles for Indigenous Data Governance complement this legal framework by addressing how benefits, risks, and decision-making authority should be managed for data and digital systems, particularly where Indigenous Peoples and local communities are contributors or rights holders (Carroll et al., 2020). When CARE Principles are applied, knowledge, labour, and cultural contributions are not treated as "free inputs" but as assets that must be recognised in financial and governance systems. The Target 3 '30x30' Guide links equitable participation and adequate resourcing to effective and fair implementation of KM-GBF Target 3, while KM-GBF Target 19 reinforces financial transparency and Targets 22 and 23 call for equitable participation, gender equality, and benefit-sharing (CBD, 2022; WWF and IUCN WCPA, 2023).

Clarity around financial responsibilities is critical. Without written agreements, ongoing costs such as maintenance, connectivity, and staffing are often overlooked or shifted disproportionately to communities or local partners. Applying Free, Prior and Informed Consent (FPIC) to financing terms ensures that roles and responsibilities are transparently defined and revisited throughout the project lifecycle. The IUCN Global PCA Standard Criteria 1.1 and 1.2 requires that rights-holders are included in governance, which extends to financial decision-making and benefit-sharing, with transparency and grievance under Criterion 1.3 (Woodley et al., 2026). For ITTs and for overlaps with Indigenous and

community conserved areas, FPIC must cover any proposed revenue-generating activities and the associated benefit-sharing arrangements, and these decisions must be documented in formal agreements consistent with the territories and areas conserved by Indigenous Peoples and local communities (ICCAs) guidance. These agreements should clearly set out custodians' governance authority, rights and responsibilities, and the procedures for resolving disputes.

Equity also underpins sustainability. The IUCN Global Standard for NbS requires that NbS are economically viable and that trade-offs are managed equitably through transparent and inclusive processes, helping to ensure that conservation outcomes are legitimate and resilient (IUCN, 2020). Similarly, the CMP Open Standards emphasise that monitoring and evaluation should consider human wellbeing and equity-related outcomes alongside ecological performance, using this evidence to support learning and adaptive management (CMP, 2025). Together, these frameworks demand that costs and benefits be distributed fairly, visibly, and accountably across all partners.

Action

1. Identify and value all contributions to the technology

Financial planning for conservation technologies must account for all forms of contribution from the outset. This includes not only cash investments but also knowledge, labour, infrastructure, and governance oversight. Proof-of-concept work shows that blockchain smart contracts can be used to link agreed benefit-sharing rules to monitoring data, so that payments are released automatically when predefined conditions or delivery milestones are met. Applying this approach helps make costs and benefits visible to all partners and reduces the risk that any group carries hidden or unrecognised burdens (Oberhauser, 2019).

The CARE Principles require that such contributions be explicitly recognised within governance and decision-making processes, so that inputs from local institutions and communities are not undervalued (Carroll et al., 2020). The Nagoya Protocol (CBD, 2011) establishes the principle that benefits arising from the utilisation of biodiversity resources and associated knowledge must be shared fairly and equitably with providers, offering a clear reference point for structuring transparent benefit-sharing arrangements in conservation technology projects. Embedding these obligations into project budgets and governance agreements ensures responsibilities are balanced and transparent. Record this in the IUCN Global PCA Standard dossier by listing contributions and benefits under Criterion 3.1, describing any unfunded burdens or cost shifting risks under Criterion 2.4, and showing how the site consulted and reached agreement with rights holders under Criteria 1.1, 1.2, and 2.1.

2. Use FPIC and formal agreements to define responsibilities and benefit-sharing

Consent processes must cover financial as well as technical aspects. Practitioners should establish clarity over costs and benefits at the outset by explicitly defining monitoring roles, incentive arrangements, and decision-making authority, including who is compensated for technology-enabled monitoring activities and how information generated through monitoring is used in community and enforcement responses (Slough et al., 2021).

FPIC, when applied to financing terms, provides a structured way of confirming who carries recurrent costs, how benefits are distributed, and how risks are managed when donor cycles end. Community protocols can codify these arrangements in practical terms, specifying responsibilities for procurement, maintenance, and data management, while outlining grievance mechanisms for when agreements are breached.

IUCN Global PCA Standard Criterion 1.3 requires transparency and an accessible grievance pathway, while Criterion 3.7 requires measurement and communication of results (Woodley et al., 2026). Together, these criteria make the preparation and disclosure of written financial protocols a compliance expectation for sites, aligning with KM-GBF Target 19 on transparent biodiversity finance (CBD, 2022). For ITTs and for

overlaps with Indigenous and community conserved areas, store FPIC records and community protocols in accessible formats and file them under IUCN Global PCA Standard Criterion 1.3 for transparency and grievance, under Criteria 1.1 and 1.2 for legitimacy and voice, and under Criterion 3.1 for the resourcing commitments, using Criterion 2.4 when precise location, extent, or severity of burdens or benefits must be shown.

3. Allocate resources for local priorities, capacity and governance

Budgets and agreements must explicitly allocate funds for training, salaries, and infrastructure that respond to local priorities. Doing so recognises that benefits are not only financial, but also related to capacity building and livelihoods.

The IUCN Global Standard for NbS emphasises that NbS should deliver benefits for both people and nature, and that trade-offs are managed equitably through inclusive and transparent processes (IUCN, 2020). Similarly, the CMP Open Standards emphasise that monitoring and evaluation should consider human wellbeing and other relevant social dimensions alongside ecological performance, where these factors are important for understanding progress toward conservation objectives and informing adaptive management (CMP, 2025).

