Identification of Global Priorities for New Mountain Protected and Conserved Areas

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Peaks of the Balkans, Montenegro: *peopleinnature*

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Abstract

Mountain ecosystems are extremely diverse and fragile. They include astonishing biodiversity in terms of number of taxa and endemicity and globally provide the most diverse range of ecosystem services.

The world's system of protected and conserved areas includes many outstanding areas within the Earth's mountainous landscape. Excluding Antarctica, about 19% of mountain areas are protected or conserved, globally. Furthermore, approximately 90% of the most strongly protected conservation estate occurs in mountains, globally and in each of most nations. Nevertheless, significant mountain areas are not adequately protected, and many mountain ranges are completely unprotected. Of over 6000 Key Biodiversity Areas (KBAs) in mountains worldwide, 40.4% are entirely unprotected.

As the world conservation movement advocates to expand the global coverage of terrestrial protected areas over the next decade toward 30%, identifying priorities for new mountain protected and conserved areas will be most efficacious if it takes a strategic approach to ensure areas of highest ecological value and most in need of protection are identified.

This paper introduces an iterative six-step decision support tool for identifying and prioritizing candidate areas for conserving mountain ecosystems, species, and habitats. The tool begins with quantitative analyses of the adequacy of protection of Mountain KBAs, world terrestrial ecosystems, biodiversity hotspots, and red-listed species. It then guides regional teams through qualitative assessments of other values, including inherent values to mountain communities, to develop lists of priority areas to give heightened consideration for protection or conservation.

The tool is framed on the notion that any of the more than 6000 Mountain KBAs can be allocated into one of nine categories: four that identify inadequately protected areas prioritised for heightened consideration, two for which no further action is required unless circumstances change, and three not requiring further action due to being deemed adequately protected.

"Protected and Conserved Areas" *collectively achieve area-based conservation. Protected areas are formally and legally established, e.g., national parks. Other conserved areas, regardless of formal status, are those that are de facto managed for conservation (e.g OECMs).*
See 2.2 for further detail

Key Biodiversity Areas (KBAs) *are sites important for the conservation of globally threatened, range-restricted, or biome-restricted species. They represent some of the highest geographical priorities for biodiversity investments.*
See 3.2 for further detail

Defining Mountains

There are several definitions of mountains. Herein, the mountain-ecosystems mapping and protection-status analysis were derived from a delineation of global Hammond landforms (Karagulle et al., 2017), where mountain classes were quantitatively defined using three terrain variables; slope (gradient), ruggedness (relative relief), and profile. The World Database on Protected Areas was used to assess the representation of mountain ecosystems in protected areas (Sayre et al., 2020).

The reference to protected and conserved areas and KBAs that occur in mountains is based on the UNEP-WCMC criteria for mountains. This is based on altitude and slope in combination, in order to represent the environmental gradients that are key components of mountain environments (UNEP-WCMC 2000 and 2002 and Kapos et al. 2000). Where other statistics on mountains are presented in this paper, refer to the source reference for the definition used.

1 PURPOSE

The project aim is to:

Identify inadequately protected mountain areas and prioritise their importance for protection and conservation.

The project objectives are to:

1. Identify mountain areas that are inadequately covered by protected and conserved areas;
2. Establish criteria and a structured decision-support tool for prioritizing the global significance of mountain areas inadequately covered by protected or conserved areas;
3. Apply the decision-support tool to determine the highest priorities for protection and conservation; and
4. Develop key actions for the WCPA Mountain Specialist Group and the mountains community of interest generally, to assist protection and conservation of the highest-priority sites.

The purpose of this paper is to:

1. Reinforce an understanding and appreciation of the critical natural and cultural values of mountains and the threats to their ecological functions;
2. Present the case for the importance of protecting and conserving representative mountain ecosystems; and
3. Present a decision-support tool to assist in determining priorities for heightened consideration, in order to inform where efforts can be focused, to protect and conserve mountain areas.

Caveats

Spatial conservation planning is complex, involving many interrelated factors. This decision-support tool is intended to present a strategic and globally consistent approach to identifying area-based priorities for new protected and conserved areas in mountains. This is an iterative approach, ranking the importance of inadequately protected KBAs in mountains, taking into account a range of factors and values.

The approach and ultimate results do not preclude the existence of other areas that may be equally or more important or given a different priority, based on evaluation of other factors and more-detailed country-specific systematic planning. The application of the tool is intended to encourage and catalyse regionally based conversations focused on mountain systems to ensure that over long time horizons, these critical mountainous areas provide ecosystem services and conserve species and populations.

The identification of existing protected and conserved areas does not assume they are effectively meeting conservation objectives. Ascertaining whether the area is effectively managed is not the purpose of this approach, but the process remains a fundamental aspect of achieving any positive outcomes for biodiversity in the long term. The IUCN has guidelines for assessing management effectiveness (IUCN 2006).

2 BACKGROUND

2.1 THE IMPORTANCE OF MOUNTAINS TO THE WORLD

Mountains are particularly important for their biodiversity, their storage and subsequent provision of fresh water, and their ecological contribution to clean air. Mountains contribute to cultural diversity, and in addition to their economic importance are valued for recreational, aesthetic, and spiritual reasons. They are income sources for communities through agriculture, tourism, and use of natural resources and are important for the minimisation of natural hazards and early-warning systems (WCPA 2019).

Mountain areas cover only ~25% of the world's total continental land surface yet are home to more than 85% of the world's species of amphibians, birds, and mammals, many of which are entirely restricted to mountains (Rahbek et al. 2019). Mountains occur in 88% of the world's 821 terrestrial ecoregions (WCPA 2019), including half of the world's biodiversity hotspots. Of the world's 237 countries, 197 include mountains. Mountains play a major role in determining global and regional climates; are the source of most rivers; act as cradles, barriers, and bridges for species; and are crucial for the survival and sustainability of many human societies (Perrigo et al. 2019).

Mountains have long been recognized as globally and regionally important centres of biodiversity (Mittermeier et al. 2011), contributing disproportionately to the terrestrial biodiversity of Earth. This is especially true in the tropics, where they host hotspots of extraordinary richness (Rahbek et al. 2019). Given the often extreme variations of climate and topography that exist in mountains over relatively short geographic distances, mountain regions commonly exhibit high levels of both endemism and beta diversity at genetic, species, and ecosystem scales of biological organization (Egan and Price 2017 and Perrigo et al. 2019).

On a global scale, mountains provide the most-diverse and highest number of ecosystem services, compared to other physiographic land features (Egan and Price 2017). Water provision is perhaps the most critical ecosystem service provided by mountains, particularly in terms of supply to more densely populated adjacent lowlands. The great importance of mountains as sources of freshwater has justified their label as the 'water towers' of the world, as it is estimated that at least half of the world's population depends on water originating from mountain headwaters. As a function of their hydrology (precipitation-based increases in discharge) and cryosphere processes (seasonal snow, permafrost, glacial and lake-ice meltwaters), mountain areas contribute to the provision of this vital resource. Mountains contribute disproportionate amounts of runoff to nearly all of the world's major rivers and many minor rivers and are also a major source and storage location of groundwater (Egan and Price 2017).

Along with many other areas, mountains are experiencing acute impacts associated with climate change. Climate change is influencing mountain ecological and geosystems at a faster rate than in other terrestrial habitats globally, especially in areas near the 0 °C isotherm (Nogués-Bravo et al. 2007, but see Pepin and Lundquist 2008).

Due to their high sensitivity, mountain ecosystems can serve as global early-warning systems for detecting climate-change impacts (Björnsen Gurung 2010).

The potential medium- to long-term impacts of climate change in mountain areas are predicted to include considerable and unprecedented change to their inherently fragile ecosystems, which are likely to be further altered by various human interventions (Egan and Price 2007). With ongoing global changes in climate and land use, the role of mountains as refugia for biodiversity may well be compromised (Rahbek et al. 2019).

The rich cultural diversity of mountains is well known. Isolation by rugged topographic barriers has contributed to the persistence of mountain cultures, and remoteness has kept many cultures relatively intact. Mountains are part of societal metageographies that help promote and define a sense of identity that is not dependent only on isolation but also in communal protection and human/environment interactions (WCPA 2019). Cultural considerations are thus vital when assessing appropriate mechanisms for protection and conservation (Foggin 2016) .

As the challenges of the 21st century affect biodiversity and ecosystem services, mountains and mountain communities will need to build ecological resilience to successfully cope with changes of such magnitude. Many communities and societies rely heavily on ecologically healthy mountainous areas for their well-being (WCPA 2019).

As one of the Nature-based Solutions (see 2.2 below), protecting and conserving important mountain sites for biodiversity is vital for ensuring long-term and sustainable use of mountain natural resources. Such actions may also build resilience, recognising that in many areas the current level of protection is relatively low. This is outlined below in 3.1: 'How Protected are Mountains?'

2.2 NATURE-BASED SOLUTIONS: PROTECTED AND CONSERVED AREAS

The Nature-based Solutions framework emerged from the Ecosystem Approach, which underpins the Convention on Biological Diversity (CBD) and considers biodiversity conservation and human well-being to be dependent on functioning and resilient natural ecosystems (CBD 2004). The Ecosystem Approach is a strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way (Shepherd 2011 & CBD 2004). Ecosystem management is a process that integrates ecological, socio-economic, and institutional factors into comprehensive analyses and action in order to sustain and enhance the quality of the ecosystem to meet current and future needs (UNEP 2011 & IUCN-CEM 2019).

'Nature-based Solutions' is an umbrella concept for ecosystem-related approaches, defined by the IUCN as "actions to protect, sustainably manage, and restore natural or modified ecosystems, which address societal challenges effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits" (Cohen-Shacham et al. 2016). These approaches have their roots in the relationship between biodiversity and human well-being (Cohen-Shacham et al. 2019). The IUCN has recently published a Global Standard for Nature-Based Solutions (IUCN 2020a).

Approaches focused on Nature-based Solutions can be placed into five main categories: Restoration, Issue-specific, Infrastructure, Management, and Protection. 'Protection' refers to Area-based Conservation approaches including protected-area management (Cohen-Shacham et al. 2016).

Area-based approaches to biodiversity conservation are an important complement to species-specific efforts. They are a cornerstone of global efforts to halt biodiversity loss, and they focus on protecting important ecosystems and habitats (UN 2011). They include a wide diversity of approaches, geographical scales, and interactions between nature and people. As these aspects may occur at many different scales and may include data-deficient taxa, protected-area design is often reliant on surrogate data (e.g., abiotic patterns thought to be associated with high biodiversity value) or existing biotic classifications such as Key Biodiversity Areas (KBAs). Key Biodiversity Areas have a primary role in identifying inadequately protected or conserved mountain areas and are described in detail below in Section 3.2.

Well-managed, protected, and conserved areas provide a variety of benefits: protection of healthy ecosystems and their associated services, support for the recovery of threatened species, control of invasive species, and maintenance of traditional ecological knowledge among indigenous communities. The goods and services delivered by protected and conserved areas can have effects well beyond their boundaries, for example, where they provide protection of watersheds that result in river flow outside the boundary of the park (Dudley 2008).

2.2.1 PROTECTED AREAS

DEFINITION

The IUCN definition of a protected area is: "A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." IUCN protected-area management categories classify protected areas according to their management objectives (Dudley 2008). The protected Area management categories are:

1. Ia - Strict nature reserve
- Ib - Wilderness area
- II - National park
- III - Natural monument or feature
- IV - Habitat/species management area
- V - Protected landscape or seascape
- VI - Protected areas with sustainable use of natural resources

GOVERNANCE

The management categories are applied with a typology of governance types – a description of who holds authority and responsibility for the protected area (Dudley 2008). IUCN defines four governance types:

- Governance by government

- Shared governance
- Private governance
- Governance by indigenous peoples and local communities

The IUCN Protected Area and Governance categories are described in detail in Appendix 3.

2.2.2 CONSERVED AREAS

DEFINITION

Conservation organisations and institutions are increasingly referring to "protected and conserved areas." The IUCN Green List of Protected and Conserved Areas (IUCN WCPA 2019) is a recent example of the terminology.

Conserved areas may be considered as incorporating all defined areas that effectively achieve conservation *in situ*. This may be found in well managed protected areas, in areas under Other Effective Area-based Conservation Measures (OECMs), Indigenous Peoples' and Community Conserved Areas and Territories (ICCAs-Territories of Life) and unmanaged and ungoverned areas (ICCA 2019). "Other" conserved areas are those areas and territories that, regardless of formal recognition or dedication and at times regardless of explicit or conscious management practices, are *de facto* being conserved and/or are showing a positive conservation trend and likely to maintain this trend in the long term (Borrini-Feyerabend & Hill 2015).

Despite the crucial role of "other" conserved areas, their extent is currently poorly known and monitored. Due to historical data-collection methods and reporting obligations, the World Conservation Monitoring Centre (WCMC) has maintained the World Database of Protected Areas (WDPA) primarily based on data on protected areas reported by governments, and, as a requirement, all sites included in the database meet the IUCN or CBD definition of a protected area (UNEP-WCMC 2018). However, now that Parties to the CBD have adopted an OECM definition, WCMC is preparing for and encouraging reporting also on OECMs as well as ICCAs—Territories of Life from governments and custodians (IUCN-WCPA 2019 & ICCA 2019) for the WDPA.

OTHER EFFECTIVE AREA-BASED CONSERVATION MEASURES (OECMS)

Since 2010, the Convention on Biological Diversity (CBD) has used the term 'other effective area-based conservation measures' (OECMs), which are defined as "geographically defined areas **other than protected areas**, which are governed and managed in ways that achieve positive and sustained long-term outcomes for the *in-situ* conservation of biodiversity, with associated ecosystem functions and services and, where applicable, cultural, spiritual, socio-economic, and other locally relevant values" (CBD 2018).

