IUCN'S LEADERSHIP IN ECOLOGICAL CONNECTIVITY CONSERVATION THROUGH INTEGRATED SCIENCE, POLICY AND PRACTICE

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ABSTRACT

As the countermeasure to fragmentation, ecological connectivity conservation is a comprehensive strategy to save biodiversity, increase resilience to climate change and benefit people across lands and waters. Building on strong science, policy and practice, the World Commission on Protected Areas' Connectivity Conservation Specialist Group (CCSG) released *IUCN Guidelines for conserving connectivity through ecological networks and corridors*. Available in six languages, the Guidelines provide consistent information to conserve ecological connectivity, especially to support achieving the "well-connected" element of Target 3 of the Kunming-Montreal Global Biodiversity Framework. To better meet area- and species-based goals at larger scales, the Guidelines provide leading definitions, recommend formal recognition of "ecological corridors" as critical building blocks of "ecological networks" and provide principles and requirements for ecological corridors. They serve as the key resource for standardising multilaterally agreed definitions and frameworks for ecological corridors to be recognised and reported as spatially explicit conservation measures. This paper examines developments in connectivity conservation policy and implementation, discusses challenges in measuring connectivity and highlights country-level efforts to recognise ecological corridors. It summarises the Guidelines and presents a replicable, adaptable approach developed by CCSG and partners for applying them through engagement with rightsholders and interested parties, supporting consistent design, governance, management and monitoring of ecological corridors and networks.

Key words: ecological corridor, ecological network, protected area network, wildlife corridor, road ecology, connectivity indicators

INTRODUCTION

Fragmentation – the division of habitat into smaller and more isolated patches – caused by human activities poses a grave threat to biodiversity and ecological processes (Haddad et al., 2015; Ma et al., 2023; Romanillos et al., 2024). Each year, unprecedented levels of deforestation, land conversion and loss of nature surpass the previous year (Durán et al., 2020; Goldman et al., 2024; WWF, 2024). Combatting this fragmentation to conserve nature at larger scales requires comprehensive approaches, including maintaining, enhancing and restoring ecological connectivity.

Ecological connectivity is defined as "the unimpeded movement of species, connection of habitats without hindrance and the flow of natural processes that sustain life on Earth" (CMS, 2024a). It facilitates ecological and evolutionary processes, from population dynamics to gene flow and adaptation to climate change (Crooks & Sanjayan, 2006; Hilty et al., 2020). It is also critical for most landscapes, seascapes and ecosystems because few protected areas and unprotected areas of intact natural habitat are large enough to support all life stages of many, especially wide-ranging, wildlife, or to sustain ecological processes and allow species to shift ranges in response to climate change (Heller & Zaveleta, 2009; Newmark et al., 2023). By conserving ecological connectivity, the habitats and genetic diversity of wild animal and plant species can be better safeguarded, along with ecosystem functions and characteristics such as

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Aerial view of land fragmented by palm oil plantations in Malaysia. © CLLC / Gary Tabor.

migration, hydrology, nutrient cycling, pollination, seed dispersal, food security, climate resilience and disease resistance, across all biomes and spatial scales.

As humans exert pressure, reducing habitats and pushing wild species into ever-smaller pieces of nature, the global community is increasingly prioritising connectivity conservation as the countermeasure to fragmentation. Connectivity conservation, grounded in scientific research (Liczner et al., 2024) and legal concepts (Lausche et al., 2013), is being addressed through policy, law and management, as demonstrated in 2019 in an analysis of 263 terrestrial connectivity conservation plans written over the preceding 30 years (Keeley et al., 2019). It is defined by the IUCN World Commission on Protected Areas' (WCPA) Connectivity Conservation Specialist Group (CCSG) as "the action of individuals, communities, institutions and businesses to maintain, enhance and restore ecological flows, species movement and dynamic processes across intact and fragmented environments" (CCSG, n.d.a). This evolution into a mainstream conservation practice is driven by decades of work across IUCN, which has solidified the concept and policies through more than 30 official IUCN resolutions adopted by its members increasingly acknowledging that isolated PCAs alone are not sufficient; their vitality is often dependent on their ecological connectivity to surrounding lands and waters. This leadership is instrumental in driving a paradigm shift from solely focusing on formal protected areas (Dudley, 2008) and other effective area-based conservation measures (OECMs) (Jonas et al., 2024) – hereafter protected and conserved areas (PCAs) – to recognising the need to create well-managed PCAs interconnected within ecological networks for conservation. This shift embraces new and expanded PCAs as fundamental for achieving conservation goals while reinforcing efforts that can fulfil the "well-connected" element of Target 3 under the Convention on Biological Diversity's (CBD) Kunming-Montreal Global Biodiversity Framework (KMGBF). This is especially critical considering that the *Protected Planet Report 2024* finds that "Protected and conserved areas must almost double in area on land and more than triple in the ocean for the 30% target to be reached by 2030" (UNEP-WCMC & IUCN, 2024a) while also concluding that although 17.6 per cent of global terrestrial land was protected by PCAs, the network of PCAs "[...] is not well-connected yet" (UNEP-WCMC & IUCN, 2024b).

