Trends in protected area types by period of establishment

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We analyse the world database on protected areas to assess if the relative importance of multipurpose protected areas has evolved compared to strictly protected areas. We show very different trends whether we focus on the number of entities or the spatial coverage of protected areas. During the last decades, there has been an increasing number of smaller strictly protected areas, and a decreasing number of larger multipurpose protected areas.

# 1. Objective

In the framework of a paper in preparation (Fromont et al. 2023), we want to know if the share of multi-purpose protected areas is increasing, compared to protected areas pursuing only conservation objectives. This document is designed to provide a verifiable and reproducible answer to this question. It is written in [quarto](https://quarto.org/) and uses R code. All the data processing can be viewed by clicking on the “code” buttons.

# 2. Data

We use the extension wdpar to fetch the World Database on Protected Areas from [the protected planet portal](https://www.protectedplanet.net/en). It is the version updated in February 2022. We only keep the areas for which a spatial area is known, that is not including the protected area for which only one point in space is reported.

As of this date, the WDPA includes information on rnrow(wdpa\_gee) protected areas. A well-formatted description of the fields available can be found [on this webpage](https://developers.google.com/earth-engine/datasets/catalog/WCMC_WDPA_current_polygons).

# 3. Methods

We keep only terrestrial protected areas and discard marine or coastal protected areas. There is no consensus on IUCN categories in the literature. Ellason et al. (2021) suggest the following classification, which we complement here with the naming used by the authors:

* Some studies group I and II in one class, and all others in another class:
  + Sharlemann et al. (2010) classify cat. I and II as “protected sites with more restrictive land management regimes” and III to VI as “all other protected sites”
  + Jones et al. (2018) designate I and II as “strict biodiversity conservation areas” and III to VI as “zones permitting certain human activities and sustainable resource extraction”
  + Anderson and Mammides (2020) designate only I and II as “areas in stricter categories”.
* Other studies group I, II and III in one class, and IV, V and VI in another class:
  + Seiferling et al. (2012) designate I to III as “areas into high-protection” and IV to VI as “low protection categories”.
  + Françoso et al. (2015) refer to IV to VI as “sustainable use PAs” and the other as “other”.
* Other studies group I to IV in one class and V and VI in another class:
  + Nelson and Chomitz (2011) refer to I to IV as “strict protection” and V and VI as “nonstrict or multi-use protection”.
  + Porter-Bordland et al. (2012) refer as I to IV as “protected areas” and V and VI as “community managed forests”.

Adding to this classification, we share Ledberger (2020) analysis that classifies the naturalness of IUCN category definition as follows: Ia = Ib > II = III > IV = VI > V and they find out that “the global ranking of the effect of the IUCN categories on the forest loss per PA at the global scale, from the least to the most forest loss, was III < Ia = Ib = II < IV = V = VI” .

We consider that Lebergers et al. results (2020) convincingly make the case to group I to III. We find out however that vivid debates focused on the category IV definition and revision (Leroux et al. 2010), so keep IV separated in our analysis, its purpose and criteria are different from V and VI[[1]](#footnote-25).

After this filtering, we have 255246 protected areas for the analysis.

# 4. Results

## 4.1 Relative importance of status in number of PAs

[Figure 1](#fig-n-pas) represents the evolution of strict vs. multipurpose categories according to the year of assignment of the conservation status of PAs.

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| Figure 1: Number of terrestrial protected areas by status and decade of creation |

The [Figure 1](#fig-n-pas) shows that the total number of PAs has sharply increased since 2000. However, the relative importance of multipurpose conservation status doesn’t seem to increase.

| Decade of status assignment | IV | Nonstrict | Strict | Unknown | Total number of PAs created | Number of PAs whith a known status | % of strict among known status | % of IV among known status | % of multipurpose among known status |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Unknown | 1980 | 20486 | 1519 | 5850 | 29835 | 23985 | 6.3 | 8.3 | 85.4 |
| Before 1960 | 1833 | 2118 | 1825 | 1568 | 7344 | 5776 | 31.6 | 31.7 | 36.7 |
| 1960-1969 | 1612 | 1639 | 1236 | 1446 | 5933 | 4487 | 27.5 | 35.9 | 36.5 |
| 1970-1979 | 3246 | 3068 | 2900 | 1190 | 10404 | 9214 | 31.5 | 35.2 | 33.3 |
| 1980-1989 | 9801 | 3784 | 7859 | 1851 | 23295 | 21444 | 36.6 | 45.7 | 17.6 |
| 1990-1999 | 14593 | 7589 | 8598 | 5573 | 36353 | 30780 | 27.9 | 47.4 | 24.7 |
| 2000-2009 | 23579 | 10972 | 8306 | 25239 | 68096 | 42857 | 19.4 | 55.0 | 25.6 |
| 2010-2019 | 23797 | 6729 | 6392 | 28314 | 65232 | 36918 | 17.3 | 64.5 | 18.2 |
| 2020-2029 | 1631 | 494 | 911 | 5718 | 8754 | 3036 | 30.0 | 53.7 | 16.3 |

For readability purpose, we present the proportions displayed in the three last column of (**tab-n-pas?**) in a figure.