Aichi Biodiversity Target 11 of the Strategic Plan for Biodiversity 2010-2020 includes OECMs alongside protected areas, to achieve targets for conserving areas of particular importance for biodiversity and ecosystem services.

Parties to the CBD included OECMs in Target 11 due to the fact that some areas outside the recognised protected area networks also result in the effective *in-situ* conservation of biodiversity and recognising that isolated areas are unable to fulfil meaningful conservation objectives (IUCN-WCPA 2019).

Although protected areas must have a primary conservation objective, this is not necessary for OECMs. OECMs may be managed for many different objectives, but they must deliver effective conservation. They may be managed either with conservation as a primary or secondary objective, or long-term conservation may simply be the ancillary result of management activities. OECMs can contribute to ecologically representative and well-connected conservation systems, integrated within wider landscapes and seascapes, and, in doing so, generate a range of positive conservation outcomes (IUCN-WCPA 2019). These may also include territories and conserved areas governed by all four governance types, i.e., by governments, private actors, indigenous peoples and local communities, and areas under shared-governance regimes (IUCN-WCPA 2019).

A screening tool has been developed by the WCPA to determine whether an area is a candidate for OECM status. Areas that meet all four key criteria can be considered as candidate OECMs. They are then subject to further empirical assessment by the WCPA. Only those areas that pass this empirical assessment, and with the full and effective participation and consent of the governance authority, should be reported to the WCMC (IUCN-WCPA 2019).

ICCAS—TERRITORIES OF LIFE

Many indigenous peoples and local communities around the world are custodians, stewards, and/or guardians of the land, water, sky, soil, minerals, and other natural resources and biodiversity that is traditionally occupied or used by them. The idea of custodianship/stewardship/guardianship builds on their relationships with their territories, which include cultural, spiritual, and social practices directed towards the protection not only of the resources themselves but also of natural cycles, ecosystems, wildlife species, and landscape features (ICCA 2019).

The terms ICCAs and "Territories of Life" refer to "territories and areas governed, managed, and conserved by custodian indigenous peoples and local communities." In the context of ICCAs – Territories of Life, traditional knowledge constitutes one of the strongest fibres of the bond between a community and its territory, embodying memories of the past and cultural continuity with the future, while providing guidance for the effective governance and management of the territory (ICCA 2019).

Many ICCAs – Territories of Life are conserved areas and may be considered OECMs: they conserve nature *de facto*, as part of biocultural systems, yet without being listed in an official protected area system (other ICCAs are included in the protected-area system, with or without the consent of the original custodians). The custodianship role of indigenous peoples and local communities is fundamentally different from the mechanism whereby authorities designate areas to be officially 'protected' and thereby constraining the use of natural resources by regulatory means alone.

Acting as custodian means "conserving nature willingly, while living with it and from it, and holding it in trust for future generations."

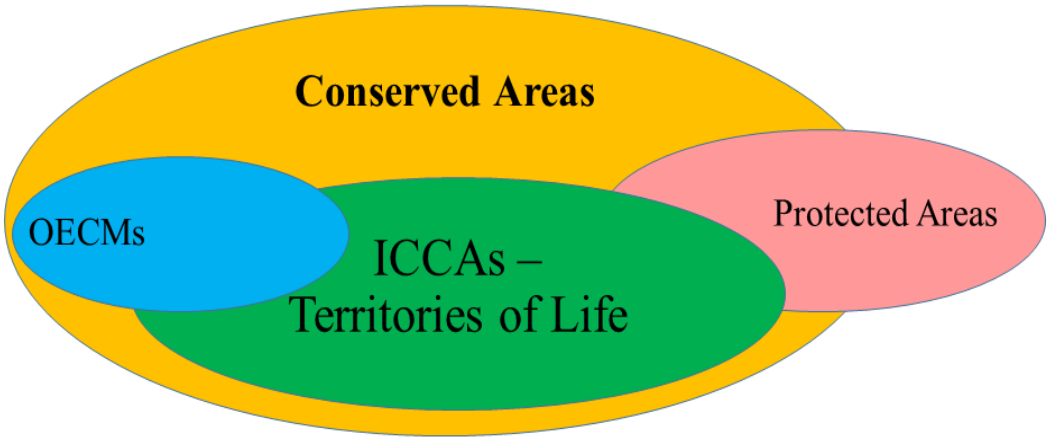
In many ways, being custodian of a territory is synonymous with governing it for the long term, with an internalized sense of responsibility and care. Indigenous or local-community custodianship may include the use of state legislation and regulatory instruments, and state authorities may enter into shared governance custodianship arrangements with indigenous peoples and local communities.

The custodian role generally adapts to the context, and it needs to be understood in context (ICCA 2019). The different ways that conserved areas and protected areas may overlap with each other and with OECMs and ICCAs are outlined below.

3 PROTECTING AND CONSERVING MOUNTAINS

3.1 HOW PROTECTED ARE MOUNTAINS?

Figure 1 Schematic overlap of how conserved areas encompass protected areas, OECMs, and ICCAs – Territories of Life (the size of shapes is not reflective of estimates of coverage (ICCA 2019)



The world's system of protected areas (Fig. 1) includes many noteworthy areas in mountainous regions. Outside Antarctica, 17% (Sayre et al. 2020) to 19% (UNEP-WCMC 2016) of mountain areas are protected globally. However, studies have identified significant mountain areas that are not adequately protected (Rodríguez et al. 2011). Nearly 40% of the world's mountain ranges do not contain any protected areas (Elsen et al. 2018). This merits further investigation, as mountains are considered vulnerable places due to significant economic development, expansion of human activities, and the effects of climate change (Chakraborty 2019).

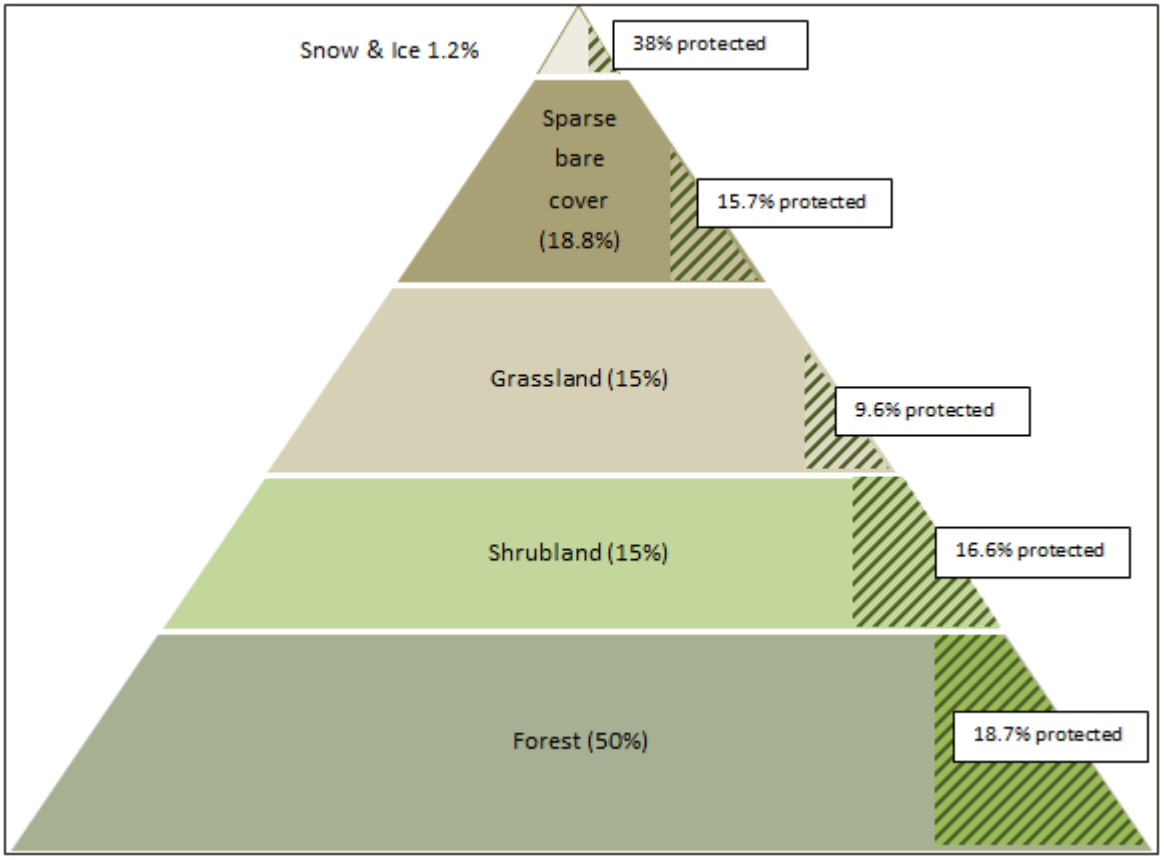
It is also widely noted that mountains may be affected disproportionately by climate change (Chakraborty 2019). Biodiversity in mountains is particularly vulnerable, as many montane species are adapted to narrow microhabitats, making them less able to adjust to climatic change (Bentley et al. 2018).

Climate change challenges include shifts in the distribution and movement of montane species and ecosystems with broad-ranging consequences (Bellard et al. 2012).

Protecting elevational gradients can help fully capture montane biodiversity patterns and facilitate species range shifts (Beier and Brost 2010, Elsen et al. 2018). Most of the world's mountain ranges are narrowly protected and lack elevational distributions needed to preserve biodiversity. Placing protected areas to better represent and connect elevational gradients will enhance ecological representation and facilitate species migration (Elsen et al. 2018). These dynamic aspects indicate the need for ongoing revision of protected areas and are of particular relevance in mountain environments.

Broadly speaking, mountains contain five natural and semi-natural biomes based on World Vegetation and Land Cover Classes: Forest, Shrubland, Grassland, Sparse/Bare cover, and Snow and Ice (Sayre et al. 2020). The level of protection of mountain biomes relative to their proportion is inconsistent, as outlined in Figures 2, 3a, and 3b.

Figure 2 Mountain Biomes: Proportion of each biome in the mountain landscape, globally (central column), and each biome's Level of Protection (right-most edge), (not including croplands or settlements): (based on Sayre et al. 2020). (Note that the heights of each biome and % protected are not to scale)



Key Biodiversity Areas (KBAS) are sites contributing significantly to the global persistence of biodiversity, in terrestrial, freshwater and marine ecosystems (IUCN, 2016). As indicators of geographic priority for species-level conservation efforts, they are an indicator of global biodiversity importance. Of the 6109 Key Biodiversity Areas located in mountains, 52% are less than 30% protected, and 40.4% are completely unprotected. See section 3.2.1 below: Mountain Key Biodiversity Areas.

There is a need to address the status and trend of natural systems worldwide (Butchart et al. 2010), and none more so than in mountain environments. Over the past two decades, a global trend towards degradation has been highlighted in the Millennium Ecosystem Assessment (MEA) and in numerous other studies (UNEP 2005, Diaz et al. 2019).

The Convention on Biological Diversity (CBD) with its 168 signatory nations has played a key role in generating conservation commitment at the global level (CBD, 2004), along with revisions such as the Aichi Targets. Despite this, current information suggests a continuation of historical declines and a need for improved conservation measures (Coad et al. 2015; Geldmann et al. 2019, Visconti et al. 2016). The Aichi global target of 17% of terrestrial and inland water areas being protected by 2020 has not been met. The post-2020 CBD is expected to contain an ambitious new target for protected and conserved areas for the next decade.

Mountain protected and conserved areas have a key role in the application of nature-based solutions for sustainable and healthy mountain communities. There may be many reasons for their non-protection that include conflicts over resource use, cultural and community concerns about formal protection mechanisms, political tensions, or lack of political will and/or lack of an appropriate statute or other protection mechanisms. It may also involve a lack of appreciation for current values, or lack of recognition of the merits of formal protected-area status as an appropriate form of governance.

The continued focus on effectively protecting and conserving mountain ecosystems globally reflects the combined value of such systems: provision of critical ecosystem services; diverse, unique and sensitive biodiversity; unique cultural values; position as geographic icons in the landscape; and alignment with global conservation programs.

3.2 KEY BIODIVERSITY AREAS (KBAS)

Key Biodiversity Areas (KBAs) are defined as 'sites contributing significantly to the global persistence of biodiversity and are found in terrestrial, freshwater, and ocean ecosystems.' KBAs are the most comprehensive dataset on areas of global importance for biodiversity; over 16,000 KBA sites have been identified to date (BirdLife International 2020).

The Global Standard for the Identification of KBAs brings together approaches to identify important Bird Areas, Alliance for Zero Extinction sites, and other existing systems (IUCN 2016). The standard cites criteria and thresholds relating to:

- threatened biodiversity;
- geographically restricted biodiversity;
- ecological integrity;
- biological processes; and
- irreplaceability assessed through quantitative analysis.

Protected area coverage of KBAs is used by the CBD as one of the measures to track progress towards Aichi Target 11, and is also a recognized indicator for the UN Sustainable Development Goals (with subsets reported for marine, terrestrial, freshwater and mountain KBAs).

In January 2020, it was reported that only 19.2% of the world's KBAs are completely covered by protected areas, while 39.3% have no protection, leaving 41.5% only partially protected (BirdLife International 2020a).

For KBAs to have the highest likelihood of long-term persistence of biodiversity and associated ecosystem services, it is important to ensure that KBAs achieve better protection within protected areas, and other effective area-based conservation measures (UNEP-WCMC 2018).KBAs can support the strategic expansion of protected area networks and assist governments and civil society in working toward achievement of new biodiversity targets in the CBD for protected and conserved areas, after 2020.

3.2.1 MOUNTAIN KEY BIODIVERSITY AREAS

The KBA approach provides one means for identifying the location of areas of importance for biodiversity within mountains that are unprotected. The *Protected Planet Report 2016* (IUCN 2016b) reports on national, regional, and global statistics for Sustainable Development Goal (SDG) Indicator 15.4: "Coverage by protected areas of important sites for mountain biodiversity."