After decades in the making, broad consensus on concepts and pathways forward was catalysed in 2016 with adoption of IUCN Policy Resolution 087, *Awareness of Connectivity Conservation Definition and Guidelines* (IUCN, 2021a). Between 2017 and 2020, more than 100 CCSG Members in 30 countries discussed, wrote, reviewed and eventually published the first-ever *IUCN Guidelines for conserving connectivity through ecological networks and corridors* (Hilty et al., 2020). The Guidelines detail the many ways ecological corridors can connect PCAs to form ecological networks and can provide communities with ecological, social and economic value. They also provide advice to governments and conservation

Deer attracted to salt used to melt ice on the wintry roads in Montana, USA © CLLC / Kylie Paul.

Zebra near the Standard Gauge Railway passing through Nairobi National Park and Tsavo National Park, Kenya © CLLC / Melissa Butynksi.

practitioners on how to design, plan and implement ecological corridors including delineation, governance, tenure, management, long-term monitoring, evaluation and reporting. Twenty-five case studies complement the Guidelines illustrating projects from around the world.

This article first details ongoing developments in science, policy and practice for advancing connectivity conservation. It then discusses challenges of measuring connectivity, briefly examines country-level efforts and shares innovations of the Guidelines, highlighting applications to scale up and implement ecological connectivity conservation through projects and initiatives that fulfil international environmental commitments and secure connectivity among PCAs. Finally, it provides insights into a replicable, adaptable planning framework for ecological corridors following the Guidelines that prioritises engagement with partners, rightsholders and interested partners and supports development of delineated corridors with defined objectives, governance models and comprehensive management and monitoring plans.

POLICY INTEGRATION FOR ECOLOGICAL CONNECTIVITY

Through a growing body of international, national and subnational policy, planning and implementation, there is a tangible shift in focus from conserving specific areas and species to planning at larger spatial scales across the matrix of human uses in landscapes, seascapes and ecosystems that surround and connect PCAs to achieve functional ecological networks. The CBD's KMGBF is important for elevating countries' commitments for ecological connectivity conservation, its measurement and implementation (Box 1), especially reinforcing the "well-connected" element of PCAs that was first included in Target 11 of the Aichi Strategic Plan for Biodiversity (2011–2020). Adopted by the CBD's 15th Conference of the Parties (CBD/CoP-15) in 2022 as Decision 15.4 (CBD, 2022a), the KMGBF emphasises the fundamental contribution that connectivity makes to functioning ecosystems and thriving species, and its benefits to people. Following rigorous review of the final version of the KMGBF, goals and targets that explicitly address connectivity include:

- Goal A: *The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050; […];*
- Target 2: *Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration, to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity;*
- Target 3: *Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, and of 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 […];* and
- Target 12: *Significantly increase the area and quality and connectivity of, access to, and benefits from green*

and blue spaces in urban and densely populated areas sustainably, by mainstreaming the conservation and sustainable use of biodiversity, and ensure biodiversity-inclusive urban planning, enhancing native biodiversity, ecological connectivity and integrity, […].