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| Figure 2: Proportion of terrestrial PAs by status and decade of creation |

According to the world database on protected areas, the proportion of new protected areas with a multipurpose status has reduced, from 36.5% in the 1960s to 18.2% in the 2010s. It has been even lower (16.3%) in the first years of the current decade.

We must, however, strikeout that the decade of creation is unknown for 29835 out of 255246 protected area ( 11.7%). There is a large proportion of multipurpose status among the protected areas for which the creation date is unknown (85.4%). The status of the protected area is unknown for 76749 protected areas out of 255246 protected areas (30.1%).

## 4.2 Relative importance of status in PA spatial extent

We now perform the same analysis, but instead of counting the number of PAs, we sum their area. The area newly covered by type of status is represented in [Figure 3](#fig-area-pas).

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| Figure 3: Area of terrestrial protected areas by status and decade of creation |

The trend that appears in [Figure 3](#fig-area-pas) is quite different than the one we saw in [Figure 1](#fig-n-pas): when accounting for their total areas, multi-purpose protected areas seem to represent an increasing proportion among newly created protected areas.

We now compute the precise area estimates and their relative importance.

| Decade of status assignment | IV | Nonstrict | Strict | Unknown | Total number of PAs created | Area of PAs whith a known status | % of strict among known status | % of IV among known status | % of multipurpose among known status |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Unknown | 64322.735 | 338497.5 | 331399.0 | 817816.01 | 1552035.2 | 734219.2 | 45.1 | 8.8 | 46.1 |
| Before 1960 | 240744.517 | 203971.6 | 569421.2 | 190733.46 | 1204870.8 | 1014137.3 | 56.1 | 23.7 | 20.1 |
| 1960-1969 | 383309.004 | 124182.8 | 443425.0 | 114394.02 | 1065310.8 | 950916.8 | 46.6 | 40.3 | 13.1 |
| 1970-1979 | 290693.915 | 655964.9 | 1930388.8 | 498173.11 | 3375220.7 | 2877047.6 | 67.1 | 10.1 | 22.8 |
| 1980-1989 | 338637.773 | 563488.1 | 1110841.0 | 1200396.70 | 3213363.6 | 2012966.9 | 55.2 | 16.8 | 28.0 |
| 1990-1999 | 235986.831 | 1195525.0 | 1140118.5 | 1690133.69 | 4261764.0 | 2571630.3 | 44.3 | 9.2 | 46.5 |
| 2000-2009 | 256228.991 | 1713561.7 | 1046666.9 | 2911189.26 | 5927646.9 | 3016457.6 | 34.7 | 8.5 | 56.8 |
| 2010-2019 | 335485.144 | 916777.5 | 816071.6 | 1100412.15 | 3168746.4 | 2068334.2 | 39.5 | 16.2 | 44.3 |
| 2020-2029 | 8057.415 | 100677.9 | 109219.7 | 41600.39 | 259555.4 | 217955.0 | 50.1 | 3.7 | 46.2 |

The same information, in graphics:

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| Figure 4: Relative area of terrestrial PAs by status and decade of creation |

According to the world database on protected areas, the total spatial extent of new protected areas with a multipurpose status has increased, from 13.1% in the 1960s to 56.8% in the 2000s and slightly decreased in the 2010s to 44.3%.

## 4.3 Average size of protected areas

The two previous figures suggest very different trends in terms of average size of protected areas depending on their status. We verify this with [Figure 5](#fig-avg-area).

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| Figure 5: Average area of terrestrial protected areas by status and decade of creation |

[Figure 5](#fig-avg-area) shows that the area of PAs with a strict status has decreased over time, while the area of PAs with a multipurpose status has increased over time.

# 5. Conclusion

The information available in the world database on protected areas indicates that **in terms of number of administrative entities**, the proportion protected areas with a multi-purpose status tends to decrease over the last decades. However, **in terms of spatial extent of these entities**,the proportion of protected area with a multi-purpose status tends to increase over the same period. In other words, countries create an increasing number of smaller strictly protected areas, and they create a decreasing number of larger multi-purpose protected areas.

This conclusion, however, could be undermined by the substantial proportion of missing information on the creation date and status of protected areas in the database of reference.

# 6. References

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1. From the literature, we could even consider also separating III in a separate category, to have 3 classes: I-II, III, IV and V-VI. [↑](#footnote-ref-25)