By embedding equity directly into financial structures, practitioners can strengthen both legitimacy and long-term sustainability. Reference the Target 3 '30x30' Guide to show that resourcing and capacity lines are essential to effective and equitable management for KM-GBF Target 3 and include payments for governance and time spent on decision-making so participation remains fair and not an uncompensated burden.

4. Use financing arrangements that support long-term equity

Financing arrangements must anticipate long-term realities rather than short-term cycles. It is important to consider that inflexible grant structures or procurement only funding frequently leave essential costs uncovered once projects move beyond their initial implementation phase. Multi-year, flexible funding structures allow for continuity of maintenance, upgrades, and governance arrangements. KM-GBF Target 19 requires all biodiversity-related finance flows to be transparent, adequate, and predictable, meaning practitioners must design budgets that extend beyond pilot phases to ensure long-term operational sustainability (CBD, 2022). Agreements should also specify how responsibilities will shift if donor funding lapses, ensuring local actors are not left with unfair burdens. Place the chosen instruments and their decision criteria in the IUCN Global PCA Standard evidence under Criterion 3.1, log funding risks such as single donor exposure under Criterion 2.4 and note any corridor or transboundary cost sharing rules where technologies operate across networks to reflect the Guidelines for conserving connectivity (Hilty et al., 2020).

5. Monitor, report and adapt cost and benefit distribution over time

Finally, equity must be tracked and reported. Monitoring systems should assess not only ecological outcomes but also who pays, who benefits, and how responsibilities are distributed. Consistent with the CMP Open Standards, indicators related to equity and human wellbeing may be included where they are relevant to objectives and assumptions, with results documented and reported to support transparency, learning, and adaptive management (CMP, 2025). The Target 3 '30x30' Guide requires that equity in financing be demonstrated as part of equitable implementation of KM-GBF Target 3 (WWF and IUCN WCPA, 2023). Publishing these results makes distributions transparent and accountable, building trust among funders, partners, and communities.

These equity indicators should be defined and reviewed under IUCN Global PCA Standard Criterion 3.7, which requires that performance be measured and documented over time (Woodley et al., 2026). Align collection methods and review points with the IUCN Biodiversity Monitoring Framework Sections 7.2 and 6.5 so that equity indicators are gathered consistently,

protected as time series, and reviewed at regular intervals to inform transparent and adaptive financial management (Dalton et al., 2024). The findings should be presented in a simple annual summary that meets the transparency and accountability expectations of IUCN Global PCA Standard Criterion 1.3 and aligns with KM-GBF Target 19 and Section J (paragraph 16), which require regular planning, monitoring, reporting, and review of financial and performance outcomes.

Relevant standards and guidance:

KM-GBF Target 3 (*Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, coastal and marine areas are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures*), Target 19 (*Mobilise financial resources from all sources in an effective, timely and easily accessible manner*), Target 22 (*Ensure participation in decision-making and access to justice and information related to biodiversity for all*), and Target 23 (*Ensure gender equality and a gender-responsive approach for biodiversity action*); KM-GBF Planning-Monitoring-Reporting-Review (PMRR) cycle (Section J, paragraph 16); IUCN Global PCA Standard Criterion 1.1 (*Demonstrate supportive legal, policy or customary framework*), Criterion 1.2 (*Ensure legitimacy and voice*), Criterion 1.3 (*Achieve transparency and accountability*), Criterion 2.4 (*Understand threats and challenges to major site values*), Criterion 2.1 (*Understand ecological, social and economic context*), Criterion 3.1 (*Develop a long-term management strategy*), and Criterion 3.7 (*Implement monitoring, evaluation and adaptive management*); IUCN Biodiversity Monitoring Framework Section 6.5 (*Continuity risks*) and Section 7.2 (*Toolkit: Overview of the indicators*); Nagoya Protocol; CARE Principles for Indigenous Data Governance; Free, prior and informed consent (FPIC); ICCAs Guidance; IUCN Global Standard for Nature-based Solutions; CMP Open Standards for the Practice of Conservation; Target 3 '30x30' Guide; and Guidelines for Conserving Connectivity through Ecological Networks and Corridors.

Tech4Nature Brazil © IUCN 2025

Practitioners should:

- [ ] Clearly identify who contributes what to the technology, including money, time, knowledge, labour, equipment, and governance roles.
- [ ] Make sure costs and benefits are written down, rather than relying on informal understandings or assumptions.
- [ ] Use FPIC to agree on financial responsibilities and benefits, not only on the use of the technology itself.
- [ ] Ensure communities and local partners are not left covering ongoing costs, such as maintenance, connectivity, or staffing, without proper support or agreement.
- [ ] Include funding for local salaries, training, infrastructure, and time spent in meetings and decision-making, so participation is fair and not unpaid.
- [ ] Use simple agreements or community protocols to explain how costs are shared, how benefits are distributed, and what happens if problems arise.
- [ ] Choose funding arrangements that work over several years, rather than short-term grants that stop before systems are stable.
- [ ] Be open about how money is spent and who benefits, by sharing clear and simple summaries with partners and communities.
- [ ] Regularly check whether costs and benefits remain balanced over time, and adjust arrangements if burdens or benefits shift unfairly.
- [ ] Track and report not only conservation results, but also who pays, who benefits, and how decisions are made, so fairness remains visible and trusted.

Technology Overview and Strategic Considerations

Table 6.4. A structured overview of key technology categories and associated tools that outlines how each aligns with relevant global frameworks and highlights practical considerations for managers when assessing, selecting, and implementing technology within conservation contexts.

