

# Mapping Global Priorities for Biodiversity Conservation:

## **Final Report**

to the

**John D. and Catherine T. MacArthur Foundation**

from the

**Informal Working Group of Global Biodiversity Conservation NGO Scientists**

American Museum of Natural History,  
BirdLife International,  
Conservation International (CI),  
The Nature Conservancy (TNC),  
World Wildlife Fund (WWF),  
Wildlife Conservation Society (WCS),  
The Union of Concerned Scientists

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## **Mapping Global Priorities for Biodiversity Conservation:**

### **Introduction**

The Informal Working Group of Global Biodiversity Conservation NGO Scientists, or IWG (Informal Working Group), is made up of science staff representing BirdLife International, Conservation International (CI), The Nature Conservancy (TNC), World Wildlife Fund (WWF), Wildlife Conservation Society (WCS), The Union of Concerned Scientists, and the American Museum of Natural History. The IWG exists to share information about conservation initiatives, develop joint initiatives, and harmonize approaches where possible. In 2003, the IWG developed a work plan designed to help build a cooperative agenda that would increase the collaboration between large international conservation-implementing biodiversity NGOs so that we could more effectively advance the biodiversity conservation agenda across the globe.

In early 2004, we requested and received a grant of \$100,000 from the John D. and Catherine T. MacArthur Foundation, to be spent on three major activities:

- I. proposing a synthesis of global biodiversity conservation agendas;
- II. supporting the establishment of site-scale biodiversity priorities within countries and regions; and
- III. outreach and product development.

It is our pleasure to provide a final report on our activities. We are proud and excited about the success we have achieved. However, we have not achieved all we had hoped to and have been chastened by the difficulties of working across organizations. Below we report on the work supported by the grant from the MacArthur Foundation.

### **I. Proposing a synthesis of global biodiversity conservation agendas**

The major success of this grant has been the production of an abridged atlas of the most current analyses of global biodiversity data sets. Support from the MacArthur Foundation has made possible the development and compilation of these data layers (listed below). Many of these are the basis for publications that are now in press or published (referenced below).

Support from MacArthur has been key in this effort. We are already seeing the benefits of the NGOs working together. There has been greater alignment and synergy amongst scientists working collaboratively on these projects. Additionally, several of the data layers that were not easily integrated before are now linked (for example, by adjusting biodiversity hotspot boundaries to conform to the terrestrial ecoregions of the world map).

The project served as a catalyst to fill several gaps in our knowledge of global biodiversity patterns. These included: a map of Critically Endangered and Endangered species exhibiting a single global population; the world's intact large mammal assemblages; large mammal migrations; and global plant richness by ecoregion. Moreover, this effort brought together a number of other global biodiversity conservation priority datasets, including an updated

biodiversity hotspots analysis, high-biodiversity wilderness areas, Endemic Bird Areas and comparative data for mammals and amphibians, and maps of species richness and of threatened species richness for mammals, birds, and amphibians. This effort also led to an understanding of gaps in our knowledge of terrestrial biodiversity. Most important in this context is the absence of a finer scale map of plant endemism than the hotspots map or wilderness areas. Because we could not “unpack” hotspots data into their constituent species or ecoregions, finer scale analyses of plant biodiversity are not yet possible. Another gap is the lack of a map of higher taxonomic uniqueness for vertebrates and plants. This last issue is currently being addressed but not in time for this report. Finally, global scale maps of important ecological services are sorely needed.

The rich set of data layers prepared and compiled under this grant is going to be made available to interested parties. We are working on developing final arrangements to house these data on a publicly accessible web site. It appears that the best option will be the Conservation Commons website hosted by The Nature Conservancy and we are completing discussions about using this option.

Our collaborative efforts were successful in two of our three objectives: 1) agreeing on a common set of currently used conservation targets, free of the brands and jargon of each group; and 2) mapping those targets as accurately as possible. However, despite our best efforts and the positive movement we reported in our interim report, we were not able to complete the final draft of the Global Priorities Paper in time for this report. Our hope was that by integrating member organizations’ conservation priorities into one agenda, we could deliver a clearer and stronger message on the importance of biodiversity conservation. This comprehensive agenda for global biodiversity conservation would weave together the priorities espoused by all of the major NGOs, placing them in a broader perspective and without the trade names associated with the different approaches.

We still hope to complete this product, but have not been successful at this point. Responsible for our lack of success are: 1) our underestimation of the time it would take to prepare the data layers; 2) difficulties in working across institutional lines in resolving differences in institutional values and priorities; 3) a mix of signals from the CEO Forum of NGO Presidents as to the direction of our work; and 4) the larger picture confronting the resolving of different approaches to conservation. We have not given up on attempting this formidable task and will keep trying to achieve this important outcome.