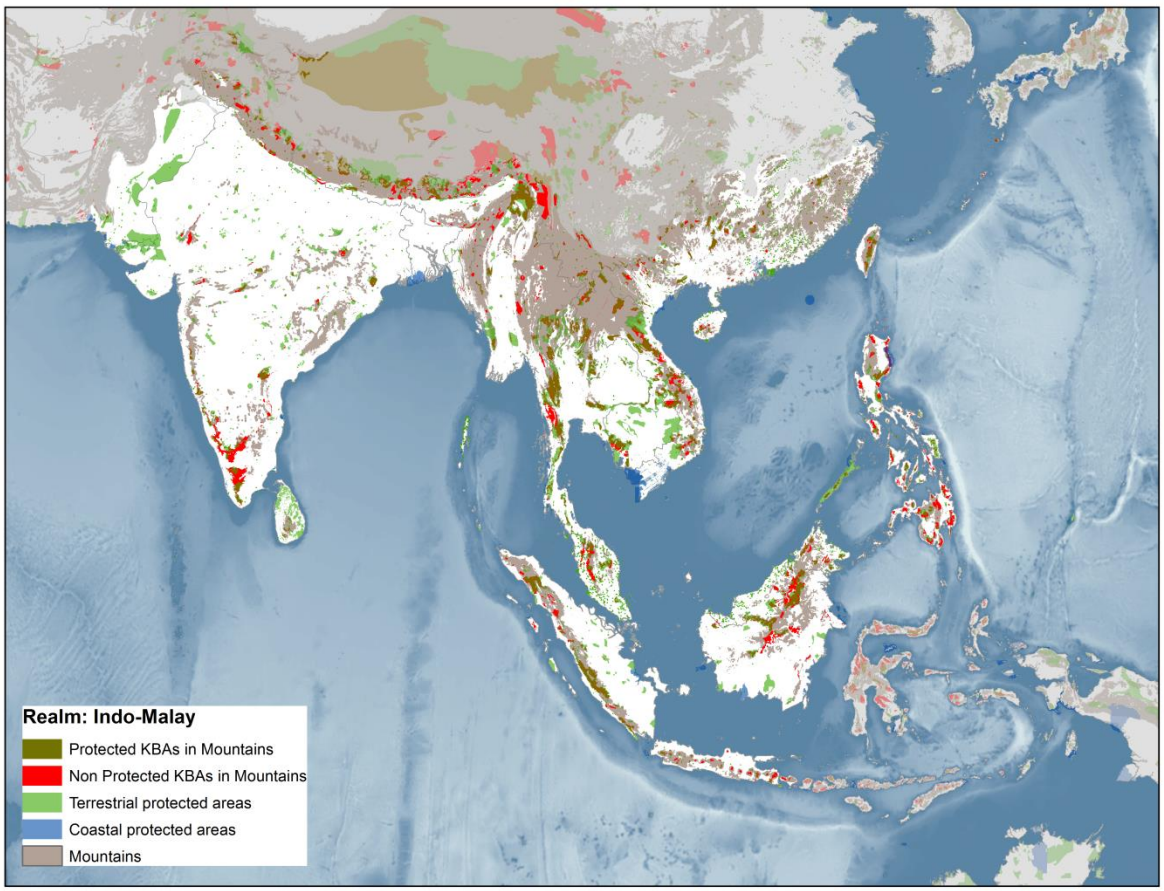
Of over 16,000 Terrestrial KBAs identified, about 40% are in mountains. In January 2020, it was reported that of 6109 KBA sites located in mountains, only 996 (16.3%) are completely covered by protected areas, while 2467 (40.4%) have no protection, leaving 2646 (43.3%) only partially protected (BirdLife International 2020a).

The availability of these Mountain KBA data is a key strategic opportunity to support and facilitate the advancement of the protection of mountains and their contribution to conserving global biodiversity and supporting societal well-being. Thus, the level of protection of KBAs in mountains is the principal factor used in the assessment framework to initially identify inadequately protected areas in mountains for further assessment. (See Section 4, Decision Support Framework for Prioritizing the Protection of Mountains).

Given the large number of partially or completely unprotected KBA sites, this framework will help to provide a pragmatic focus by applying logic and explicit, transparent criteria to prioritize areas for potential action.

The World Database of Key Biodiversity Areas includes specific detail for each KBA such as criteria and thresholds met, species lists, and landscape descriptions, which may further influence the importance placed on conserving a Mountain KBA (BirdLife International 2020). This level of detail is not considered in this decision-support tool at the strategic level, but nevertheless may be useful to add value to the regional assessment process.

Map 1 Protection Status of Mountain KBAs for Indo-Malay Biogeographic Realm (UNEP-WCMC 2020)



3.3 BIODIVERSITY HOTSPOTS

Biodiversity hotspots are an initiative of Conservation International (Conservation International 2019). To qualify as a biodiversity hotspot, a region must meet two strict criteria: It must have at least 1,500 vascular plants as endemic species — that is, it must have a high percentage of plant life found nowhere else on the planet — and its original distributional area must have been reduced by 70% or more, leaving less than 30% of the original area remaining. A hotspot is thus irreplaceable and threatened (Conservation International 2019).

Around the world, 36 areas qualify as biodiversity hotspots (CEPF 2019). They represent just 2.4% of Earth's land surface but contain more than 50% of the world's plant species as endemics and nearly 43% of bird, mammal, reptile and amphibian species as endemics. About half of the world's biodiversity hotspots are in mountainous regions.

Examples of mountainous areas that are biodiversity hotspots include: The Mountains of Central Asia, Himalaya, Tropical Andes, Caucasus, Irano-Anatolian, Mediterranean Basin, Eastern Afro Montane, Mountains of Southwest China, Indo-Burma/India/Myanmar, New Zealand, Chilean Valdivian Forests, Eastern Australia Temperate Forests, and Japan. Information on Biodiversity Hotspot locations and values can be sourced from the Critical Ecosystem Partnership Fund website (CEPF 2019).

3.4 IUCN RED LISTS FOR ECOSYSTEMS AND SPECIES

The IUCN Red List of Ecosystems (RLE) is a global standard for assessing the risk of ecosystem collapse at local, national, regional, and global levels. Assessments determine whether an ecosystem is vulnerable, endangered, or critically endangered (IUCN-CEM 2019). The RLE is coordinated by the IUCN Commission on Ecosystem Management (CEM). Completed assessments are accessible from the website, as are guidelines and criteria for carrying out new assessments (IUCN-CEM 2019a).

The IUCN Red List of Threatened Species is the world's most comprehensive information source on the global conservation status of animal, fungi, and plant species. By evaluating the extinction risk of thousands of species, it is a powerful tool to inform and catalyse action for biodiversity conservation. It also influences the policy changes that are critical to protecting the natural resources and processes that humans rely on (IUCN 2019). The Red List of Threatened Species is overseen and guided by the Red List Committee, which in turn is co-ordinated by the IUCN Global Species Programme and Species Survival Commission (SSC). Associated data are available from the website (IUCN 2019).

The consideration of the Red List of Ecosystems and Threatened Species is valuable for ranking the importance of protecting or conserving a Mountain KBA.

3.5 MOUNTAIN ECOSYSTEMS: CLASSIFICATION AND LEVEL OF PROTECTION

The principle of ecosystems representation in protected areas and other conservation management strategies is a foundational element of conservation priority setting and systematic conservation planning approaches (Possingham et al. 2006). Although the Aichi Target 11 outlines a goal of 17% protection of terrestrial ecosystems, it is also recognized that conservation of as much as 30% or more of an ecosystem's distribution might be necessary for the ecosystem to provide sufficient habitat for species maintenance (Andren 1994). Nevertheless, ecosystem protection of over 17% can be considered relatively well represented.

A review and a classification of the world's terrestrial ecosystems have recently been undertaken, through the integration of global temperature domains, global moisture domains, global landforms, and global vegetation and land use, at a fine-scale resolution of 250 metres (Sayre et al. 2020).

Four hundred thirty-one (431) different World Terrestrial Ecosystems have been identified. When disaggregated by the seven biogeographic realms (excluding the eighth realm, Antarctica) the total number of ecosystems increases to 1778. If each of the 431 globally aggregated ecosystems were to occur in each of the seven realms there would be 3017 ecosystems (431 * 7 = 3017). However, each ecosystem does not occur in every realm (e.g., moist tropical forests in mountains do not occur in the Nearctic realm), and the total number of observed ecosystems (1778) is thus less than the total possible number of ecosystems (3017).

Of the 431 World Ecosystems, 278 are considered natural or semi-natural vegetation/environment combinations. Of those, 77 (28%) are identified as mountain ecosystems that cover 32% in area of the world's natural or semi-natural ecosystems (Sayre et al. 2020).

Freshwater ecosystems within mountains are currently being mapped and are expected be added to the World Ecosystem dataset in late 2021.

3.5.1 MOUNTAIN MOISTURE/VEGETATION CLASSES: COVERAGE AND PROTECTION

To obtain a sub-biome landscape perspective of coverage and protection, the mountain areas were subset by moisture domains because moisture (along with temperature) is a driving factor behind biotic distributions (Sayre et al. 2020). The mountain ecosystems have been grouped into 15 Moisture/Vegetation classes, based on World Vegetation and Land Cover 2015 data and World Moisture Domains (Sayre et al. 2020). The 77 Mountain Ecosystems are then determined by the intersection of 6 World Temperature Domains (Sayre et al. 2020) to the 15 Moisture/Vegetation classes (see Appendix 2 for the list of world mountain ecosystems coverage and level of protection). The coverage and protection of Moisture/Vegetation classes in mountains is outlined below in Table 1 and Figures 3a & 3b. All data are derived from Sayre et al. 2020.

Table 1 Moisture/Vegetation Classes; Proportion of Mountains by Area and Level of Protection (in order of Area Protected km^2)

Moisture/Vegetation Class	Size (km^2)	% of the Global Total Area of Mountains	Area in the Class that is Protected (km^2)	% Protection (column 4/column 2)*100
Desert Snow and Ice on Mountains	11	0.00003	0.43	3.9
Desert Forest on Mountains	1340	0.00395	73	5.4
Desert Grassland on Mountains	50253	0.14797	3091	6.2
Dry Snow and Ice on Mountains	62157	0.18302	7836	12.6
Desert Shrubland on mountains	73707	0.21702	10250	13.9
Moist Snow and Ice on Mountains	341880	1.00663	146764	42.9
Desert Sparsely or Non-vegetated on Mountains	1183239	3.48393	204532	17.3
Dry Grassland on Mountains	3089424	9.09651	209345	6.8
Moist Grassland on Mountains	1868116	5.50049	268937	14.4
Dry Sparsely or Non-vegetated on Mountains	3321443	9.77967	343165	10.3
Moist Shrubland on Mountains	2030014	5.97718	373542	18.4
Moist Sparsely or Non-vegetated on Mountains	1701472	5.00982	413707	24.3
Dry Shrubland on Mountains	3125303	9.20215	485638	15.5
Dry Forest on Mountains	3181949	9.36894	500172	15.7
Moist Forest on Mountains	13932436	41.02270	2696176	19.4
Total Area	**33962744**		**5663229**	**16.7**

Figure 3a Percent of total mountain area that each Moisture/Vegetation class constitutes