Additionally, the KMGBF implicitly addresses the key role of connectivity in two additional targets:

- Target 1: *Ensure that all areas are under participatory integrated biodiversity inclusive spatial planning and/or effective management processes addressing land and sea use change, […];* and
- Target 14: *Ensure the full integration of biodiversity and its multiple values into policies, regulations, planning and development processes, poverty eradication strategies, strategic environmental assessments, environmental impact assessments and, as appropriate, national accounting, within and across all levels of government and across all sectors, […].*

Focusing on Target 3 – also known as the "30x30 Target", a central strategy for biodiversity conservation is expanding and improving the coverage, representativeness, connectivity and equitable governance of PCAs. Coverage is a key component of area-based conservation; connectivity and representation have received less attention in science and practice because they can be more challenging to measure and communicate. Nonetheless, to ensure that the global PCA network fully achieves the KMGBF's purpose to halt and reverse biodiversity loss, countries need to focus on the "well-connected" element of PCAs (Maxwell et al., 2020) to meet the third essential principle for area-based biodiversity conservation that "habitat patches must be functionally connected" (Riva et al., 2024).

Additional policy decisions of multilateral instruments and international institutions emphasising connectivity to achieve their objectives continue to be summarised (Hilty & Laur, 2021) and documented online (CCSG, n.d.b). Additional recent key developments include the following.

- In 2021, the 7th IUCN World Conservation Congress (WCC) adopted Policy Resolution 073, *Ecological connectivity conservation in the post-2020 global biodiversity framework: from local to international levels* (IUCN, 2021b) emphasising the importance of ecological networks and corridors to sustain biodiversity and nature's contributions to people; recommending that all IUCN Members work to conserve connectivity by documenting it across ecosystems, informing policies, laws and plans, identifying key drivers and building synergies across institutions and borders to implement solutions; and recommending that Parties to the Convention on Biological Diversity (CBD) include appropriate goals, targets and indicators, including an indicator for migratory species. Additionally, Policy Resolution 071, *Wildlife-friendly linear infrastructure* (IUCN, 2021c) recognises the particular importance of avoiding and mitigating fragmentation caused by linear infrastructure (i.e. roads, railways, canals) to conserve connectivity.
- In 2023, the 10th Plenary of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) adopted a decision on its work programme up to 2030, including approving a "methodological assessment of integrated biodiversity-inclusive spatial planning and ecological connectivity". As a fast-track assessment, it is intended to be completed by 2027 to address methods, guidance, tools, scenarios, models, data, knowledge and capacity-building for integrating biodiversity into, and promoting connectivity, in spatial planning across sectors and scales (IPBES, 2023).
- In 2023, the UN Convention on the Law of the Sea (UNCLOS) adopted the *Agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ Agreement)* that includes connectivity among the indicative criteria for identifying marine protected areas in the high seas (BBNJ, 2023; IUCN-HSSG, 2025).
- In 2024, the Convention on Migratory Species adopted:
  - *The Samarkand Strategic Plan for Migratory Species 2024–2032* with the vision "by 2032, migratory species are thriving and live in fully restored and connected habitats" (CMS, 2024b); and
  - The resolution on *Impact Assessment and Migratory Species* asking Parties to take connectivity into account to avoid impediments when planning linear infrastructure and constructing other barriers such as fences and walls (CMS, 2024c).

At time of writing, IUCN Members had just adopted Motion 127, *Recognising and Reporting Ecological Corridors* as part of deliberations of the 8th WCC in Abu Dhabi (United Arab Emirates) from 9–15 October 2025. Building on previous mandates, and progress made since the 7th WCC, this Policy Resolution calls on IUCN to foremost:

- *[…] recognise the value of, and advocate for, a multilaterally agreed definition and frameworks for ecological corridors as a spatially explicitly conservation measure that reflects biocultural diversity and supports multifunctional landscapes*

> *and seascapes, assisting in the full implementation of the CBD Kunming-Montreal Global Biodiversity Framework (KMGBF), especially for Target 3, and to encourage further actions to advance this work, in line with the IUCN Connectivity Guidelines and the KBA (Key Biodiversity Area) Standard* (IUCN, 2025)

This is a critical step in mobilising strong, coordinated efforts by IUCN, diverse institutions, experts and practitioners to advocate for and support connectivity conservation.