## **The Abridged Atlas of Global Terrestrial Biodiversity and Conservation Priorities**

This abridged atlas incorporates assessments of aspects of global terrestrial biodiversity at fine and coarse scales. At present, the fine scale analysis contains a single data layer and a single map. The coarse-scale analyses are divided into six major categories with 11 data layers portrayed in 24 individual maps. Each data layer we present is accompanied by a rationale for its inclusion, the data layer(s) selected, an abstract of the work, and a literature citation where more documentation can be found. Note that many of the contributions to the grant report are still under review, in press, or recently published.

### ***Fine-Scale Priorities***

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#### **I. Vertebrate species with single global populations**

##### Rationale

- Avoiding imminent extinctions of most threatened species
- Limited geographic distributions of these species
- Make sure that rare species don't "fall through the cracks" of large-scale conservation carried about by conservation agencies and NGOs

##### Data layer

- Single population species (AZE – Alliance for Zero Extinction)

##### **Single Population Species (AZE)**

Abstract: Slowing rates of global biodiversity loss requires preventing species extinctions. In this analysis we pinpoint centers of imminent extinction, where highly threatened species are confined to single sites. Within five globally assessed taxa, we found 794 such species, three times the number recorded as having gone extinct since 1500. These species occur in 595 sites, concentrated in tropical forests, on islands, and in mountainous areas. Only a third of the sites are legally protected, and most are surrounded by intense human development. These sites represent clear opportunities for urgent conservation action to prevent species loss (Ricketts et al. in review).

See Map 1: Single population species (AZE) (Ricketts et al. in review.)

## **II. Ecoregion Base map**

### Rationale

- Enhance data exchange and analyses by settling on common base map
- Align large-scale priority areas (biodiversity hotspots and high-biodiversity wilderness areas) with ecoregion boundaries
- Data on ecoregion boundaries and descriptions published and on website

### Data layer

- Terrestrial Ecoregions of the World (WWF)

### **Terrestrial Ecoregions of the World: A New Map of Life on Earth (WWF)**

Abstract: The tapestry of life on Earth is unraveling as humans increasingly dominate and transform natural ecosystems. Scarce resources and dwindling time force conservationists to target their actions to stem the loss of biodiversity — a pragmatic approach, given the highly uneven distribution of species and threats. Unfortunately, the ability to focus strategically is hindered by the absence of a global biodiversity map with sufficient biogeographic resolution to accurately reflect the complex distribution of the Earth's natural communities. Without such a map, many distinctive biotas remain unrecognized. We address the disparity in resolution between maps currently available for global conservation planning and the reality of the Earth's intricate patterns of life by developing a detailed map of the terrestrial ecoregions of the world that is better suited to identify areas of outstanding biodiversity and representative communities. We define ecoregions as relatively large units of land containing a distinct assemblage of natural communities and species, with boundaries that approximate the original extent of natural communities prior to major land-use change. Our ecoregion map offers features that enhance its utility for conservation planning at global and regional scales: comprehensive coverage, a classification framework that builds on existing biogeographic knowledge, and a detailed level of biogeographic resolution. Ecoregions reflect the distributions of a broad range of fauna and flora across the entire planet, from the vast Sahara Desert to the diminutive Clipperton Island (eastern Pacific Ocean). They are classified within a system familiar to all biologists — biogeographic realms and biomes. Ecoregions, representing distinct biotas, are nested within the biomes and realms, and together these provide a framework for comparisons among units and the identification of representative habitats and species assemblages.

See Map 2: Terrestrial Ecoregions of the World (WWF)

## **III. Geographic areas of high endemism for a range of taxa**

### Rationale

- Concentrations of irreplaceable species
- Limited geographic distributions

- Surrogacy of well known taxa used to predict other rare elements of biodiversity

#### Data layers

- a. Hotspots and High-biodiversity wilderness areas (CI-Plants)
- b. Vertebrate species endemism by ecoregions (WWF WildFinder)
- c. Global vertebrate assessments (IUCN)
- d. Endemic vertebrate areas (BirdLife, IUCN)

#### **a. Hotspots and High-biodiversity wilderness areas (CI-Plants)**

Abstract: Methods for identifying broad regional conservation priorities at a global scale have been in existence for several decades, for example, using plant endemism as a surrogate for irreplaceability and extent of habitat loss as a surrogate for vulnerability. These regional conservation priorities are informative for globally flexible conservation resources such as those managed by foundations, bilateral and multilateral donors, and global conservation NGOs. In 2000, Myers et al. (2000) revisited the concept to identify a total of 25 broad regions holding at least 1,500 endemic plants and with at least 70% habitat loss to date. Mittermeier et al. (2003) complemented this by identifying 5 regions holding at least 1,500 endemic plants but with less than 30% habitat loss to date. Full species lists of endemic and occurring vertebrate species lists also exist for all of these regions. While broadly biogeographic, the boundaries of the regions used by Myers et al. (2000) do not align directly to global bioregional classification schemes such as that of WWF-US (Olson et al. 2001), complicating data sharing, organizational integration, and production of common conservation messages. Moreover, while Myers et al. (2000) omitted a number of regions meeting the thresholds due to lack of information, much new data have subsequently become available.