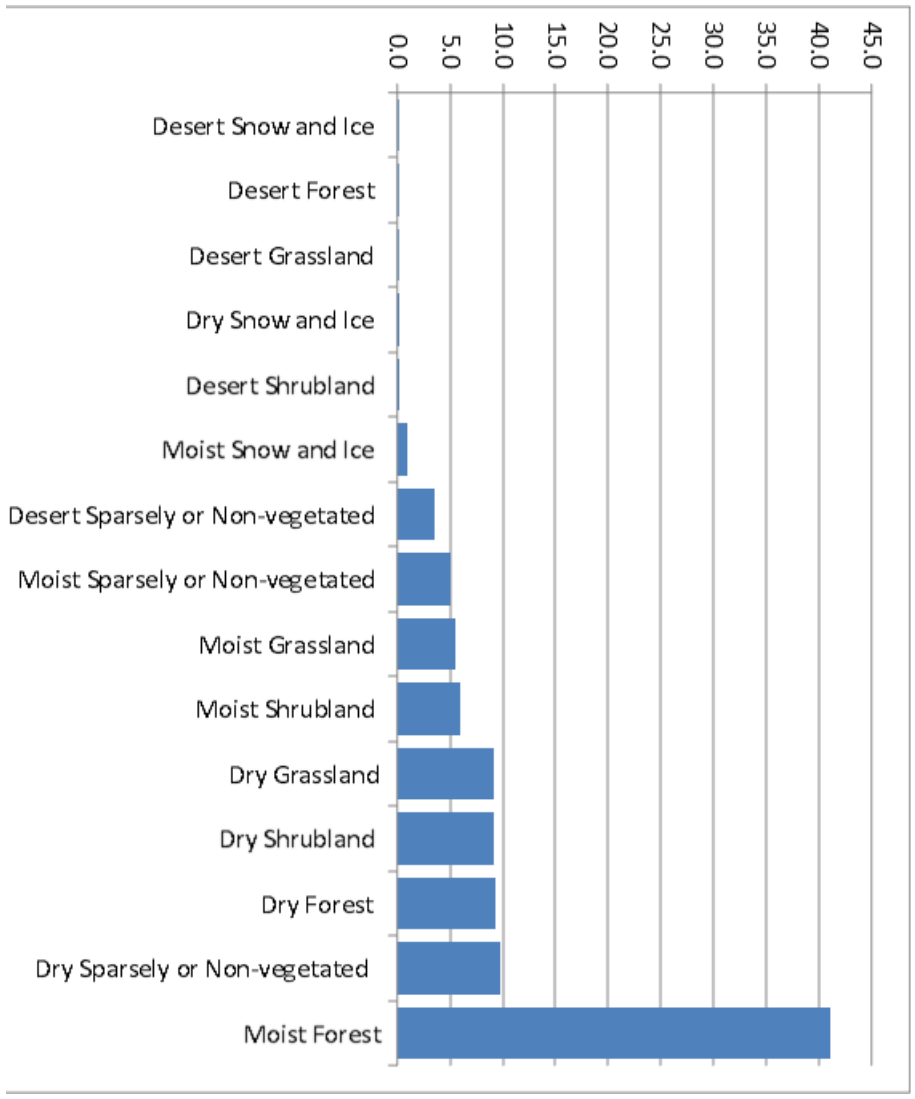
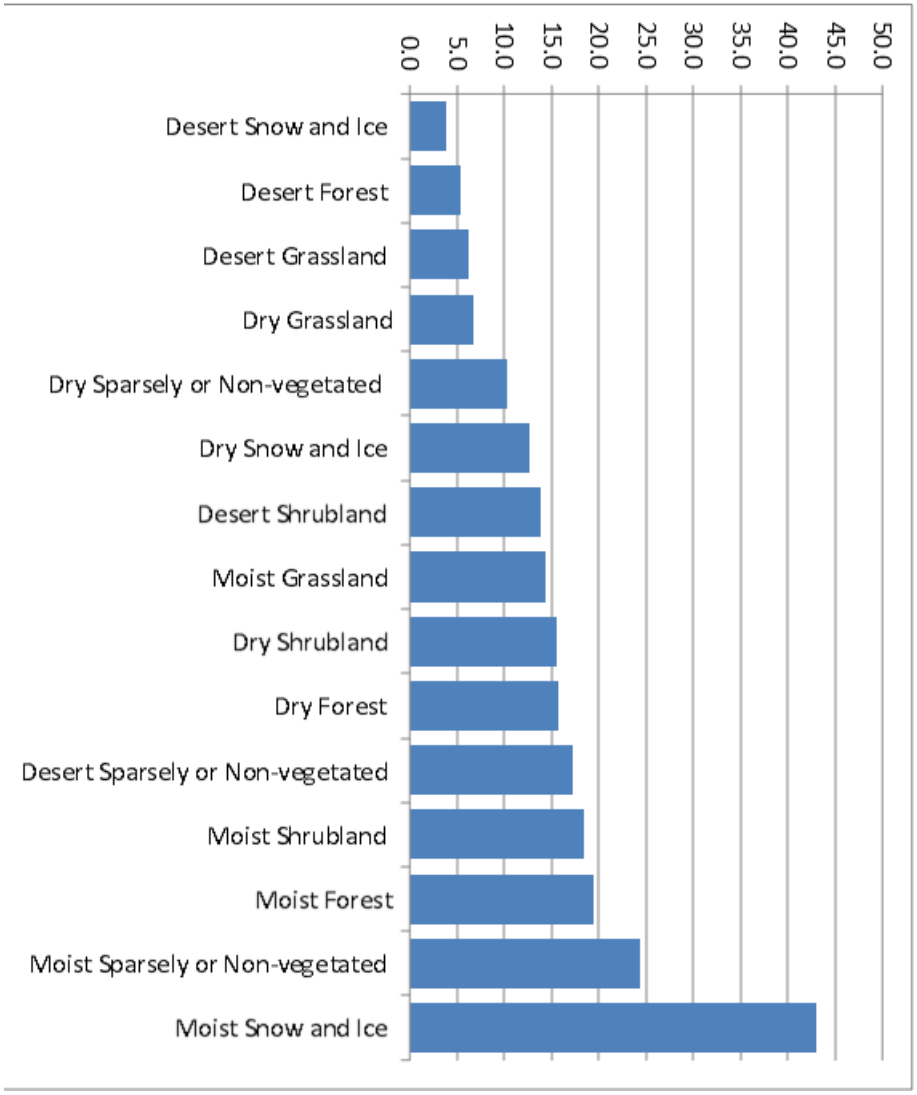


Figure 3b Percent of each Moisture/Vegetation class that occurs within protected areas, as defined in sections 2.2.1 and 3.1, above



3.5.2 MOUNTAIN ECOSYSTEMS QUANTIFIED BY AREA

The most extensive of the mountain Moisture/Vegetation classes is overwhelmingly Moist Forest on Mountains, which covers 41% of the total area of mountains.

The coverage of ecosystems within that class includes:

- Boreal Moist Forest on Mountains, the largest mountain ecosystem, which constitutes 10.4% of the total global extent of mountains;
- Subtropical Moist Forest on Mountains constitutes 8.9% of the total global extent of mountains;
- Cool Temperate Moist Forest on Mountains covers 8.4% of the total global extent of mountains;
- Warm Temperate Moist Forest on Mountains covers 6.7% of the total global extent of mountains; and
- Tropical Moist Forest on Mountains covers 6.1% of the total global extent of mountains.

The smallest of the mountain Moisture/Vegetation classes is Desert Snow & Ice, which covers only 0.0003% of the total global area of mountains. That grouping contains the smallest individual mountain ecosystem on the planet, Polar Desert Snow & Ice on Mountains, at only 11 km^2.

Forty-eight mountain ecosystems each contain less than 1% of the total area of mountain ecosystems, globally.

3.5.3 GAP ANALYSIS OF MOUNTAIN ECOSYSTEMS PROTECTED

A global gap analysis of the representation of protected areas in the world's ecosystems (at both the less-inclusive (IUCN I-IV) and more-inclusive (IUCN I-VI) levels has been carried out (Sayre et al.2020) This is instructive as one of many factors in considering the adequacy and comprehensiveness of the mountain protected-areas estate globally, and for prioritizing future protection.

3.5.3.1 PROTECTION QUANTIFIED BY AREA

The most protected (IUCN I-VI) mountain Moisture/Vegetation class by area is Moist Forest with a protected area of 2,696,176 km^2, covering almost half of the mountain protected area estate.

The mountain ecosystems with the largest protected area include:

- Subtropical Moist Forest on Mountains (643,140 km^2);
- Cool Temperate Moist Forest on Mountains (642,942 km^2); and
- Tropical Moist Forest on Mountains (625,087 km^2).

The least protected (IUCN I-VI) mountain Moisture/Vegetation classes by area include:

- Desert Snow and Ice (0.43 km^2);
- Desert Forest (73.68 km^2); and
- Desert Grassland (3091 km^2

3.5.3.2 PROTECTION QUALIFIED BY PROPORTION

The most comprehensively protected (IUCN I-VI) mountain Moisture/Vegetation class is overwhelmingly Moist Snow & Ice which is 43% protected.

The mountain ecosystems most comprehensively protected include:

- Cool Temperate Moist Snow and Ice on Mountains (60% protected);
- Polar Moist Snow and Ice on Mountains (43% protected); and
- Boreal Moist Snow and Ice on Mountains (40% protected).

The least comprehensively protected (IUCN I-VI) mountain Moisture/Vegetation classes include:

- Desert Snow and Ice (3.9% protected);
- Desert Forest (5.4% protected); and
- Desert Grassland (6.2% protected).

The mountain ecosystems least protected, include:

- Boreal Desert Sparsely or Non-vegetated on Mountains (0% protected);
- Boreal Desert Grassland on Mountains (0% protected); and
- Cool Temperate Desert Grassland on Mountains (0.006% protected).

3.6 GLOBAL POLICY INITIATIVES FOR MOUNTAIN PROTECTION

3.6.1 INTERNATIONAL POLICY RECOGNITION OF THE IMPORTANCE OF MOUNTAIN ECOSYSTEMS

The Conference of the Parties to the CBD, at its tenth meeting in 2010, noted amongst other decisions referring to mountain biological diversity, the invitation to parties, other governments, relevant organizations and indigenous and local communities to establish effectively and appropriately managed protected areas in line with the programme of work on protected areas to safeguard the highest priority Key Biodiversity Areas in mountain ecosystems (UNEP 2010).

The "Future We Want" statement from the Rio +20 United Nations Conference on Sustainable Development notes in Paragraph 210: "fragile mountain ecosystems are particularly vulnerable to the adverse impacts of climate change, deforestation, and forest degradation, land use change, land degradation and natural disasters," and further, in Paragraph 212, "calls for greater efforts towards the conservation of mountain ecosystems, including their biodiversity" (UN 2012).

Sustainable Development Goal 15 (SG15): Life on Land, states that healthy mountain ecosystems are fundamental to ensuring the provision of ecosystem services to upland communities as well as lowland peoples. SG15 target 15.4 is: "by 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development". Indicator 15.4.1 is: "Coverage by protected areas of important sites for mountain biodiversity" (UN 2019).

Several resolutions adopted by the United Nations General Assembly on 21 December 2016 were related to Sustainable Mountain Development. Resolution 14, "notes the importance of ensuring the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for human well-being, economic activity and sustainable development, and of developing innovative means of implementation for their protection" (UN 2016).

3.6.2 THE IUCN PROGRAMME 2017–2020

The IUCN Programme 2017–2020 consists of three programme areas:

1. Valuing and conserving nature;
2. Promoting and supporting effective and equitable governance of natural resources; and
3. Deploying nature-based solutions to address societal challenges including climate change, food security and economic and social development (IUCN 2017).

The mountain protected areas project crosses over and supports these programs:

(i) Identifying inadequately protected Mountain KBAs and importantly, developing a decision support framework for prioritizing those of most value for protection or conservation and where heightened consideration is more likely to be effective. This aligns with valuing and conserving nature IUCN Target 10 "*Protected area networks are expanded to conserve areas of particular importance (including mountains) for biodiversity through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures" (IUCN 2017) and through contributing to meeting Sustainable Development Goal 15 (see 2.5.1 above).*

(ii) *Distinguishing varying natural resource governance arrangements that equitably and effectively meet protection and conservation outcomes, also aligned with IUCN Targets 10 and Target 15: "Community-led, cultural, grassroots or protected area governance systems that achieve the effective and equitable governance of natural resources are recognised, supported and promoted, while respecting the rights of nature" (IUCN 2017).*

(iii) *Deploying nature-based solutions though attempting to achieve effective area-based protection and conservation of KBAs, also taking into account a wide range of other protected area values such as climate-change mitigation, mountain community support, and opportunities for economic returns through regional assessments, all of which are aligned with IUCN Target 30; "Work with government and NGO Members and other partners to enable the effective protection and management of intact, natural and semi-natural ecosystems through a range of mechanisms so that they continue to deliver key nature-based solutions to society"(IUCN 2017).*

3.6.3 GLOBAL ENVIRONMENT FACILITY

As an independent mechanism for international cooperation, the Global Environment Facility's (GEF) purpose is to support **developing countries** by providing grants or concessional funding to contribute to agreed global environmental benefits. The GEF serves several Conventions including the United Nations CBD. Biodiversity is one of six GEF Focal Area Strategies, which includes the Programme: Improving Sustainability of Protected Area Systems (GEF 2015). The IUCN is one of several organisations called on to implement GEF-financed projects.

Developing countries are characterised by being less developed industrially and with a lower Human Development Index, when compared to other countries. The United Nations Development Programme (UNDP 2018) lists 6 Developing Regions that amalgamate 159 countries classified as 'Developing'.

The Developing regions include:

- Arab States (20 countries or territories);
- East Asia and the Pacific (24 countries);
- Europe and Central Asia (17 countries);
- Latin America and the Caribbean (33 countries);
- South Asia (9 countries); and
- Sub-Saharan Africa (46 countries).

Many inadequately protected or conserved KBAs occur in developing countries. In developed regions, 25% of Mountain KBAs are protected, compared to 15% in developing regions (UNEP-WCMA 2016). The GEF provides an opportunity to support investment into establishing new protected or conserved areas in developing countries.

4 DECISION SUPPORT FRAMEWORK FOR PRIORITIZING THE PROTECTION OF MOUNTAINS

A decision-support framework for identifying mountains that are not adequately protected and for prioritizing their importance for protection is described below, (See 4.2 Assessment Framework, Figures 2 and 3, and Appendix 1). It is based principally on inadequately protected Mountain KBAs that are then further assessed and ranked against other values. The framework contains six steps that result in any of the over 6000 Mountain KBAs being allocated into nine categories with different actions.

4.1 METHOD DEVELOPMENT

UNEP-WCMC and Birdlife International have provided data and maps of protected areas and KBAs by Biogeographical Realm that supported the preparation of the Protected Planet Report 2016; Contribution to the 2016 Sustainable Development Goals (Indicator 15.4.1 "Coverage by protected areas of important sites for mountain biodiversity"). The protection status comes from the World Database of Protected Areas (WDPA) and KBA status from the World Database of Key Biodiversity Areas. These data were updated in January 2020 (Birdlife International 2020a).

The maps provided a basis for an initial discussion at a Mountain Knowledge Café at the IUCN World Conservation Congress in Hawaii on 4 September 2016. Subsequently, the tool has been developed with broad stakeholder input in the design, a reliance on principles of conservation ecology, and a robust set of inputs. The USGS has provided new data on World Ecosystems and their level of protection (Sayre et al. 2020). Uptake and evaluation of its utility to the mountains biodiversity community is now encouraged. To support this project, the WCPA Mountain Specialist Group now has a representative from each of the 13 WCPA Regions covering all eight Bio-geographical Realms.

SCALE AND LIMITATIONS

This tool is designed to guide the work of the WCPA Mountain Specialist Group and, by extension, the larger mountain conservation community. The application of the framework may be varied to suit a variety of governance models and levels of institutional capacity. The tool represents a rapid and strategic assessment approach with a global reach that makes use of existing global datasets aimed at galvanising relatively prompt action where it is needed most. It aims to be a catalyst for further extensive discussions involving on-ground knowledge and truthing and consultations at multiple spatial and organizational scales.

