Methods

To calculate the coverage of mountainous Key Biodiversity Areas (KBAs) by the WCMC World Database on Protected Areas (WDPA), we replicated the methods in [Birdlife Publication?] for calculating protected area coverage. Utilizing the Global Mountain Biodiversity Assessment Mountain Inventory (GMBA), we were able to identify mountainous KBAs and perform an adjusted calculation for each mountain range and country.

The WDPA shapefile data utilized included only polygons, sites whose status was one of Adopted', 'Designated', 'Inscribed', or 'Established'. Excluded from the analysis were UNESCO-MAB protected areas, and protected areas that were saved as points rather than polygons. The dataset was cleaned following the methods in [Birdlife Pub], including reassignment of ISO3 codes to be consistent with KBA data, and removing disputed regions.

Most mountainous KBAs were identified with the GMBA Inventory. Utilizing the ‘sf’ package in R, we identified any KBAs that intersected with one or more identified mountain ranges and selected those for the analysis. For any KBA that overlapped with more than one mountain range, it was assigned to the range with the larger overlap area. In order to align with previous calculation strategies, we also included and tracked any KBA that had been labeled as mountainous, but did not intersect with a GMBA polygon.

To calculate the percent PA coverage by mountain range, for each KBA, we save the area of the union between the polygon with the earliest year for that KBA, and all protected areas it overlaps with. For any additional year, if the remaining area of the protected area is greater than 2%, the additional area overlap is calculated for each successive year.

For KBA polygons without an assigned status year, a random year was assigned using either a random year from the other polygons of the same KBA, or if none of those have a year, a random year after 1986 was selected.

The resulting dataset includes a row for each available year of each mountainous KBA and the following information:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Column Name** | **SitRecID** | **kba** | **ovl** | **year** | **random** | **nPAs** |
| **Description** | KBA ID | Area of KBA polygon | Area of KBA, PA overlap | Status year of the given KBA polygon | Indicator if the status year was randomized | Number of Pas that intersect with this KBA |
| **Column Name** | **Domain** | **range\_countries** | **RangeName** | **Country** | **multiple\_ranges** | **all\_gmba\_intersec** |
| **Description** | Mountain Range ID | All of the ISO3 codes of the countries that overlap with the given mountain range | The common name for the mountain range | The country associated with the KBA | Does this KBA intersect with multiple GMBA ranges | All domains that this KBA intersects with |
| **Column Name** | **in\_gmba** | **note** | **percPA** |  |  |  |
| **Description** | Was this KBA identified by the GMBA layer as mountainous | Note on any issues/NAs/zero values | The percent coverage of this KBA by protected areas |  |  |  |

**Analysis**

Adapted Birdlife International standard for calculating coverage by protected areas of important sites for mountain biodiversity.

In order to integrate the GMBA spatial polygons, the data were intersected with KBAs in python to create a new subset of KBA’s that are found in mountainous regions. This dataset was then run through the adapted Birdlife script for individual countries, and mountain ranges as well. See figure X for details on handling calculations based on various overlap scenarios.