Category	Technologies	How the technology aligns with global frameworks	Considerations for managers
Programme-level outcome & finance reporting	Restoration Barometer	The Target 3 '30x30' Guide promotes transparent reporting of outcomes and partnerships to ensure equitable benefit-sharing and accountability. The KM-GBF requires transparent progress reporting under Section J (16) to support equitable benefit-sharing and accountability. The IUCN Global PCA Standard Criterion 1.3 requires transparent governance and reporting of partnerships and results to ensure equitable benefit-sharing and accountability.	Record outcomes, roles, and financing; publish agreed (non-sensitive) summaries and align updates with national KM-GBF reporting.
Official registries & recognition	UNEP-WCMC Reporting Systems	The OECMs Guidance requires recognised sites to be reported transparently to global inventories to uphold equitable governance and accountability. The KM-GBF Target 3 requires recognition of area-based measures and equitable governance through transparent reporting to global inventories. The IUCN Global PCA Standard Criteria 1.3, 2.4 and 3.7 require transparent governance, documented consent processes, and regular monitoring of equitable benefit-sharing commitments linked to global recognition systems.	Submit accurate governance notes, boundaries, and links to monitoring outputs; include consent/FPIC documentation where relevant.

Category	Technologies	How the technology aligns with global frameworks	Considerations for managers
Official registries & recognition	Protected Planet	The OECMs Guidance links recognised sites to reporting through global systems such as Protected Planet to ensure transparency and equitable governance. The KM-GBF Target 3 anchors transparent recognition and equitable governance of protected and conserved areas through official reporting systems. The IUCN Global PCA Standard Criteria 1.3 and 2.4 require documentation of governance agreements, FPIC processes, and benefit-sharing arrangements to ensure equitable recognition and ongoing transparency.	Keep submissions current; reflect agreed governance and access arrangements in metadata and documentation.
Shared species data platforms	Wildlife Insights	The IUCN Biodiversity Monitoring Framework (Section 7.3) profiles platform-based camera-trap workflows for standardised data and sharing. The KM-GBF promotes accessible biodiversity data under Section J (16) to ensure transparent participation and equitable benefit-sharing. The IUCN Global PCA Standard Criteria 1.3 and 3.7 require transparency in data access, clear communication of benefits to contributors, and regular review of participation and sharing practices.	Share agreed datasets and results with communities/ partners; document roles, permissions, and how benefits of data use are communicated.
Shared species data platforms	eMammal	The IUCN Biodiversity Monitoring Framework (Section 7.3) notes standardised workflows enabling comparison and shared evidence for decision-making. The IUCN Global PCA Standard Criteria 1.3 and 3.7 require transparent governance of data-sharing processes, equitable interpretation of results, and regular review of benefit-sharing mechanisms. The KM-GBF requires transparent data-sharing processes under Section J (16) to promote equitable access to monitoring results and benefits.	Use standard metadata and QA; provide participant access to results and methods to support equitable interpretation and benefit-sharing

Question 5: Are your funders and partners aligned with your long-term goals for technology sustainability and adaptation?

Overview

Funding partnerships must align with long-term technology strategies if conservation tools are to remain useful beyond their pilot phase. Planning for the full life cycle of technology use is essential. Projects that focus only on acquiring new tools, without resourcing maintenance, training, data management, and ongoing technical support, often struggle to sustain or scale those technologies beyond initial deployment. Practitioners should ensure that funding and implementation plans account for recurrent costs and long-term use, not only short-term delivery or demonstration (Hahn et al., 2022).

Partnerships that emphasise novelty over stability often create cycles of testing and abandonment. In Zambia's Kafue National Park, a multi-partner coalition coordinated donor and partner funding to support law enforcement, monitoring technologies, and associated staffing over multiple years, and reported investment levels on a per km² basis, providing transparency on the scale and continuity of resourcing required (African Parks et al., 2022). Donors may seek rapid results or pilot-scale demonstrations, but without embedding technologies into organisational budgets and governance systems, sustainability is undermined. This wastes resources, erodes trust with local partners, and prevents technologies from adapting to evolving ecological and social contexts. The CMP Open Standards (CMP, 2025) emphasise that considerations of financial feasibility and long-term sustainability should be integrated into conservation planning and adaptive management alongside ecological evidence, while KM-GBF Target 19 calls for transparent, adequate, and predictable biodiversity finance within the broader PMRR cycle (CBD, 2022). The Target 3 '30x30' Guide reinforces this for KM-GBF Target 3 by emphasising that effective and equitable management depends on adequate and appropriate resources established through participatory and transparent processes, meaning partnership terms should align with the technology strategy rather than drive it (WWF and IUCN WCPA, 2023).

Equity is another critical dimension of alignment. Partnerships dominated by actors from high-income countries may reflect Northern priorities rather than the needs and capacities of lower-income partners, contributing to unequal participation and reinforcing existing North–South divides in resources, data access, and scientific capacity (Blicharska et al., 2021). The Nagoya Protocol (CBD, 2011) establishes legally binding expectations for fair and equitable benefit-sharing arising from the utilisation of genetic resources, grounded in prior informed consent and mutually agreed terms. The CARE Principles for Indigenous Data Governance complement this by articulating governance benchmarks for data and technology use, including collective benefit and authority to control, which are critical for aligning funders and partners with long-term sustainability and accountability beyond genetic resources (Carroll et al., 2020). Aligning partnerships with KM-GBF Targets 22 and 23 ensures that equity, participation, gender equality, and benefit-sharing are treated as compliance requirements rather than optional considerations. For ITTs and for overlaps with Indigenous and community conserved areas, alignment must include FPIC for the financial and governance terms, with records stored in accessible formats so authority, responsibilities, and recourse are clear.