KBAs are but one way to initiate a global strategic assessment of natural values of mountains and are based on known and recorded data. For some regions, current limitations on capacity and technology mean that it will take time to compile the necessary data and level of detail to demonstrate that sites meet the quantitative thresholds associated with the KBA criteria. In addition, other areas may be important for other reasons (e.g., maintaining productivity, ecosystem services, aesthetics, cultural heritage and mountain landscapes important for the persistence of biodiversity beyond the site scale) (IUCN 2016). The presence or otherwise of recorded Mountain KBAs should not override other important values that are identified in other regional assessments.

4.2 THE ASSESSMENT FRAMEWORK

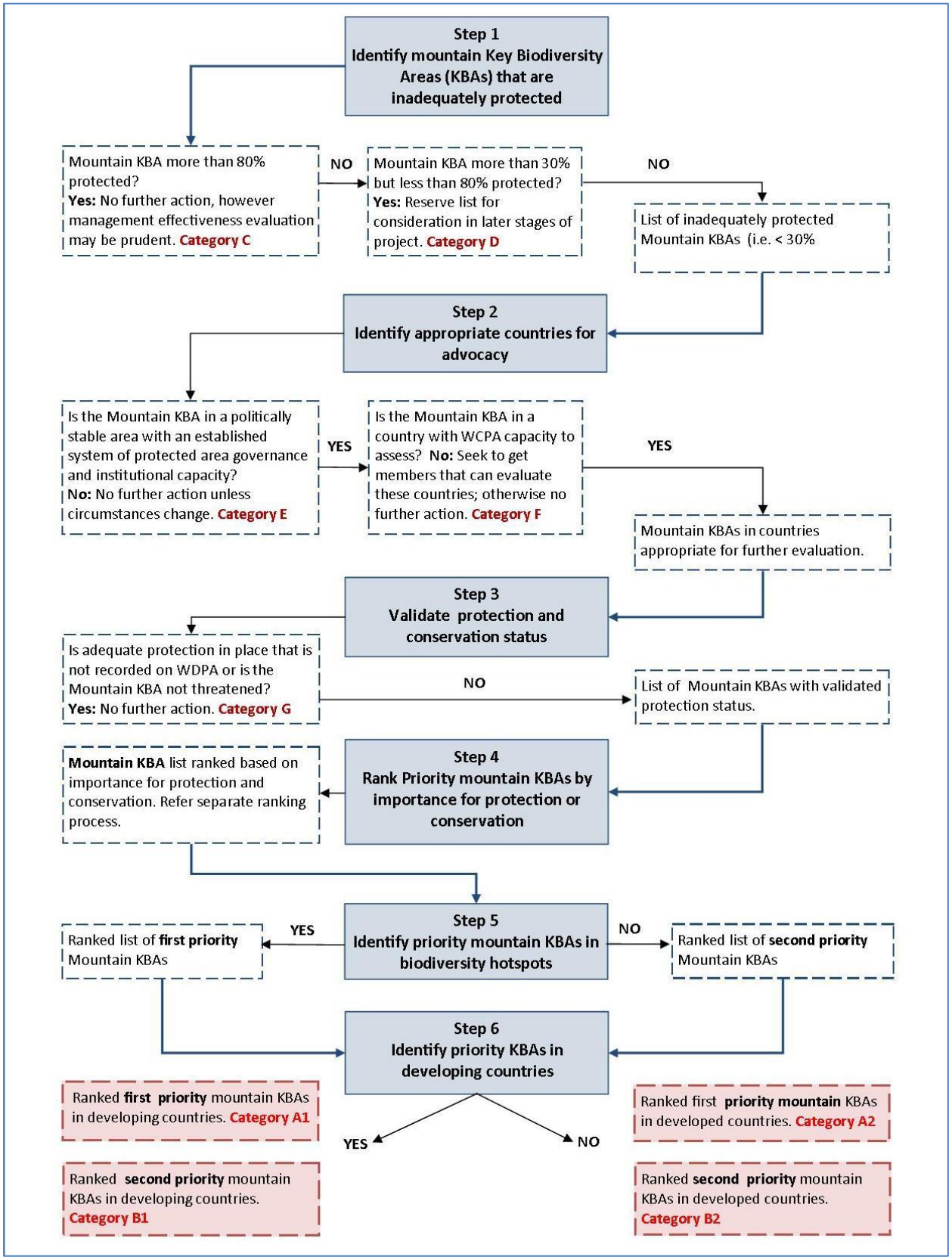


Figure 4: Decision-Support Tool for Identification of Global Priorities for new Mountain Protected and Conserved Areas

The interactive Decision Support Tool is designed and presented in Microsoft Excel. It contains built in selection and scoring functions and references and datasets. It is available on the WCPA Mountains Specialist Group web page here. Below is an outline of the steps and supporting data.

4.2.1 STEP 1: IDENTIFY MOUNTAIN KBAS THAT ARE INADEQUATELY PROTECTED

This first step identifies Mountain KBAs that are considered to be inadequately protected and require further examination. **Inadequately protected** is defined in this case by the area of the Mountain KBA being less than 30% protected or conserved. This is aligned with WCPA support for the calls for an international goal of protecting 30% of the oceans and land by 2030 (known as 30X30) under new targets for the Convention on Biological Diversity. **Protected or conserved area** refers to one being listed on the WDPA as a protected area or OECM, that meet the IUCN definition of a protected area or OECM. See sections 2.2.1 and 2.2.2.

Knowledge source:
The World Database on Protected Areas (WDPA) is the most comprehensive global database on terrestrial and marine protected areas. The Birdlife International and UNEP-WCMC analysis of spatial overlap between KBA polygons and WDPA polygons, (Birdlife International 2020a) quantifies the area of the Mountain KBA that covered by protected areas.

Values	Data Source
Protected areas	World Database of Protected Areas (UNEP-WCMC and IUCN 2020). https://www.protectedplanet.net
Key Biodiversity Area data and maps	World Database of Key Biodiversity Areas (BirdLife International 2020). www.keybiodiversityareas.org
Key Biodiversity Areas and protected area status	Integrated Biodiversity Assessment Tool. https://ibat-alliance.org/
Quantification of global coverage of KBAs by protected Areas	Refer; (BirdLife International, 2020a), data held by WCPA Mountain Specialist Group and Appendix 1 of Mountain Protected and Conserved Areas Decision Support Tool here

4.2.2 STEP 2: IDENTIFY APPROPRIATE COUNTRIES FOR HEIGHTENED CONSIDERATION

This second step considers the countries where there are inadequately protected Mountain KBAs from Step 1 to determine if they are suitable for further evaluation. Prioritization and heightened consideration will focus on countries that are politically stable and safe to work in and have an established protected or conserved area system with institutional capacity to build on. Furthermore, where the WCPA has access to regional representatives with in- country knowledge.

Knowledge source

Consideration and Values	Data source
Assessment of suitability of country to proceed with assessment	The suitability for a country to work in may be a rather subjective assessment and the guidance of the relevant IUCN Regional Councillors and WCPA Regional vice Chair would be sought.
Availability of in-country expertise for assessment of KBAs	Regional in-country expertise and knowledge is crucial for accurate validation of protection status of KBAs in step 3 and to assess and rank other protected area values in step 4. The WCPA Mountain Specialist Group Regional Representatives will determine if support is available. If this expertise in not accessible at this stage, assessment of KBAs in that country will be set aside, until that capacity is available.

4.2.3 STEP 3: VALIDATE PROTECTION AND CONSERVATION STATUS

This third step is to validate the information available on the WDPA and the UNEP-WCMC analysis of spatial overlap between KBA polygons and WDPA polygons (Birdlife International 2020a) for the list of inadequately protected KBAs from Step 2. This will be done by regional experts with access to on-the-ground knowledge.

The Mountain KBAs identified as inadequately protected may be adequately protected or conserved by *de facto* or unregistered arrangements. These may be OECMs, ICCAs or other protected areas that haven't been registered on the WDPA and/or may not choose to be (see 2.2.2. Conserved Areas). The information in the WDPA may also be incorrect. There may also be a situation where it is considered that the Mountain KBA, despite not being formally protected or conserved, is not at risk or not under any apparent threat and therefore remains a lower priority for action. Only those where the inadequate protection status is validated continue to step 4 for ranking.

Knowledge source

Value	Data source
Validate Protection and conservation status	The WCPA Mountain Specialist Group Regional Representatives will arrange validation of protection and conservation status. Refer: IUCN-WCPA (2019). *Recognising and reporting other effective area-based conservation measures.* Task Force on OECMs. https://doi.org/10.2305/IUCN.CH.2019.PATRS.3.en

4.2.4 STEP 4: RANK PRIORITY MOUNTAIN KBAS BY IMPORTANCE FOR PROTECTION OR CONSERVATION

This fourth step then evaluates each Mountain KBA on the list of inadequately protected Mountain KBAs in countries appropriate for further evaluation with protection status validated. They will be scored and ranked as candidates for prioritized consideration against a range of other values and attributes that raise their importance for protection. The ranking is based on accumulated scores as calculated in the Decision Support Tool.

Knowledge source

This evaluation is undertaken at the regional level with accumulated scores ranking the importance of each Mountain KBA within the region (see Appendix 1, Step 4). Mountain values and attributes are assessed to augment the importance of protecting or conserving the Mountain KBA. The attributes and supporting data are listed below.

Value/Attribute	Data and information Source
Presence of inadequately protected world ecosystems	Refer Appendix 2 and Sayre et al. (2020). Ecosystem information available at: https://rmgsc.cr.usgs.gov/outgoing/ecosystems/Global/
Opportunity to enhance connectivity conservation	*Guideline for Conserving Connectivity through Ecological Networks and Corridors*. IUCN-WCPA. https://portals.iucn.org/library/node/49061 Tools and advice available at: http://conservationcorridor.org/
Presence of flagship or iconic species or ecological communities	A flagship species is a species selected to act as an ambassador, icon or symbol for a defined habitat. These iconic species or ecological communities may be internationally recognised or be determined by regional significance.
Presence of Red List threatened species	IUCN Red list species list: https://www.iucnredlist.org/ Presence in KBAs: https://ibat-alliance.org/
Presence of Red List threatened ecosystems	IUCN criteria for method for determining level of endangerment of ecosystems: https://www.iucn.org/resources/conservation-tools/iucn-red-list-ecosystems https://iucnrle.org/assessments/
Represents a range of elevation gradients	Qualitative assessment based on local knowledge and judgement. Refer: Elsen et al. 2018. *Global patterns of protection of elevational gradients in mountain ranges*.

Value/Attribute	Data and information Source
Conservation would provide benefits to mountain communities such as protection of critical resources and ecosystem services	*Tools for measuring, modelling, and valuing ecosystem services: guidance for Key Biodiversity Areas, natural World Heritage sites, and protected areas.* IUCN-WCPA. https://portals.iucn.org/library/node/47778
Provides protection of cultural sites, cultural heritage and cultural landscapes	Qualitative assessment based on Regional and in country cultural heritage information & World Heritage Cultural Sites. https://whc.unesco.org/en/list/
Provides ecotourism opportunities to benefit mountain communities	Qualitative assessment based on local knowledge and judgement and advice from tourism industry and ecotourism strategies. *Tourism and visitor management in protected areas: Guidelines for sustainability* IUCN-WCPA: https://portals.iucn.org/library/node/47918
Provides peace building across borders	Qualitative assessment based on local knowledge and judgement in trans frontier situations. IUCN Commission of Environment Economic and Social policy theme on Environment and Peace; and Global Transboundary Conservation Network; Transboundary Diagnostic Tool: http://www.tbpa.net/page.php?ndx=22
Vulnerability to climate change and/or opportunity to mitigate the impacts of climate change	Qualitative assessment based on regional knowledge, climate change mitigation and adaptation plans and judgement. Natural Solutions*: Protected areas helping people cope with climate change*. IUCN-WCPA. https://portals.iucn.org/library/sites/library/files/documents/Rep-2011-021.pdf
Opportunity for disaster risk reduction	Qualitative assessment based on regional knowledge, risk assessments and judgement. Dudley et al. (2013). *Reducing vulnerability: the role of protected areas in mitigating natural disasters.* Natural Solutions: *Protected Areas Protecting People: a tool for Disaster Risk Reduction.* IUCN-WCPA. https://www.iucn.org/sites/dev/files/import/downloads/natural_solutions_drren.pdf Monty, F., Murti, R. and Furuta, N. 2016. *Helping nature help us: Transforming disaster risk reduction through ecosystem management*. https://portals.iucn.org/library/node/46537 Murti & Buyck (Eds.) (2014). *Safe Havens: Protected Areas for Disaster Risk Reduction and Climate Change Adaptation*. https://www.iucn.org/sites/dev/files/2014-038.pdf

4.2.5 STEP 5: IDENTIFY PRIORITY MOUNTAIN KBAS IN BIODIVERSITY HOTSPOTS

The fifth step determines if Mountain KBAs on the ranked list from Step 4 are in Biodiversity Hotspots. Biodiversity Hotspots indicate very high values under threat (see 3.3). Those in Biodiversity Hotspots are listed as the first priorities, the second priority list being those not in Biodiversity Hotspots.

Knowledge source

Value/Attribute	Data Source
Biodiversity Hotspots	Critical Ecosystem Partnership Fund. https://www.cepf.net/our-work/biodiversity-hotspots/hotspots-defined

4.2.6 STEP 6: IDENTIFY PRIORITY KBAS IN DEVELOPING COUNTRIES

In Step 6, the first and second priority ranked lists of Mountain KBAs from Step 5 are separated into those classified as being in developing or developed countries. The Global Environment's Facility (GEF) is to support developing countries by providing grants or concessional funding to contribute to agreed global environmental benefits. Many inadequately protected or conserved KBAs occur in developing countries. The GEF provides an opportunity to support investment into establishing new protected or conserved areas in developing countries (see 3.6.3).