MEASURING ECOLOGICAL CONNECTIVITY

Building on the developments in science, policy, and practice, the accompanying monitoring framework adopted to assess implementation of the KMGBF (CBD, 2025) includes numerous indicators relevant to ecological connectivity (Theobald et al., 2024). These indicators are intended to assist CBD Parties in monitoring and reporting progress towards the goals and targets by 2030. They can also be useful for national target setting, scenario planning and adaptive management. For Target 3, the coverage (area, proportion) of PCAs is identified in the monitoring framework as a major ('headline') indicator, while four minor ('component/complementary') indicators are included for monitoring progress of the "well-connected" element of Target 3: ProtConn (Saura et al., 2017), ProNet (Theobald et al., 2022), Protected Area Representativeness and Connectedness (PARC-connectedness; Harwood et al., 2022) and the Protected Area Isolation (PAI) indicator (Brennan et al., 2022).

Countries typically calculate indicators using their authoritative data. However, there is value in third parties (e.g. the UNEP World Conservation Monitoring Centre (UNEP-WCMC)) computing indicators in a consistent, comparable manner leveraging global datasets, such as the degree of human modification (Theobald et al., 2025). Such globally standardised indicators enable direct comparison across countries, can be reported to the CBD Secretariat and support countries with limited resources, time or technical capacity.

The *Protected Planet 2024* report shares the results for the four connectivity indicators related to Target 3 concluding that although 17.6 per cent of global terrestrial land was protected by PCAs, the network of PCAs "[…] is not well-connected yet" (UNEP-WCMC & IUCN, 2024b). However, thresholds above which a country's PCA system is considered well-connected are arbitrarily set. Also, the four indicators measure connectivity in different ways precluding a direct comparison of connectivity values (Table 1).

Although there has been no further guidance from CBD on how to establish what "well-connected" means or how to quantify it, research is increasing and a recent effort has been made to offer a framework for harnessing scientific knowledge to monitor, map, conserve and restore areas that promote connectivity and maintain well-connected ecosystems. This work is driven by the recognition that "[o]nly by being able to characterize connectivity in measurable terms will we be able to assess whether we have successfully met the 30x30 objective for well-connected protected areas" and therefore provides the following definition:

> *A landscape, seascape, or protected-area network is well connected if organismal movement is sufficient to maintain the long-term persistence of focal taxa, maintain ecological functions, and/or sustain the provisioning of ecosystem services relative to counterfactuals with the same amount of intact habitat and no barriers to movement.* (Brodie et al., 2025)

THE IUCN CONNECTIVITY GUIDELINES

Commitments to conserving ecological connectivity, its measurement and implementation are now more elevated in importance and focus, especially with adoption of the KMGBF. This section highlights objectives, details and applications of the *IUCN Guidelines for conserving connectivity through ecological networks and corridors* (Hilty et al., 2020) that have supported increased focus in policy fora and the implementation that is now being driven with IUCN's leadership. The publication of the Guidelines in 2020 met a clear demand for a more consistent understanding of, and effective approaches to, connectivity conservation across sectors, supporting conservation commitments from international to local levels, including the KMGBF. The Guidelines also provide the world with a leading resource for advancing and scaling application of best practices to safeguard the interconnectedness of PCAs and to restore degraded or fragmented ecosystems that are critical to the health of biodiversity.

The Guidelines are based on best available science and practice for maintaining, enhancing and restoring connectivity among and between PCAs and other intact ecosystems, with the main purposes being to:

Table 1. Indicators included in the Kunming-Montreal Global Biodiversity Monitoring Framework for monitoring progress of the well-connected element of Target 3