Partnerships that support resilience and adaptability are far more likely to sustain technology. Those that provide flexible financing, ongoing technical support, and multi-year capacity-building extend the lifespan of tools and maintain their relevance. The Taskforce on Nature-related Financial Disclosures (TNFD) reinforces this approach by requiring organisations and financial institutions to integrate nature-related risk management and adaptive planning into core strategy, governance, and decision-making processes (TNFD, 2023). In parallel, the IUCN Global Standard for Nature-based Solutions emphasises that interventions should be economically viable, deliver benefits for both people and nature, and manage trade-offs transparently and equitably (IUCN, 2020).

By aligning with these standards, conservation organisations can ensure that partnerships build both ecological impact and durable institutional capacity, consistent with KM-GBF Target 19 on sustainable finance and Target 3 on effective and equitable management (CBD, 2022). Where technologies support corridors or transboundary networks, the Guidelines for conserving connectivity emphasise that roles and responsibilities should reflect network-scale realities, including coordinated duties and co-operative arrangements across jurisdictions (Hilty et al., 2020).

Action

1. Secure funding for the full technology lifecycle

Funding agreements must explicitly cover the entire lifecycle of technology, not just procurement. This includes training, staffing, maintenance, upgrades, and eventual decommissioning. Experience from Kafue National Park shows that monitoring and enforcement technologies such as SMART patrol systems, camera traps, and real-time coordination platforms only remained effective because partner funding supported ongoing staffing, patrol operations, data management, and coordination over multiple years, rather than being limited to pilot deployment (African Parks et al., 2022). This illustrates the importance of structuring funding commitments so that partners are investing in continuity, adaptation, and operational readiness beyond short donor cycles, providing a practical test of whether funders are aligned with long-term technology sustainability goals.

In infrastructure and digital systems more broadly, blockchain-based financing models have been proposed to attract long-term investors by linking performance-based payments to measurable outcomes through smart contracts. Conceptual models discussed for energy and infrastructure projects illustrate how tokenisation could support transparent, outcome-linked financing structures that align returns with technology performance over time (Tian et al., 2022). This approach makes the link between funding, ongoing operations, learning, and adaptation explicit, helping partners move beyond a focus on initial deployment alone.

The IUCN Global PCA Standard Criterion 3.1 requires adequate resourcing, and Criterion 3.7 requires credible monitoring and reporting to show whether those resources remain sufficient over time (Woodley et al., 2026). Tools developed through the UNDP BIOFIN support this process by providing practical methods for identifying and budgeting for costs that are often overlooked (Cruz-Trinidad et al., 2024). Prioritise engagement with conservation trust funds that meet recognised standards for transparency, accountability, and risk management (Bath et al., 2020). Doing so reduces the risk of stranded investments and supports the integration of technologies into long-term governance and management arrangements.

2. Embed equity, participation and transparency in funding arrangements

The IUCN Global PCA Standard also clarifies how equity and participation underpin long-term financial sustainability, Criteria 1.1 and 1.2 ensures that rights-holders and partners have a legitimate voice in setting priorities, while Criterion 1.3 requires transparency and accessible grievance processes so that funding decisions and benefits remain visible and accountable (Woodley et al., 2026). Criterion 2.4 can be used to record funding pressures only where they pose genuine risks to management or conservation outcomes, and Criterion 2.1 ensures these risks are assessed within their wider social and economic context. Together, these provisions link resource planning to fairness and legitimacy, ensuring that technology financing remains transparent, participatory, and sustainable over time. File these lifecycle commitments and partner roles under Criterion 3.1, record any exposure to single-donor or short-grant horizons as pressures under Criterion 2.4, and when the location, extent, or severity of funding gaps must be shown, still cite Criterion 2.4.

3. Ensure financing arrangements support adaptation and flexibility

Accountability and adaptation must be integral to financing design. Partners aligned with the TNFD framework expect systematic monitoring, credible metrics and disclosures, and embedded nature-related risk management, strengthening confidence in investments and improving resilience over time (TNFD, 2023). Flexible instruments such as blended finance or outcome-based contracts can provide adaptive, multi-year support, but they must be structured to prevent recurrent costs, such as ranger training, data storage, and connectivity, from being shifted onto communities or underfunded local organisations. Agreements should include transparent provisions for covering these costs, giving practitioners the confidence to integrate technologies into strategic planning and reporting systems. Publish a clear summary of who funds each lifecycle element and who is responsible for approving changes, in line with IUCN Global PCA Standard Criterion 1.3 on transparency and accountability and KM-GBF Target 19 on transparent biodiversity finance (Woodley et al., 2026). Record stakeholder participation in choosing financing instruments under IUCN Global PCA Standard Criteria 1.1 and 1.2 to demonstrate legitimacy and voice, and document how these decisions reflect local social and economic realities under Criterion 2.1 so that the alignment remains participatory and context aware.