Knowledge source

Attribute	Data source
Developing or developed countries	The UNDP Human Development Indices and Indicators Statistical Update provides list of developing countries and regions. (UNDP 2018). http://hdr.undp.org/en/content/human-development-indices-indicators-2018-statistical-update

OUTCOME

The result of application of the decision support tool is that Mountain KBAs will be allocated into one of nine categories:

- Four categories for follow up action (see below).
- Three categories (Categories C, D and G) not requiring further action as they are considered to be adequately protected by means of a protected area, OECMs, ICCAs: Territory for Life, other effective protection, or the Mountain KBA is considered not threatened by not being protected.
- Two categories (Categories E & F) for no further action due to countries being not suitable for working in and/or lack of a protected area system , institutional support or in-country expertise and capacity for assessment.

The four lists for follow up action are ranked in order of importance and priority for action:

1. Category A1: List of ranked first-priority Mountain KBAs occurring in developing countries (and within Biodiversity Hotspots);
2. Category A2: List of ranked first-priority Mountain KBAs occurring in developed countries (and within Biodiversity Hotspots);
3. Category B1: List of ranked second-priority Mountain KBAs occurring in developing countries (and not within Biodiversity Hotspots); and
4. Category B2: List of ranked second-priority Mountain KBAs occurring in developed countries (and not within Biodiversity Hotspots).

The decision support tool description is expanded in Appendix 1. The iterative Decision Support Tool with datasets is designed and presented in Excel and available on the WCPA Mountains Specialist Group web page here .

Systematic Conservation Planning

The ranking of mountain KBAs is purposefully aimed at identifying priorities for protection and conservation based on a range of global and local mountain values. There is an opportunity for a country or region to build this information into a systematic assessment of alternatives for conservation action which evaluates the most efficient way to design a conservation network. In this context taking a systematic conservation planning approach might be appropriate.

5 SUMMARY

Mountain ecosystems are extremely diverse and fragile, include astonishing biodiversity in terms of number of taxa and endemicity, and make up half of the world's biodiversity hotspots. On a global scale, mountains provide the most-diverse range of ecosystem services. Water is perhaps the most critical ecosystem service provided by mountains.

The world's system of protected areas includes many outstanding areas within the Earth's mountainous landscape. Outside Antarctica, only about 19% of mountain areas are protected globally; i.e., over four-fifths of mountain areas are not adequately protected. Mountain protected and conserved areas have a key role in the application of nature-based solutions for sustainable and healthy mountain communities.

Identifying priorities for new mountain protected and conserved areas is a key aim of the WCPA Mountain Specialist Group. However, this necessitates taking a strategic approach to ensure areas of highest value and most in need of protection are identified as priorities for consideration.

Key Biodiversity Areas (KBAs) are defined as sites that contribute significantly to the global persistence of biodiversity. The identification of inadequately protected KBAs provides one means for determining spatially unprotected areas of importance for biodiversity within mountains. Of 6109 KBA sites currently identified in mountains, 16.3% are completely protected, 43.3% of KBAs are only partially protected, and 40.4% of KBAs are entirely unprotected (Birdlife International 2020a).

This paper presents an iterative decision-support tool based principally on identifying inadequately protected Mountain KBAs. The tool assists in identifying priority areas to inform and support area-based protection or other conservation action. Inputs that could add value to the importance for protection include data from sources such as world ecosystem typologies, biodiversity hotspots, IUCN red lists, and a range of other values. This approach aligns with numerous IUCN and other global policy frameworks, such as Sustainable Development Goal 15, the IUCN 2017-2020 Program targets 10, 15, & 30, GEF priorities, and the UN CBD. The Framework considers a range of governance options within IUCN Protected Area categories and governance approaches including OECMs and ICCAs -Territories of Life.

The decision-support tool is aimed at both global assessments and to support in-country decision making for the benefit of governments and organisations seeking to improve the protection of mountain environments. The application of the tool begins at the strategic assessment level but also involves on-the-ground assessments by regional representatives and experts to ensure accurate ground truthing and validation.

Through application of the decision-support tool over time, the entire 6000-plus Mountain KBAs can be allocated into one of nine categories: four identify inadequately protected areas that are given highest priority for considering greater protection status, two designated for no further action unless circumstances change, and three being deemed adequately protected.

5.1 ACKNOWLEDGMENTS

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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7 APPENDIX 1 DECISION SUPPORT TOOL

7.1 DECISION SUPPORT TOOL FOR PRIORITIZING PROTECTION OF MOUNTAINS

The iterative Decision Support Tool for prioritising protection of mountains is separately available as a Microsoft Excel document, here . It contains built-in selection and scoring functions, plus references for information as one works through the steps. Below is an outline only of the tool's design and process.

STEP 1 IDENTIFY MOUNTAIN KBAs THAT ARE INADEQUATELY PROTECTED

To assess:

Select the study area KBAs from the Database of 6109 Key Biodiversity Areas (KBAs) in mountains and their protection status based on comparison with the World Database of Protected Areas (WDPA)[9].

Are the Mountain KBAs 80-100% protected? [8] [9]

No **Yes;** Category C[10]

Are the Mountain KBAs over 30% but less than 80% protected? [1] [2]

No **Yes;** Category D[10]

List of inadequately protected Mountain KBAs (i.e., < 30% protected). (3174 of 6109 Mountain KBAs are < 30% protected in 2020)

Go to Step 2

[8] Protected area refers to one being listed on the WDPA (IUCN 2020) as a protected area or OECM, that meet the IUCN definition of a protected area or OECM. See sections 2.1.1 and 2.1.2

[9] Refer to Birdlife International (2020a), data held by WCPA Mountain Specialist Group and the interactive Decision Support Tool

[10] No further action; see 7.2 Final Categories of Mountain Key Biodiversity Areas

STEP 2 IDENTIFY APPROPRIATE COUNTRIES FOR HEIGHTENED CONSIDERATION FOR GREATER PROTECTION STATUS

To assess: List of inadequately protected Mountain KBAs from Step 1

Is the Mountain KBA in a country that is politically stable or realistic for the WCPA/Mountains Specialist Group to work in[11]?

Yes **No;** Category E[12]

Does the country have a protected area system and capacity and will to build on and implement?

Yes **No;** Category E[12]

Are there active WCPA/Mountain Specialist Group members or affiliates in this country that have the capacity to carry out the regional assessment as outlined in step 3?

Yes **No;** Category F[12]

List of inadequately protected Mountain KBAs in countries appropriate for further evaluation

Go to step 3

[11] This may be a rather subjective assessment and the guidance of the relevant IUCN Regional Councillor and WCPA Regional vice Chair would be sought

[12] No further action; see section 7.2: Final Categories of Mountain Key Biodiversity Areas

STEP 3 **VALIDATE PROTECTION AND CONSERVATION STATUS**

To assess: List of inadequately protected Mountain KBAs in countries appropriate for further evaluation from Step 2.

Are there other effective conservation measures not recorded on the WDPA such as OECMs, ICCAs, alternative arrangements or updated protection status in place that adequately protects this Mountain KBA[13]?

No **Yes:** Category G[14]

Is the key biodiversity value/s of this unprotected Mountain KBA threatened by not being protected or conserved[15]?

Yes **No;** Category G[14]

List of inadequately protected Mountain KBAs in countries appropriate for further evaluation with protection status validated.

Go to Step 4.

[13] The KBA may be adequately protected but not listed as such on the WDPA (see 2.2.2 Conserved Areas)

[14] No further action; see section 7.2: Final Categories of Mountain Key Biodiversity Areas

[15] Circumstances may be where it is considered there to be no risk or apparent threat to the Mountain KBA by not being formally protected or conserved.

STEP 4 RANK PRIORITY MOUNTAIN KBAs BY IMPORTANCE FOR PROTECTION OR CONSERVATION.

To assess; Each Mountain KBA on the list of inadequately protected Mountain KBAs in countries appropriate for further evaluation with protection status validated, from Step 3.

Mountain Key Biodiversity Area *ID Number* *Name*			
Criteria[16]	**No**[17]	**Somewhat**[17]	**Definitely**[17]
Does the Mountain KBA contain a world ecosystem (s) that is considered inadequately protected?			
Does the Mountain KBA contain a world ecosystem (s) that is considered adequately protected?			
Does the Mountain KBA provide connectivity conservation and/or corridor values and opportunities?			
Is the Mountain KBA in an area vulnerable to climate change?			
Does the Mountain KBA have refugia functions that contribute to nature-based solutions for climate change?			
Does this Mountain KBA contain flagship or iconic species or ecological communities?			
Does this Mountain KBA contain IUCN Red Listed Threatened Species?			
Does this Mountain KBA contain IUCN Red Listed Ecosystems?			
Does this Mountain KBA contain (or contribute to) conserving a range of elevation or climatic gradients?			
Will local mountain communities benefit from enhanced ecosystem services that protection of this Mountain KBA would provide?			
Would protecting this Mountain KBA lead to increased protection of cultural or heritage values?			
Does this Mountain KBA contain ecotourism values that may further support communities and prioritized consideration for their protection?			
Will protection of this Mountain KBA contribute to peace building though transboundary initiatives?			
Will protection of this Mountain KBA contribute to disaster risk reduction?			
Total Score			

Ranked List of inadequately protected Mountain KBAs in countries appropriate for further evaluation with protection status validated.

Go to Step 5.

[16] See 4.2.4 step 4 and Interactive Decision Support Tool for knowledge sources and references here

[17] Refer to Interactive Decision Support Tool for guidance on scoring here

STEP 5 IDENTIFY PRIORITY KBAs IN BIODIVERSITY HOTSPOTS

To assess: Ranked list of inadequately protected Mountain KBAs in countries appropriate for further evaluation with protection status validated, from Step 4.

Is the priority Mountain KBA in a Biodiversity Hotspot[18]?

Yes → Ranked list of **first**-priority KBAs.

No → Ranked list of **second**-priority KBAs.

STEP 6 IDENTIFY PRIORITY KBAs IN DEVELOPING COUNTRIES

To assess: Ranked list of first- and second-priority KBAs from Step 5.

From the **first-priority** Mountain KBA list, is the KBA in a developing country[19]?

Yes → **Category A1** Ranked first-priority mountain KBAs in **developing** countries

No → **Category A2** Ranked first-priority mountain KBAs in **developed** countries

From the **second-priority** Mountain KBA list, is the KBA in a developing country?

Yes → **Category B1** Ranked second-priority mountain KBAs in **developing** countries

No → **Category B1** Ranked second-priority mountain KBAs in **developed** countries

[18] Refer 3.3 Biodiversity hotspots

[19] The United Nations Development Programme (UNDP 2018) list 6 Developing Regions incorporating 159 countries classified as "Developing". (see 3.6.3 Global Environment Facility)

7.2 FINAL CATEGORIES OF MOUNTAIN KEY BIODIVERSITY AREAS

The result of application of the decision-support tool is that any of the more than 6000 Mountain KBAs may be allocated into one of nine categories: Four for follow-up action, two for no further action unless circumstances change, and three not requiring further action, based on this assessment (refer 4.1 Method Development: Scale and Limitations).

Table 1 Categories for Mountain Key Biodiversity Areas

Categories for heightened consideration for greater protection status	**Categories for no further action unless circumstances change**	**Categories that indicate adequate protection appears to be achieved**
Category A1: List of ranked first-priority Mountain KBAs occurring in **developing** countries (i.e., within Biodiversity Hotspots).	Category E: Mountain KBA less than 30% protected but in unstable areas or no effective system or capacity for Protected Area Governance. No further consideration by WCPA/Mountains Specialist Group unless circumstances change.	Category C: Mountain KBA more than 80% protected; No further action for WCPA-Mountain SG for now; however, management effectiveness evaluation may be prudent.
Category A2: List of ranked first-priority Mountain KBAs occurring in **developed** countries (i.e., within Biodiversity Hotspots).	Category F: Mountain KBA less than 30% protected but no WCPA/Mountain Specialist Group connection to assess in steps 3 & 4. WCPA/Mountain Specialist Group to seek to get members that can evaluate KBAs in these countries; otherwise no further action.	Category D: Mountain KBA more than 30% but less than 80% protected; Reserve list for consideration in later stages of project.
Category B1: List of ranked second priority Mountain KBAs occurring in **developing** countries. (i.e., not within Biodiversity Hotspots).		Category G: OECM, ICCA; Territory of Life or other arrangement in place (i.e., nor registered on the WDPA) to adequately protect Mountain KBA or Mountain KBAs not threatened. No further action by Mountains SG. Inform UNEP-WCMC.
Category B2: List of ranked second priority Mountain KBAs occurring in **developed** countries. (i.e., not within Biodiversity Hotspots).		

8 APPENDIX 2: LEVEL OF PROTECTION OF MOUNTAIN ECOSYSTEMS

Of 278 natural or semi-natural World Ecosystems, 77 (28%) are identified as mountain ecosystems. Collectively, those 77 ecosystems cover 32% in area of the world's natural or semi-natural ecosystems (Sayre et al. 2020).