	ProtConn	ProNet	PARC-connectedness	PAI
Description	Measures the percentage of a country or region covered by protected lands reachable by moving between protected areas	Measures how well protected areas are grouped together in the landscape, with higher values meaning PCAs are closer and form larger connected clusters, and lower values meaning they are more isolated from one another	Measures how well each protected cell is connected not only to other protected areas, but also to nearby unprotected areas with intact natural vegetation	Measures how isolated each protected area is from other protected areas, based on the resistance in the intervening landscape
Data or parameters needed	• PCA shapefiles • Total landscape area • Least-cost or Euclidean distances between patches • Distance threshold • The maximum product probability of all possible paths between 2 patches (where a path is a set of steps in which no patch is visited >1 time)	• PCA shapefiles • Least-cost or Euclidean distances between patches • Distance threshold	• PCA shapefiles • Raster layer of natural and semi-natural vegetation • Resistance layer • Maximum dispersal distances or decay functions that weight connectivity by distance	• PCA shapefiles • Resistance layer
***Protected Planet Report 2024* parameters**	• 10 km distance threshold • Euclidean distance between PCAs	• 10 km distance threshold • Euclidean distance between PCAs	Remotely-sensed data on land cover change to track the loss of connectivity that occurs when unprotected intact vegetation is lost	Resistance layer: based on the relationship between the human footprint and movement distance of 48 mammal species
***Protected Planet Report 2024* results**	8.52% of the world's terrestrial surface is protected and connected	28.9% of PCAs are connected	On average, each grid cell (1 km^2) on land within a PA or OECM is 71% connected to grid cells containing intact vegetation and/or other PCA grid cells	Does not provide a global-level indicator of connectivity, but provides scores at the national or subregional level that are then used to compare relative levels of connectivity

- consolidate a wealth of knowledge and best available practices;
- set global definitions that function across terrestrial, freshwater and marine environments much in the same way that IUCN's protected area definition is agnostic of ecosystem type;
- outline the fundamentals of what needs to be in place to recognise an ecological corridor as being effectively conserved; and
- highlight an approach that could be used to begin tracking conserved ecological corridors at a global level.

For the first time, the Guidelines introduce a common definition of ecological corridors as "[...] a clearly defined geographical space that is governed and managed over the long term to maintain or restore effective ecological connectivity". The Guidelines recognise ecological corridors as distinct and separate from PCAs. They also advance their formal recognition as critical building blocks of ecological networks alongside PCAs. The definition addresses that while ecological corridors may conserve biodiversity, their only strict requirement is to conserve connectivity. Specifically, corridors may not always be habitat for focal species but may function to permit movement of those species between habitats. However, corridors may also provide continuous habitat for a variety of species. Overall, the Guidelines account for different types of ecological corridors suitable for meeting a range of connectivity goals.

Ecological networks for conservation are defined by the Guidelines as "[a] system of core habitats (protected

areas, OECMs and other intact natural areas), connected by ecological corridors, which is established, restored as needed and maintained to conserve biological diversity in systems that have been fragmented". Assuming that the elements are well-designed and managed, the ecological network will function to conserve biological diversity over time and through space better than any individual element on its own (Bennett & Mulongoy, 2006; Hilty et al., 2020).

Fundamental principles of ecological corridors are as follows:

- Ecological corridors are not a substitute for PCAs.
- Ecological corridors should be identified and established in areas where connectivity is required aiming to build ecological networks for conservation.
- Each ecological corridor should have specific ecological objectives and be governed and managed to achieve connectivity outcomes.
- Ecological corridors may consist partly or entirely of natural areas managed primarily for connectivity.
- Ecological corridors should be differentiated from non-designated areas by the specific uses that are allowed or prohibited within them.
- To achieve their objectives, ecological corridors require their own management plans (terrestrial, freshwater or marine as the case may be).
- Input from rightsholders and interested parties, together with corridor modelling and mapping are effective approaches for identifying where conserving connectivity may be important and feasible (Hilty et al., 2020). Once a specific area is identified, conserving ecological corridors requires steps ranging from documenting basic information, selecting objectives, choosing a governance model, delineating boundaries, agreeing on and implementing management actions and designing monitoring plans. The basic elements to be incorporated in an ecological corridor plan include:
  - **Objectives:** The biodiversity elements and associated ecosystem service values to be connected;
  - **Contribution to ecological network:** The role of the ecological corridor in the larger ecological network in which it is located;
  - **Social and economic values**: The wide range of social and economic benefits considered to maximise design, acceptance, management of allowable human activities and effectiveness of connectivity;
  - **Delineation:** The agreed boundaries, ensuring the size allows for effective management to achieve the objectives, demarcated by the entity or entities governing and managing it;
  - **Governance:** The arrangement of how the corridor is governed, by whom and who is held accountable;
  - **Tenure:** The conditions and rights under which the areas are held, occupied or used, including a mix of tenure whether legal or customary;
  - **Legal or other effective mechanisms:** The specific instruments pertaining to management, describing the governing authority, and establishing the area's tenure to support implementation;
  - **Longevity:** The considerations made to support durability over significant periods of time, so long as connectivity values remain, and including succession of governance arrangements and periodic reviews;
  - **Management:** The actions required to meet objectives of structural needs, functional needs and management of allowable human activities; and
  - **Monitoring, evaluation, reporting:** Both aspirational and readily feasible components of the plan that can be tracked, evaluated and adapted to achieve the objectives.
- Lastly, ecological corridors should be documented and tracked at both national and international levels.