4. Use financing mechanisms that support durable partnerships

Financial mechanisms should also be tested for long-term durability. Instruments such as biodiversity credits, nature-linked bonds, or digital conservation tokens can generate sustained revenue streams, but they will only deliver if they are underpinned by strong governance and equitable benefit-sharing. The IUCN Global PCA Standard Criterion 3.1 requires that financial systems provide reliable and sufficient resources for long-term management, while Criteria 1.1 and 1.2 ensures that rights-holders and partners have a legitimate voice in decisions about financing and governance (Woodley et al., 2026). Transparency and accessible grievance routes, required under Criterion 1.3, are essential safeguards against extractive or inequitable practices. Embedding safeguards, such as FPIC for affected communities, equitable attribution, and community seats on governance boards, ensures that these tools avoid replicating extractive finance practices. Partnerships that engage governments, non-governmental organisations (NGOs), communities, and technical actors across the design, deployment, and use of conservation technologies can improve coordination, clarify roles, and reduce implementation risks, supporting longer-term adoption and use (Hahn et al., 2022).

For OECMs that contribute to ecological corridors or transboundary conservation systems, financial plans should document how long-term management and reporting needs are resourced, using the recognised categories of establishment, operational, core institutional, opportunity, damage and transactional costs. Corridor related planning should also align with the Guidelines for conserving connectivity to clarify how cooperation and information sharing will be supported.

5. Monitor and review alignment over time

Finally, alignment must be monitored and reported transparently. Embedding equity indicators and financial performance metrics into agreements ensures that funders, partners, and communities can hold each other accountable for commitments. The CMP Open Standards (CMP, 2025) emphasise that considerations of human wellbeing, equity, and financial feasibility should be integrated into conservation planning, monitoring, and adaptive management alongside ecological evidence, while KM-GBF Target 19 requires transparent, adequate, and accountable reporting of all biodiversity-related finance flows (CBD, 2022). Regular joint reviews, with community participation, make sure that financial support adapts alongside conservation contexts, maintaining legitimacy and sustaining trust. Define two to four alignment indicators under IUCN Global PCA Standard Criterion 3.7 using the IUCN Biodiversity Monitoring Framework Section 7.2 and Section 6.5, such as the share of lifecycle costs covered

by secure multi-year finance, the proportion of partner funds tied to the technology roadmap, the time to resolve funding related grievances, and a perceived fairness score from stakeholders, and schedule reviews that trigger corrective action (Dalton et al., 2024). Reference the 30×30 Guide in donor reporting to show that financial and governance alignment supports effective and equitable management for KM-GBF Target 3.

Relevant standards and guidance:

KM-GBF Target 3 (*Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, coastal and marine areas are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures*), Target 19 (*Mobilise financial resources from all sources in an effective, timely and easily accessible manner*), Target 22 (*Ensure participation in decision-making and access to justice and information related to biodiversity for all*), and Target 23 (*Ensure gender equality and a gender-responsive approach for biodiversity action*); IUCN Global PCA Standard Criterion 1.1 (*Demonstrate supportive legal, policy or customary framework*), Criterion 1.2 (*Ensure legitimacy and voice*), Criterion 1.3 (*Achieve transparency and accountability*), Criterion 2.4 (*Understand threats and challenges to major site values*), Criterion 2.1 (*Understand ecological, social and economic context*), Criterion 3.1 (*Develop a long-term management strategy*), and Criterion 3.7 (*Implement monitoring, evaluation and adaptive management*); IUCN Biodiversity Monitoring Framework Section 6.5 (*Continuity risks*) and Section 7.2 (*Toolkit: Overview of the indicators*); Nagoya Protocol; CARE Principles for Indigenous Data Governance; Free, prior and informed consent (*FPIC*); IUCN Global Standard for Nature-based Solutions; CMP Open Standards for the Practice of Conservation; Target 3 '30x30' Guide; Taskforce on Nature-related Financial Disclosures (*TNFD*); UNDP Biodiversity Finance Initiative (*BIOFIN*); Conservation Trust Funds guidance; and Guidelines for Conserving Connectivity through Ecological Networks and Corridors.

Tech4Nature Spain by Gemma Miralda © AP Content Services for Huawei 2026

Practitioners should:

- [ ] Ask funders and partners to support the full life of the technology, including training, staffing, maintenance, data management, upgrades, and safe retirement, not only the initial purchase.
- [ ] Check whether proposed funding supports long-term continuity, rather than repeated pilots that end before tools are stable and useful.
- [ ] Make sure technologies are built into normal budgets and workplans, so they can continue when short-term grants end.
- [ ] Prefer partners who are willing to fund and support the everyday work that keeps technology running, including field operations, data processing, coordination, and technical support.
- [ ] Agree in writing who pays for each part of the lifecycle, and who can approve changes when costs, risks, or needs shift.
- [ ] Avoid arrangements that leave local organisations or communities carrying unfunded running costs, such as connectivity, storage, and ongoing training.
- [ ] Check that partnerships are fair and balanced, with local partners able to shape priorities and not only follow external agendas.
- [ ] Use clear and simple ways to share funding information, including who funds what, how decisions are made, and how concerns can be raised.
- [ ] Build in regular joint reviews, including community participation where relevant, so funding and support can adjust as conditions and needs change.
- [ ] Track a small set of alignment measures over time, such as how many lifecycle costs are covered by secure multi-year finance, whether partner funding follows the technology plan, and how quickly funding-related concerns are resolved.

Technology Overview and Strategic Considerations

Table 6.5. A structured overview of key technology categories and associated tools that outlines how each aligns with relevant global frameworks and highlights practical considerations for managers when assessing, selecting, and implementing technology within conservation contexts.