Mountain Ecosystem	Area (in km^2)	% Protected IUCN cat I-IV	% Protected IUCN cat I-VI	Area Protected (in km^2)
Boreal Desert Sparsely or Non-vegetated on Mountains	1,530	0	0	0
Boreal Desert Grassland on Mountains	1,803	0	0	0
Cool Temperate Desert Grassland on Mountains	33,683	0.006	0.006	2
Polar Desert Grassland on Mountains	951	0.03	0.09	1
Warm Temperate Desert Forest on Mountains	108	0.05	0.66	1
Warm Temperate Desert Shrubland on Mountains	23,376	2.15	2.68	626
Cool Temperate Dry Grassland on Mountains	826,432	1.4	3.31	27,355
Tropical Desert Forest on Mountains	581	0	3.34	19
Tropical Desert Shrubland on Mountains	10,054	0.6	3.34	336
Polar Desert Snow and Ice on Mountains	11	0	3.92	0.4
Warm Temperate Dry Grassland on Mountains	480,653	1.63	5.79	27,830
Tropical Dry Sparsely or Non-vegetated on Mountains	401,978	2.87	6.17	24,802
Polar Dry Grassland on Mountains	940,507	3.26	6.66	62,638
Subtropical Desert Forest on Mountains	602	4.09	7.15	43
Cool Temperate Desert Sparsely or Non-vegetated on Mountains	98,924	5.24	7.36	7,281
Warm Temperate Desert Grassland on Mountains	2,500	5.53	7.62	191
Subtropical Moist Grassland on Mountains	129,111	1.97	7.93	10,239
Boreal Dry Grassland on Mountains	476,082	6.42	8.08	38,467
Cool Temperate Dry Sparsely or Non-vegetated on Mountains	749,317	4.97	8.64	64,741
Warm Temperate Desert Sparsely or Non-vegetated on Mountains	201,681	3.64	8.88	17,909
Cool Temperate Dry Shrubland on Mountains	591,941	6.19	9.02	53,393
Warm Temperate Dry Sparsely or Non-vegetated on Mountains	834,991	2.74	9.17	76,569
Warm Temperate Moist Grassland on Mountains	176,172	2.2	9.35	16,472
Tropical Moist Sparsely or Non-vegetated on Mountains	6,893	4.27	10.09	696
Tropical Moist Grassland on Mountains	43,999	3.27	10.35	4,554
Cool Temperate Dry Forest on Mountains	630,661	7.11	10.46	65,967
Subtropical Moist Shrubland on Mountains	525,318	4.43	10.53	55,316
Boreal Moist Forest on Mountains	3,544,054	7.5	10.74	380,631
Cool Temperate Desert Shrubland on Mountains	11,810	2.06	10.83	1,279
Subtropical Dry Sparsely or Non-vegetated on Mountains	547,647	3.33	11.55	63,253
Cool Temperate Desert Forest on Mountains	19	6.09	11.73	2
Boreal Dry Forest on Mountains	894,446	6.88	11.82	105,724
Boreal Dry Sparsely or Non-vegetated on Mountains	323,358	7.86	12.04	38,932
Boreal Dry Snow and Ice on Mountains	1,201	5.75	12.22	147
Warm Temperate Dry Shrubland on Mountains	1,045,259	5.12	12.46	130,239
Polar Dry Snow and Ice on Mountains	60,407	6.88	12.61	7,617
Polar Moist Grassland on Mountains	722,899	8.59	12.95	93,615

Mountain Ecosystem	Area (in km^2)	% Protected IUCN cat I-IV	% Protected IUCN cat I-VI	Area Protected (in km^2)
Tropical Desert Grassland on Mountains	2,557	1.31	13.13	336
Tropical Dry Grassland on Mountains	111,453	5.01	13.15	14,656
Cool Temperate Dry Snow and Ice on Mountains	549	9.2	13.25	73
Boreal Moist Grassland on Mountains	356,929	8.56	13.99	49,934
Subtropical Dry Grassland on Mountains	254,297	3.5	15.1	38,399
Warm Temperate Moist Forest on Mountains	2,265,851	7.06	15.43	349,621
Tropical Desert Sparsely or Non-vegetated on Mountains	364,302	5.66	15.61	56,868
Polar Desert Shrubland on Mountains	7,645	2.96	15.81	1,209
Warm Temperate Moist Shrubland on Mountains	158,965	4.93	16.06	25,530
Polar Dry Sparsely or Non-vegetated on Mountains	464,152	7.69	16.13	74,868
Boreal Moist Shrubland on Mountains	699,650	9.9	16.17	113,133
Tropical Dry Forest on Mountains	306,806	7.01	16.6	50,930
Polar Dry Shrubland on Mountains	81,709	9.9	17.33	14,160
Boreal Moist Sparsely or Non-vegetated on Mountains	584,985	12.59	18.57	108,632
Tropical Moist Shrubland on Mountains	201,410	7.16	18.63	37,523
Boreal Dry Shrubland on Mountains	95,461	8.34	18.87	18,013
Polar Dry Forest on Mountains	34,626	15.78	18.91	6,548
Tropical Dry Shrubland on Mountains	311,581	7.35	19.15	59,668
Subtropical Dry Forest on Mountains	753,774	5.61	19.68	148,342
Subtropical Dry Shrubland on Mountains	999,352	6.14	21.03	210,164
Subtropical Moist Forest on Mountains	3,012,368	10.6	21.35	643,141
Cool Temperate Moist Grassland on Mountains	439,006	8.43	21.44	94,123
Polar Desert Sparsely or Non-vegetated on Mountains	10,977	7.79	21.79	2,392
Warm Temperate Dry Forest on Mountains	561,636	5.6	21.84	122,661
Polar Moist Shrubland on Mountains	168,806	12.09	22.24	37,542
Cool Temperate Moist Forest on Mountains	2,854,983	12.24	22.52	642,942
Subtropical Desert Sparsely or Non-vegetated on Mountains	505,825	13.3	23.74	120,083
Warm Temperate Moist Sparsely or Non-vegetated on Mountains	11,611	10.4	24.21	2,811
Polar Desert Forest on Mountains	30	6.66	24.29	7
Polar Moist Sparsely or Non-vegetated on Mountains	950,754	18.97	25.81	245,390
Subtropical Moist Sparsely or Non-vegetated on Mountains	7,962	8.93	26.05	2,074
Subtropical Desert Grassland on Mountains	8,759	15.21	29.25	2,562
Tropical Moist Forest on Mountains	2,076,010	12.1	30.11	625,087
Polar Moist Forest on Mountains	179,170	19.81	30.56	54,754
Subtropical Desert Shrubland on Mountains	20,822	22.38	32.66	6,800
Cool Temperate Moist Shrubland on Mountains	275,865	22.13	37.88	104,498
Cool Temperate Moist Sparsely or Non-vegetated on Mountains	139,267	25.79	38.85	54,105
Boreal Moist Snow and Ice on Mountains	32,729	36.21	39.67	12,984
Polar Moist Snow and Ice on Mountains	298,440	33.44	42.67	127,344
Cool Temperate Moist Snow and Ice on Mountains	10,711	54.78	60.09	6,436
Total	**33,962,744**			**5,663,230**

9 APPENDIX 3 IUCN PROTECTED AREA AND GOVERNANCE CATEGORIES

9.1 PROTECTED AREAS

Ia - Strict nature reserve: Strictly protected for biodiversity and also possibly geological/ geomorphological features, where human visitation, use, and impacts are controlled and limited to ensure protection of the conservation values.

Ib - Wilderness area: Usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, protected and managed to preserve their natural condition.

II - National Park: A large, natural or near-natural area protecting large-scale ecological processes with characteristic species and ecosystems; the area also has environmentally and culturally compatible spiritual, scientific, educational, recreational, and visitor opportunities.

III - Natural monument or feature: Areas set aside to protect a specific natural monument, which can be a landform, sea mount, marine cavern, geological feature such as a cave, or a living feature such as an ancient grove.

IV - Habitat/species management area: Areas designated to protect particular species or habitats, where management reflects this priority. Many will need regular, active interventions to meet the needs of particular species or habitats, but this is not a requirement of the category.

V - Protected landscape or seascape: Where the interaction of people and nature over time has produced a distinct character with significant ecological, biological, cultural and scenic value, and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.

VI - Protected areas with sustainable use of natural resources: Areas which conserve ecosystems, together with associated cultural values and traditional natural resource management systems. Generally large, mainly in a natural condition, with a proportion under sustainable natural resource management and where low-level non-industrial natural resource use compatible with nature conservation is seen as one of the main aims.

9.2 GOVERNANCE

The management categories are applied with a typology of governance types – a description of who holds authority and responsibility for the protected area. IUCN defines four governance types:

Governance by government: Federal or national ministry/agency in charge; sub-national ministry/agency in charge; government-delegated management (e.g., to NGO).

Shared governance: Collaborative management (various degrees of influence); joint management (pluralist management board; transboundary management; various levels across international borders).

Private governance: By individual owner; by non-profit organisations (NGOs, universities, cooperatives); by for-profit organisations (individuals or corporate).

Governance by indigenous peoples and local communities: Indigenous peoples' conserved areas and territories; community conserved areas – declared and run by local communities (Dudley 2008).

10 APPENDIX 4 CASE STUDY: WESTERN HIMALAYA

An example of how the decision-support tool can be applied is outlined below. The case study area includes the western Himalaya States in India, Nepal, and bordering areas in China.

Step 1: Identify Mountain KBAs that are Inadequately Protected

An analysis of the database of Key Biodiversity Areas (KBAs) in mountains and their protection status indicates that:

- Thirty-three Mountain KBAs in the Western Himalaya case study area are considered inadequately protected (i.e., < 30% protected) and are thus listed for further assessment.
- Fifty-one Mountain KBAs in the Western Himalaya case study area are considered adequately or substantially protected (i.e., 30-100% protected), and will not be assessed further at this stage.

Table 5 Mountain KBAs and Protection Status per Country in the Western Himalaya Case Study Area

Country	Mountain KBAs	Mountain KBAs 80-100% protected	Mountain KBAs 30-80% protected	Mountain KBAs < 30% protected
India	317	51	65	201
Nepal	23	12	3	8
China	419	22	30	367
Total	**759**	**85**	**98**	**576**

Table 6 Mountain KBAs and Protection status in the Western Himalaya Case Study area

Country	Mountain KBAs in the study area	Mountain KBAs 80-100% protected	Mountain KBAs 30-80% protected	Mountain KBAs < 30% protected
India	**58**	**14**	**22**	**22**
Nepal	**23**	**12**	**3**	**8**
China	**3**	**0**	**0**	**3**
Total	84	**26**	**25**	**33**

Step 2: Identify Appropriate Countries for Heightened Consideration for Greater Protection Status
India, Nepal, and China are considered realistic for heightened focus on conservation of KBAs, due to each having a stable government and protected-area system, and locally based WCPA staff or affiliates available to lead assessment.

Step 3: Validate Protection and Conservation Status
This step requires regional in-country experts to validate WDPA data. Subject to this step; all 33 KBA's proceed to Step 4.

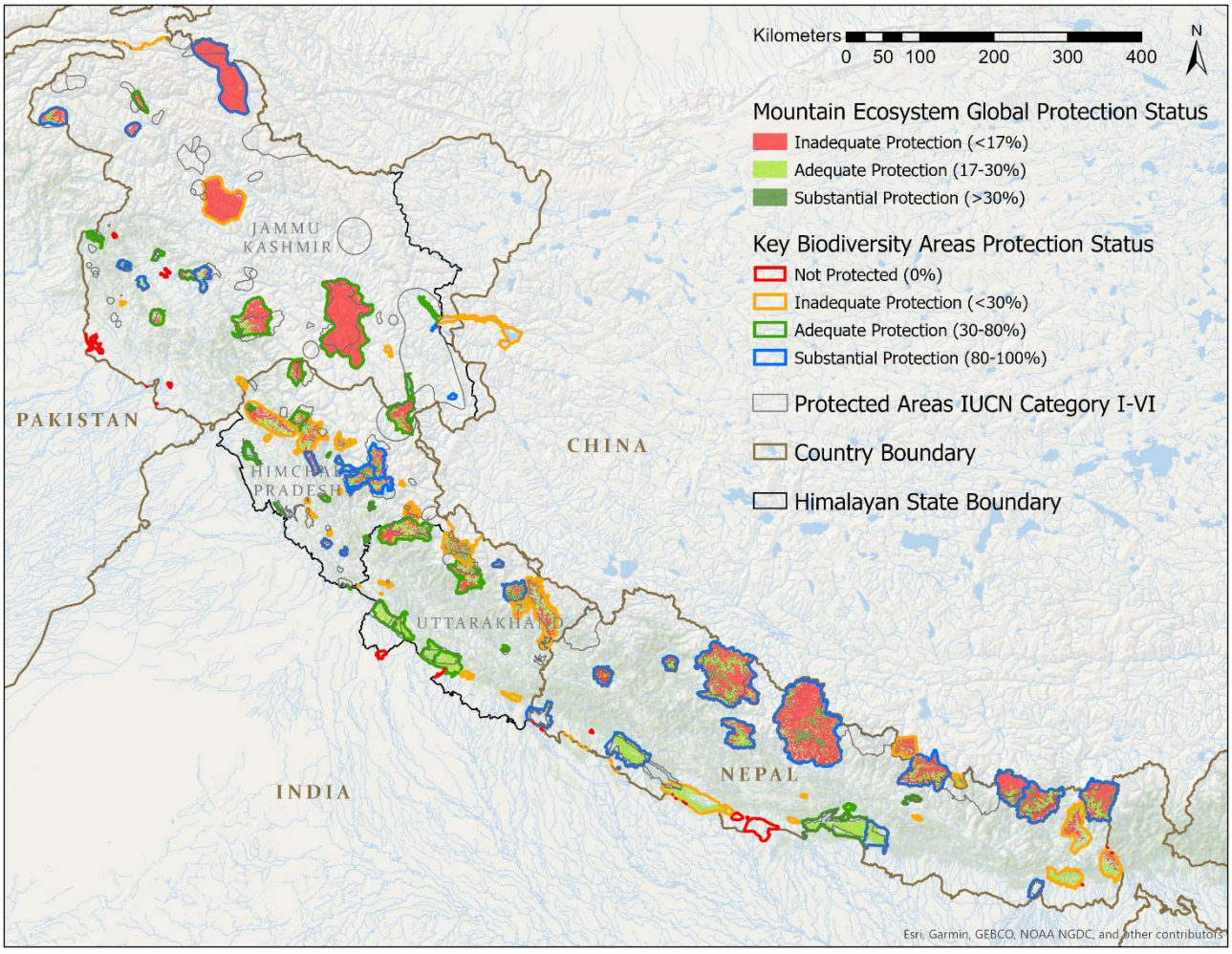
Step 4 Rank Priority Mountain KBAs By Importance for Protection or Conservation.
This step requires evaluation of a range of other values by regional in-country specialists. However, analysis of World Mountain Ecosystems data indicates that of the 33 inadequately protected KBAs, 29 also contain inadequately protected World Mountain Ecosystems. Refer to Maps 2-5.