The Guidelines recommend that documentation for reporting includes at least the following:

- Name of the area;
- Geographic description;
- Map of location using a polygon shapefile;
- Year of establishment; and
- Contact information of reporting organisation(s).

With the Guidelines at hand, and approaches tailored to national and subnational contexts, ecological corridors are being increasingly designated at national and subnational levels. To support efforts to meet or exceed the best practices in the Guidelines and achieve enduring connectivity, UNEP-WCMC is working with CCSG and other partners to build a World Database on Ecological Corridors (WDEC) as a global, spatial, open database. When officially launched, the WDEC is intended to be part of *Protected Planet* – the most up to date and complete source of data on protected areas and other effective area-based conservation measures (OECMs) – and contribute towards improved understanding of how well-connected PCAs are globally, while tracking progress towards connectivity conservation goals. As ecological corridors become a more standardised tool and are entered into the WDEC, decisions about whether PCAs are connected can be based on the presence of an ecological corridor.

FOLLOWING THE IUCN CONNECTIVITY GUIDELINES TO ESTABLISH ECOLOGICAL CORRIDORS

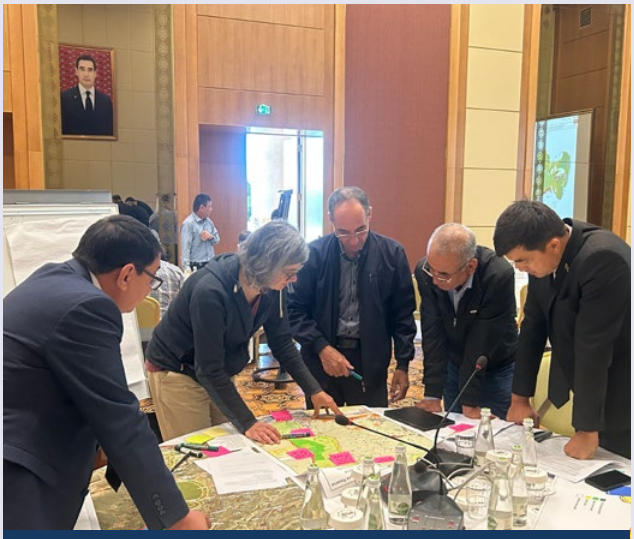
Beyond policy negotiations, scientific research and producing guidance, IUCN's leadership is advancing a diversity of efforts around the world that are working to apply the Guidelines and scale up and implement ecological connectivity conservation through projects and initiatives that fulfil international environmental commitments. Driven by partnerships among local and regional decision-makers, landowners, scientists and community members, new projects are emerging that integrate connectivity conservation into land-use and marine spatial plans, infrastructure development, and conservation frameworks. Much of this is informed by NGOs, governments and communities increasingly working together to ensure delivery of consistent connectivity practices effectively tailored to specific contexts (CMP, 2025).

Connectivity planning can occur at two scales: at the country or regional scale and at the scale of an individual corridor (Beier et al., 2008, 2011). In many cases, planning at the country or regional scale precedes planning at the corridor scale. At both scales it is important that rightsholders and interested parties take the following steps:

- Already have, or during the workshops create, a shared vision of a connected land- or seascape;
- Build a shared understanding of ecological corridors based on the Guidelines;
- Identify the project team;
- Define the scope;
- Decide on the connectivity conservation values (species, places, processes);
- Identify critical threats; and
- Assess the situation with respect to connectivity.