Category	Technologies	How the technology aligns with global frameworks	Considerations for managers
Forest/ pressure transparency	Global Forest Watch	The Target 3 '30x30' Guide promotes transparent, shared monitoring to strengthen accountability and long-term collaboration among partners. The KM-GBF (Section J, paragraph 16) emphasises publicly available monitoring for accountability to promote shared monitoring and long-term collaboration. The IUCN Global PCA Standard Criteria 1.3 and 3.7 require transparent governance arrangements and periodic review of data-sharing partnerships to ensure consistency, accountability, and long-term collaboration.	Use shared dashboards and agreed indicators to align partner expectations on pressures and responses; record how evidence triggers joint actions.
Marine activity transparency	Global Fishing Watch	The Target 3 '30x30' Guide links transparent marine monitoring to shared understanding and lasting trust among partners. The KM-GBF (Section J, paragraph 16) highlights transparent marine monitoring to align partner interpretation and sustain trust. The IUCN Global PCA Standard Criteria 1.3 and 3.7 require open, verifiable collaboration frameworks that align partner thresholds, ensure shared interpretation of results, and maintain trust in data-driven marine monitoring	Agree common views and thresholds with partners; publish non-sensitive summaries to maintain alignment and trust.

Category	Technologies	How the technology aligns with global frameworks	Considerations for managers
Open spatial data portal	UN Biodiversity Lab	The Target 3 '30x30' Guide promotes interoperable data systems for consistent collaboration and long-term comparability. The KM-GBF (Section J, paragraph 16) ensures accessible biodiversity information to maintain long-term interoperability and shared evaluation. The IUCN Global PCA Standard Criteria 2.4 and 3.7 require that information systems used for spatial monitoring are adequately resourced and periodically evaluated to ensure long-term accessibility, accuracy, and interoperability among partners.	Provide partners with access and methods notes; archive layers and map products for audit and long-term comparability.
Species data & distribution	Map of Life	The IUCN Biodiversity Monitoring Framework (Section 5.3) references species repositories to support analysis and learning. The KM-GBF emphasises consistent biodiversity indicators and reliable long-term datasets under Section J (16) for adaptive management and reporting. The IUCN Global PCA Standard Criteria 2.4 and 3.7 require that analytical systems are supported by sufficient capacity and undergo regular performance reviews to sustain long-term data consistency and comparability.	Align partner indicator sets with Map of Life products; document methods and updates to keep expectations consistent over time.
Biodiversity trend indicator	Living Planet Index	The IUCN Biodiversity Monitoring Framework (Section 7.1) recognises use of established biodiversity indicators. The KM-GBF calls for transparent methodologies under Section J (16) to support periodic evaluation and shared interpretation of biodiversity trends. The IUCN Global PCA Standard Criteria 1.3 and 3.7 require that indicator systems incorporate transparent communication of results, participatory interpretation, and periodic evaluation of data-sharing agreements with funders and partners.	Cite Living Planet Index methods and data sources; co-review trends with partners and record agreed interpretations and actions.

Relevant Standards, Tools and Templates

The following standards, tools, and templates provide reference points to support informed decision-making on the financing of conservation technologies. They help users consider full lifecycle costs, examine whether funding models and partnerships align with long-term management goals, and reflect on how financial responsibilities, risks, and benefits are distributed. Together, these resources support transparency, accountability, and equity in conservation finance, and offer a shared basis for dialogue between practitioners, partners, and funders.

Relevant Global Standards

- **CBD Kunming–Montreal Global Biodiversity Framework (KM-GBF)** - The global agreement under the Convention on Biological Diversity that sets expectations for transparent, adequate, and predictable biodiversity finance. Target 19 establishes requirements for accountable resource mobilisation and reporting of biodiversity-related financial flows, while Section J (paragraph 16) of the Planning–Monitoring–Reporting–Review cycle reinforces transparency, monitoring, and adaptive review of financial commitments. Target 3 provides the wider context in which sustained financing underpins effective and equitable management of protected and conserved areas.

- **IUCN Global Standard for Effective and Equitable Protected and Conserved Areas: Standard, Version 2.0.** - A global benchmark for good governance, effective management, and long-term sustainability in protected and conserved areas. The standard brings together requirements on legitimacy and inclusive participation, transparency and accountability, understanding of social and economic context, identification of risks and pressures, adequate and sustained resourcing, and ongoing monitoring and review. Taken together, its criteria provide a structured way to consider whether financial arrangements, partnerships, and resource commitments are sufficient, fair, transparent, and capable of supporting conservation outcomes over time.

- **IUCN WCPA Guidance on Other Effective Area-Based Conservation Measures (OECMs)** - Provides principles for recognising and supporting conserved areas outside formal protected areas, including clear guidance on governance, equity, and resourcing. It reinforces the need to identify establishment, operational, institutional, opportunity, damage, and transactional costs, supporting transparent lifecycle costing and fair allocation of responsibilities in community-governed and Indigenous contexts.

- **WWF and IUCN WCPA A Guide to Inclusive, Equitable and Effective Implementation of Target 3 of the Kunming-Montreal Global Biodiversity Framework** - Provides guidance on inclusive, equitable, and effective implementation of KM-GBF Target 3. It emphasises that adequate, predictable, and transparently managed finance is a prerequisite for effective management, monitoring, and reporting, linking long-term resourcing directly to equity, accountability, and management credibility.

- **IUCN A framework for monitoring biodiversity in protected areas and other effective area-based conservation measures** - Offers structured guidance for defining indicators, tracking performance, and managing continuity risks across conservation systems. It supports the monitoring of financial sufficiency, lifecycle costs, and operational sustainability alongside ecological outcomes, enabling organisations to review whether technology investments remain effective, affordable, and fit for purpose over time. The framework underpins transparent reporting, adaptive review cycles, and evi-

dence-based adjustments to resourcing and partnerships.