Step 5: Identify Priority KBAs in Biodiversity Hotspots
All inadequately protected Mountain KBAs are within the Himalaya Biodiversity Hotspot.

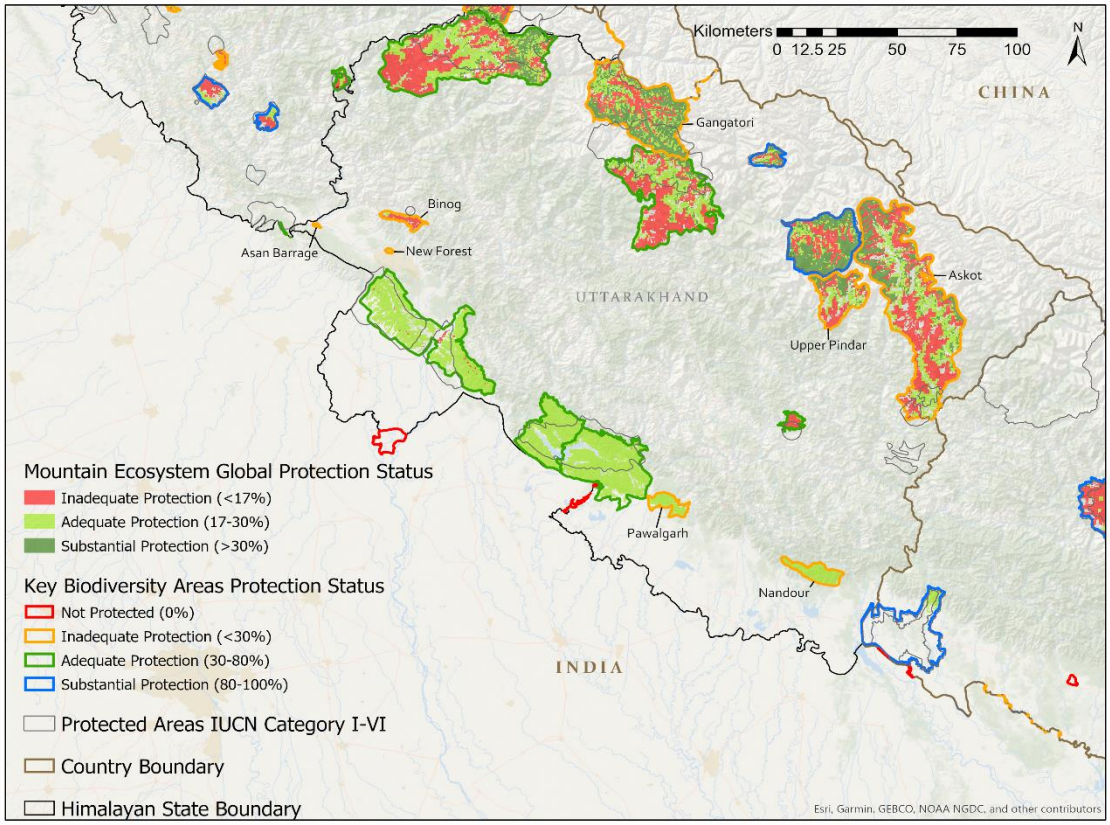
Step 6: Identify Priority KBAs in Developing Countries
India, China, and Nepal are all classified as Developing Countries.

The assessment indicates that all of the 33 inadequately protected KBAs in the Himalayan Study Area will be in Category A1: first-priority Mountain KBAs (i.e., in Biodiversity Hotspots and in Developing Countries), unless it is found that their level of protection status is under-reported when assessed by regional specialists. The ranking of importance of the list will be subject to regional assessment.

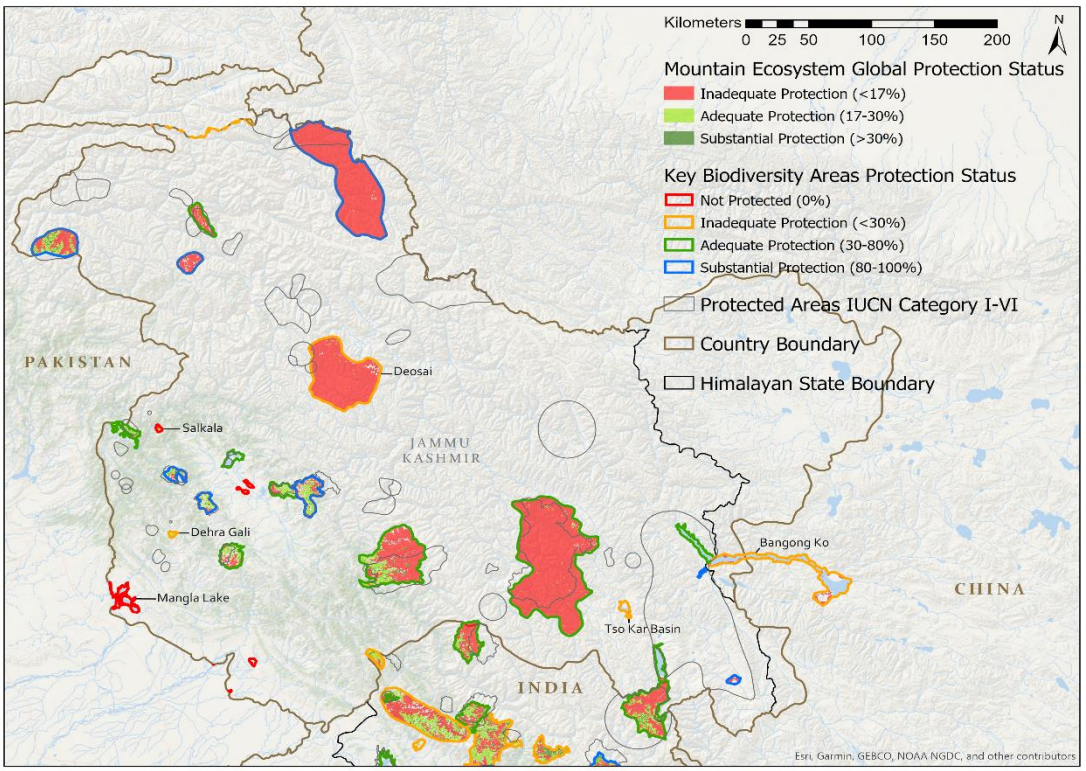
Map 2 Protection Status of KBAs and Mountain Ecosystems in Western Himalaya Indian States and Nepal (USGS 2020 & UNEP-WCMC 2020)



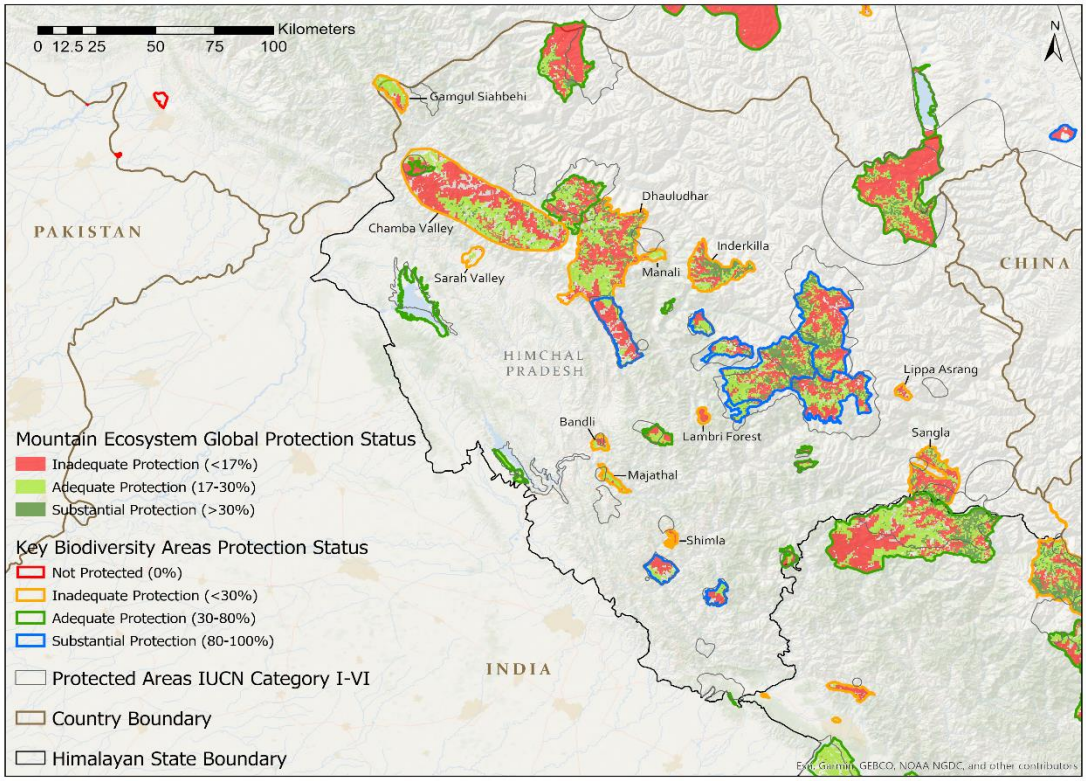
Map 3 Protection Status of KBAs and Mountain Ecosystems in Uttarakand (USGS 2020 & UNEP-WCMC 2020)



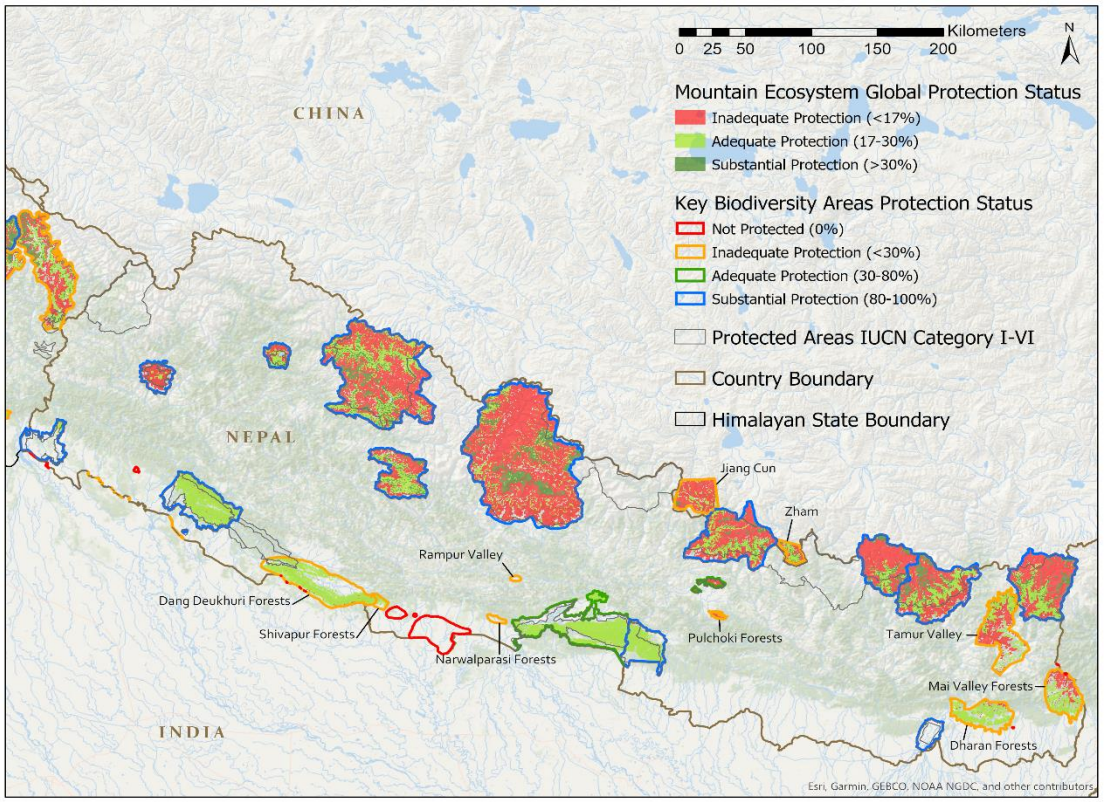
Map 4 Protection Status of KBAs and Mountain Ecosystems in Jammu Kashmir (USGS 2020 & UNEP-WCMC 2020)



Map 5 Protection Status of KBAs and Mountain Ecosystems in Himachal Pradesh (USGS 2020 & UNEP-WCMC 2020)



Map 6. Categories of [Level of] Protection Status of both KBAs and Mountain Ecosystems in Nepal (USGS 2020 & UNEP-WCMC 2020)



11 ABBREVIATIONS

CBD	Convention on Biodiversity
CEM	Commission of Ecosystem Management (IUCN)
GEF	Global Environment Facility
ICCA—Territories of Life	An abbreviation for territories and areas conserved by indigenous peoples and local communities.
IUCN	International Union for the Conservation of Nature
KBA	Key Biodiversity Area
MEA	Millennium Ecosystem Assessment
Mountain SG	Mountain Specialist Group (WCPA)
NGO	Non-Governmental Organization
OECM	Other Effective area-based Conservation Measures
RLE	Red-Listed Ecosystems
SDG	Sustainable Development Goal
SSG	Species Survival Commission (IUCN)
UN	United Nations
UNEP	United Nations Environment Program
USGS	United States Geological Survey
WCMC	World Conservation Monitoring Centre
WCPA	World Commission of Protected Areas (IUCN)
WDPA	World Database of Protected Areas