Box 1: Practical applications of the IUCN Connectivity Guidelines

A diversity of efforts have been led by CCSG, the Center for Large Landscape Conservation (CLLC) and partners to focus on applying the principles and requirements in the Guidelines, as well as related best practices in the IUCN Technical Report *Addressing ecological connectivity in the development of roads, railways and canals* (Ament et al., 2023) and *Marine connectivity conservation 'rules of thumb' for MPA and MPA network design* (Lausche et al., 2021). Initially conducted in Romania in 2019 (BearConnect Project, CLLC, & CCSG, 2020), related workshops have been held in Turkmenistan (CLLC, 2023), the Pantanal-Chaco in South America (Creech et al., 2023), Southern Kenya-Northern Tanzania (CLLC, n.d.), Uzbekistan (CLLC, 2024) and Quebec (Canada) (CEM, 2024). Each workshop has contributed towards ongoing development of a replicable and tailorable framework to advance practical application of the principles by engaging partners, rightsholders and interested parties in connectivity conservation planning. Efforts continue via CCSG seeking more places and partners to plan and execute effective delivery of workshops and recommendations in countries and regions to demonstrate application, replication and efficacy.



Participants at Connectivity Conservation Workshop – Ecological Networks for Koytendag State Nature Reserve (SNR) in Ashgabat (Turkmenistan) in April 2023 © CLLC / Aaron Laur.

Participants at Workshop: Transboundary Multi-Species Functional Connectivity in Southern Kenya-Northern Tanzania in Arusha (Tanzania) in August 2024 © CLLC / Annika Keeley.

Once these steps are completed, corridors can be modelled, mapped and, if relevant, prioritised for implementation based on values, risks and opportunities (MNRT, 2022). Informed by detailed spatial data and local knowledge, the project team can delineate the corridor(s), decide on a governance structure and develop a management plan. Once this is accomplished, creating a monitoring plan is important to track the effectiveness of the ecological corridors and report progress (Keeley et al., in press). While implementing this planning framework in workshops over the past six years (Box 1), the following insights have been gained.

- Invest time to identify key partners, rightsholders and interested parties to be engaged in the workshops, ensuring no one feels excluded. Be aware of different contributions participants can offer in the planning process.
- In many land- and seascapes, connectivity studies and projects have already been undertaken and may be ongoing. A key step preparing for the first workshop is to review existing connectivity-related information from the region, including legislation and policies, and design it to participants' current context. Avoid re-inventing the wheel and build on previous work.
- Carefully plan workshops to maximise outcomes, ensuring clear goals are set jointly among planning partners.
- During the workshops, provide participants with opportunities to share past and ongoing connectivity planning and implementation and agree on additional information and steps needed.
- Printing large format maps with relevant data (e.g. PCAs, existing corridors, roads, watercourses, settlements) about the area grounds the discussion allowing participants to make spatially explicit comments and recommendations.
- The Conservation Standards (CMP, 2025) are a useful planning framework for designing conservation projects and provide guidance on assessing the situation and developing management plans.
- Working in small groups is an effective way for all participants to share knowledge and perspectives. Worksheets and world-café-style discussions are effective ways to engage participants in small groups and contribute efficiently to overall workshop outcomes.
- It is important to prepare a comprehensive workshop report summarising presentations, discussions and contributions and clearly stating recommendations and next steps. Such a report can guide subsequent strategic planning and implementation of recommendations.

Examples of country-level efforts towards connectivity conservation are given in the Supplementary Online Material.

CONCLUSION

The path forward for ecological connectivity conservation is both urgent and full of opportunities. Combatting fragmentation is essential to bend the curve for positive biodiversity gains. Defining clear and concise connectivity metrics will be essential for tracking progress and ensuring accountability. Countries will need tailored support to determine the best application of well-connected PCA networks, complemented by strategic conservation efforts that safeguard ecological flows across human-dominated land- and seascapes. Cross-realm coordination, linking terrestrial, freshwater and marine systems, will be critical to sustaining the integrity of ecological networks at scale.

Equally important is enabling policy that facilitates on-the-ground implementation. As many countries and subnational governments have already established ecological corridors on public, community and private lands and seas, increasing application of the IUCN Connectivity Guidelines and the formal recognition of ecological corridors is crucial as a distinct category of spatially explicit conservation measures, in addition to PCAs and Indigenous People and Local Communities-managed areas. This recognition will strengthen ecological network design, accelerate conservation action and provide clearer reporting for global biodiversity-related targets.