- **IUCN Global Standard for Nature-based Solutions (NbS)** - Establishes requirements for economic viability alongside ecological integrity and social equity. It reinforces the need to identify costs, benefits, trade-offs, and risks over time, supporting lifecycle costing and transparent financial planning for conservation technologies that contribute to nature-based outcomes.

- **Taskforce on Nature-related Financial Disclosures (TNFD)** - Provides a framework for identifying, managing, and disclosing nature-related risks, dependencies, and opportunities within organisational strategy and finance. It supports alignment between long-term conservation objectives and funding decisions by encouraging predictable, transparent, and adaptive financing arrangements. TNFD reinforces the importance of embedding technology costs, risks, and adaptation needs into core governance and financial planning, strengthening accountability to funders, partners, and rights-holders over time.

- **CARE Principles for Indigenous Data Governance** - Provide a rights-based framework for recognising contributions, authority, responsibility, and ethics where technologies generate, manage, or use data linked to Indigenous Peoples and local communities. They support transparent recognition of non-financial contributions and equitable distribution of benefits and responsibilities.

- **CBD Nagoya Protocol on Access and Benefit-Sharing** - Applies where conservation technologies intersect with genetic resources or associated traditional knowledge, including technologies such as environmental DNA. It establishes legally binding requirements for prior informed consent, mutually agreed terms, and fair and equitable benefit-sharing that must be reflected in financial and governance arrangements.

- **CMP Open Standards for the Practice of Conservation** - Provide a structured framework for linking objectives, actions, resources, monitoring, and learning. They reinforce the importance of assessing financial feasibility, revisiting cost assumptions, and integrating financial sustainability into adaptive management and review cycles.

Tools and Frameworks

- **Biodiversity finance planning tools (UNDP BIOFIN)** - Support structured identification of one-off and recurring costs, linkage of financial planning to conservation objectives, and development of multi-year budgets that account for full technology lifecycles.

- **Protected area management effectiveness tools (IMET, METT)** - Support identification of management and resourcing gaps, helping align technology costs and financial needs with management effectiveness assessments and reporting requirements.

- **Cloud hosting and data management platforms (Google Cloud, Amazon Web Services)** - Provide scalable infrastructure for data storage, processing, and access, with recurring cost implications for hosting, security, and long-term data stewardship that must be reflected in lifecycle budgeting.

- **Field monitoring technologies (camera traps, drones, acoustic sensors, IoT sensor networks)** - Generate ongoing costs related to power, connectivity, maintenance, replacement cycles, data processing, and staffing, making them central to lifecycle cost planning and long-term financing strategies.

- **Transparency and reporting platforms (Protected Planet, UNEP-WCMC report-**

ing systems) - Support public reporting, documentation, and long-term retention of information related to governance, resourcing, and monitoring, reinforcing transparency and accountability in financial and management commitments.

Templates and Planning Resources

- **IUCN GSAP SKILLS Platform** - Provides modular guidance and practical resources that can support transparent budgeting, capacity planning, and documentation of financial and governance decisions linked to technology use.
- **PANORAMA Solutions** - Provides documented case studies and practical examples of conservation initiatives that illustrate how financing models, partnerships, and governance arrangements have supported long-term sustainability, equity, and accountability. These examples can inform reflection on cost-sharing, benefit distribution, and durable financing approaches for conservation technologies.

Additional Resources

- IUCN WCPA (2025). *IUCN World Commission on Protected Areas Impact Report 2024*. Gland,
- Stevens, S., Hay-Edie, T., Miranda, C., Ramos, A. & Pathak Broome, N. (Eds.). Stevens, S. with contributions by Eghenter, C., Fitzsimons, J., Goradze, I., Ironside, J., Mellis, C., Nitah, S., Parling, P., Reyes, G. & Tabanao, G. (2024). *Recognising territories and areas conserved by Indigenous Peoples and local communities (ICCAs) overlapped by protected areas*. IUCN WCPA Good Practice Guidelines No. 34. Gland, Switzerland: IUCN.

References

African Parks; Game Rangers International; KAZA Secretariat; Musekese Conservation; North Carolina Zoo; Panthera; The Nature Conservancy; Wildlife Crime Prevention; Zambian Carnivore Programme (2022). Kafue National Park: A conservation case study 2018–2022.

Bath, P., Luján-Gallegos, V. and Guzmán-Valladares A. (2020). Practice Standards for Conservation Trust Funds Funds - 2020 edition, Conservation Finance Alliance, New York.

Blicharska, M., Teutschbein, C. & Smithers, R.J. (2021). SDG partnerships may perpetuate the global North–South divide. Scientific Reports, vol. 11, article 22092.

Brazilian Development Bank (BNDES) (2022). The Amazon Fund: Activity report 2021. Edited by BNDES's Publishing and Memory Division and the Communication Department of the President's Office of BNDES, June 2022, BNDES, Rio de Janeiro, Brazil.

Caro, T. & Scholte, P. (2007). When protection falters. African Journal of Ecology, vol. 45, no. 3, pp. 233–235.

Carroll, S.R., Garba, I., Figueroa-Rodríguez, O.L., Holbrook, J., Lovett, R., Materechera, S., Parsons, M., Raseroka, K., Rodriguez-Lonebear, D., Rowe, R., Sara, R., Walker, J.D. and Hudson, M. (2020). 'The CARE Principles for Indigenous Data Governance', Data Science Journal, vol. 19.