Efforts focusing solely on PCA designation miss the dynamic aspects of nature conservation challenged by climate change. Rapid advances in methods and technology, coupled with an unprecedented explosion of species movement data, are transforming our understanding of connectivity needs for both species and ecological processes. Demand for effective connectivity conservation will only grow. In this pivotal moment, IUCN must continue to lead in advancing ecological connectivity as a foundational conservation practice.

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SUPPLEMENTARY ONLINE MATERIAL

Country-level efforts towards connectivity conservation

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RÉSUMÉ

En tant que contre-mesure à la fragmentation, la conservation de la connectivité écologique est une stratégie globale visant à préserver la biodiversité, à accroître la résilience au changement climatique et à bénéficier aux populations terrestres et aquatiques. S'appuyant sur des données scientifiques, des politiques et des pratiques solides, le Groupe de spécialistes de la conservation de la connectivité (CCSG) de la Commission mondiale des aires protégées a publié les Lignes directrices de l'UICN pour la conservation de la connectivité grâce aux réseaux et corridors écologiques. Disponibles en six langues, ces lignes directrices fournissent des informations cohérentes pour préserver la connectivité écologique, en particulier pour soutenir la réalisation de l'élément « bien connecté » de l'objectif 3 du Cadre mondial de Kunming-Montréal pour la biodiversité. Afin de mieux répondre aux objectifs basés sur les zones et les espèces à plus grande échelle, les lignes directrices fournissent des définitions de référence, recommandent la reconnaissance officielle des « corridors écologiques » comme éléments essentiels des « réseaux écologiques » et énoncent les principes et les exigences applicables aux corridors écologiques. Elles constituent une ressource essentielle pour normaliser les définitions et les cadres multilatéraux convenus pour que les corridors écologiques soient reconnus et signalés comme des mesures de conservation spatialement explicites. Le présent document examine l'évolution des politiques et de la mise en œuvre en matière de conservation de la connectivité, aborde les défis liés à la mesure de la connectivité et met en évidence les efforts déployés au niveau national pour reconnaître les corridors écologiques. Il résume les lignes directrices et présente une approche reproductible et adaptable développée par le CCSG et ses partenaires pour les appliquer en collaboration avec les détenteurs de droits et les parties intéressées, en soutenant la conception, la gouvernance, la gestion et la surveillance cohérentes des corridors et réseaux écologiques.

RESUMEN

Como contramedida a la fragmentación, la conservación de la conectividad ecológica es una estrategia integral para salvar la biodiversidad, aumentar la resiliencia al cambio climático y beneficiar a las personas en todas las tierras y aguas. Basándose en sólidos fundamentos científicos, políticos y prácticos, el Grupo de Especialistas en Conservación de la Conectividad (CCSG) de la Comisión Mundial de Áreas Protegidas publicó las Directrices de la UICN para la conservación de la conectividad a través de redes y corredores ecológicos. Disponibles en seis idiomas, las Directrices proporcionan información coherente para conservar la conectividad ecológica, especialmente para apoyar el logro del elemento «bien conectado» de la Meta 3 del Marco Mundial de Biodiversidad de Kunming-Montreal. Para cumplir mejor los objetivos basados en áreas y especies a mayor escala, las Directrices proporcionan definiciones principales, recomiendan el reconocimiento formal de los «corredores ecológicos» como elementos fundamentales de las «redes ecológicas» y establecen principios y requisitos para los corredores ecológicos. Sirven como recurso clave para estandarizar las definiciones y los marcos acordados multilateralmente para que los corredores ecológicos sean reconocidos y notificados como medidas de conservación espacialmente explícitas. En este documento se examinan los avances en la política y la aplicación de la conservación de la conectividad, se analizan los retos que plantea la medición de la conectividad y se destacan los esfuerzos realizados a nivel nacional para reconocer los corredores ecológicos. Resume las Directrices y presenta un enfoque replicable y adaptable desarrollado por el CCSG y sus socios para aplicarlas mediante la colaboración con los titulares de derechos y las partes interesadas, apoyando el diseño, la gobernanza, la gestión y el seguimiento coherentes de los corredores y redes ecológicos.