Centre for Industrial Studies (CSIL) (2019). Guidelines on cost estimation of research infrastructures. StR-ESFRI Study, developed for Support to Reinforce the European Strategy Forum on Research Infrastructures (StR-ESFRI), funded by the European Union's Horizon 2020 Research and Innovation Programme.

Conservation Measures Partnership (CMP) (2025). Open Standards for the Practice of Conservation. Version 5.0. Conservation Measures Partnership. Available at: https://www.conservationstandards.org

Convention on Biological Diversity (CBD). (2011). Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity. Montreal, Canada: Secretariat of the Convention on Biological Diversity.

Convention on Biological Diversity (CBD) (2022) Kunming-Montreal Global Biodiversity Framework: Decision 15/4 CBD/COP/DEC/15/4 [online]. Montreal: Convention on Biological Diversity. Available at: https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf [Accessed 4 April 2025].

Cruz-Trinidad, A., Cumming, T., Bellot, M., Barois, H., Seidl, A., van den Heuvel, O., Orozco, A.L., Arlaud, M., Bortolotti, E., Fischer, R., Gupta, G., Lanfranco, P., Mweemba, B., Shalakhanova, A. & Paxton, M. (2024). The BIOFIN Workbook 2024: Finance for Nature. The Biodiversity Finance Initiative, United Nations Development Programme, New York.

Dalton, D., Berger, V., Kirchmeir, H., Adams, V., Botha, J., Halloy, S., Hart, R., Švara, V., Torres Ribeiro, K., Chaudhary, S. & Jungmeier, M. (2024). A framework for monitoring biodiversity in protected areas and other effective area-based conservation measures: Concepts, methods and technologies. IUCN WCPA Technical Report Series No. 7, Gland, Switzerland: IUCN.

Hahn, N.R., Bombaci, S.P. & Wittemyer, G. (2022). Identifying conservation technology needs, barriers, and opportunities. Scientific Reports, vol. 12, no. 1, article 4802.

Hilty, J., Worboys, G.L., Keeley, A., Woodley, S., Lausche, B., Locke, H., Carr, M., Pulsford I., Pittock, J., White, J.W., Theobald, D.M., Levine, J., Reuling, M., Watson, J.E.M., Ament, R., and Tabor, G.M. (2020). Guidelines for conserving connectivity through ecological networks and corridors. Best Practice Protected Area Guidelines Series No. 30. Gland, Switzerland: IUCN.

IUCN (2020). Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS. First edition. Gland, Switzerland: IUCN.

IUCN ESARO (2020). Closing the gap. The financing and resourcing of protected and conserved areas in Eastern and Southern Africa. Nairobi, Kenya: IUCN ESARO; BIOPAMA.

Woodley, Stephen, Joanne Wilson, Jonas Geldmann, Marc Hockings, Charlotte Karibuhoye, Paola Mejia, Florence Palla, Petch Manopawitr and Nadine Seleem. (2026). IUCN Global Standard for Effective and Equitable Protected and Conserved Areas: Standard, Version 2.0.Jonas, H. D., Wood, P. & Woodley, S., Volume Editors (2024). Guidance on other effective area-based conservation measures (OECMs). IUCN WCPA Good Practice Series, No.36. Gland, Switzerland: IUCN.

Ministry of Environment, Forestry and Tourism (MEFT) & Namibia Association of CBNRM Support Organisations (NACSO) (2023). The state of community conservation in Namibia (Annual Report 2022). MEFT/NACSO, Windhoek.

Mitchell, H.L., Cox, S.J. & Lewis, H.G. (2024). A low-cost sensor network for monitoring peatland. Sensors, vol. 24, no. 18, article 6019.

Oberhauser, D. (2019). Blockchain for environmental governance: Can smart contracts reinforce payments for ecosystem services in Namibia? Frontiers in Blockchain, vol. 2, article 21.

Slough, T., Kopas, J. & Urpelainen, J. (2021). Satellite-based deforestation alerts with training and incentives for patrolling facilitate community monitoring in the Peruvian Amazon. Proceedings of the National Academy of Sciences of the United States of America, vol. 118, no. 29, article e2015171118.

The Taskforce on Nature-related Financial Disclosures (TNFD) (2023). Recommendations of the Taskforce on Nature-related Financial Disclosures.

Tian, Y., Wang, C., Asutosh, A., Woo, J. & Adriaens, P. (2022). Blockchain-enabled tokenization for sustainable and inclusive infrastructure investment. arXiv, article arXiv:2208.04709.

United Nations Environment Programme (UNEP) (2025). Sustainable Procurement Guidelines for Data Centres and Servers. Paris.

White, T.B., Petrovan, S.O., Christie, A.P., Martin, P.A. & Sutherland, W.J. (2022). What is the price of conservation? A review of the status quo and recommendations for improving cost reporting. BioScience, vol. 72, no. 5, pp. 461–471.

World Wide Fund for Nature (WWF) (2020). Annual report: Tiger conservation and monitoring in Nepal. WWF Nepal, Kathmandu.

WWF and IUCN WCPA. 2023. A Guide to Inclusive, Equitable and Effective Implementation of Target 3 of the Kunming-Montreal Global Biodiversity Framework: Version 1, August 2023.

INTERNATIONAL UNION
FOR CONSERVATION OF NATURE

WORLD HEADQUARTERS
Rue Mauverney 28
1196 Gland
Switzerland
Tel +41 22 999 0000
Fax +41 22 999 0002
www.iucn.org
www.iucn.org/resources/publications