Here, we produce a data layer for areas of high endemism and of high and low threat updated in two ways: a) Updating the layer of terrestrial regions of high endemism and high threat to incorporate newly available biological data. These suggest that regions such as the Madrean Pine-Oak woodlands of northern Mexico and the southwestern USA, Maputaland-Pondoland-Albany in South Africa, the Afromontane highlands, the Horn of Africa, the Irano-Anatolian, Central Asian and Himalayan mountains, Japan, and the East Melanesian islands all exceed the Myers et al. (2000) thresholds. b) Harmonizing the boundaries of all of the regions identified by Myers et al. (2000), plus those new regions identified above with those identified by Olson et al. (2001), to provide a common framework for the identification of broad regions characterized by high endemism, for the communication of common conservation messages, and for facilitation of data sharing. These data are all downloadable from [www.biodiversityhotspots.org](http://www.biodiversityhotspots.org). The high-biodiversity wilderness areas identified by Mittermeier et al. (2003) are already harmonized with the ecoregion boundaries of Olson et al. (2001).

See Map 3: Expanded Hotspots and High-biodiversity wilderness areas (CI-Plants)

#### **b. Vertebrate species endemism by ecoregions (Lamoreux et al. and WWF WildFinder)**

Abstract: A new interactive global vertebrate species database linked to WWF ecoregions has just been launched ([www.worldwildlife.org/wildfinder](http://www.worldwildlife.org/wildfinder)). This new site allows for users to type in the scientific or common name of any species and WildFinder returns a map of the ecoregions where the species of bird, mammal, reptile, or amphibian is found. Alternatively, one can click on an ecoregion and download and export a complete list of the terrestrial vertebrates found there and those species endemic to the ecoregion. This new tool will allow users to analyze patterns of endemism and richness across these taxa and realms.

The first scientific application of the WildFinder database is an assessment of how well focusing on vertebrate endemism serves as a surrogate for other taxa and how well an endemism focus captures species richness. Our findings show that while endemism has long been championed for the sake of protecting narrow-ranging species, it also appears to perform well in the conservation of all vertebrates (Lamoreux et al. in review).

See Maps 4a-e.

Map 4a. Vertebrate species endemism by ecoregions: Total

Map 4b. Vertebrate species endemism by ecoregions: Amphibians

Map 4c. Vertebrate species endemism by ecoregions: Birds

Map 4d. Vertebrate species endemism by ecoregions: Mammals

Map 4e. Vertebrate species endemism by ecoregions: Reptiles

### **c. Global vertebrate assessments (IUCN)**

Abstract: Over the last few years, a number of datasets derived from comprehensive assessments of species across entire classes have become available, providing important new insight into global biodiversity conservation priorities (Baillie et al. 2004). BirdLife International first stimulated such assessments, producing a global map of all species with ranges of <50,000 sq. km (Stattersfield et al. 1998), and then a global map of threatened species richness (BirdLife International 2000). The IUCN Global Mammal Assessment and Global Amphibian Assessment have now paralleled this work, providing equivalent data for mammals and amphibians respectively. Critically, these comprehensive assessments compile geographic range data individually for all species. These data can then form the basis for a number of biodiversity analyses.

Maps of threatened species richness, following the IUCN Red List criteria (IUCN 2001), are presented here for mammals (1,101 species), birds (1,213 species), and amphibians (1,856 species). Data such as these can be used alongside measures of irreplaceability to inform conservation priority (Rodrigues et al. 2004). The disparity between the threatened species maps for the three taxa incorporated here is noteworthy: while at least one threatened mammal species occurs nearly everywhere on the land, threatened amphibians are highly concentrated into small areas in the montane tropics.

See Maps 5a-c. Threatened vertebrate species

Map 5a. Distribution of threatened mammal species

Map 5b. Distribution of threatened bird species

Map 5c. Distribution of threatened amphibian species

#### **d. Endemic vertebrate areas** (BirdLife, IUCN)

Abstract: The pioneering work of Stattersfield et al. (1998) identified Endemic Bird Areas as regions holding two or more of the ~2,500 bird species (~25%) with global ranges of <50,000 sq. km. The comprehensive assessments of mammals and amphibians now allow a similar approach to be taken to identify Endemic Mammal Areas and Endemic Amphibian Areas. Approximately 1,250 mammal species (~25%) and ~3,360 amphibian species (~60%) have ranges below the 50,000 sq. km threshold. In contrast to the threatened species richness maps, the Endemic Biodiversity Areas are remarkably concordant between the three taxa. The bird data herein are property of BirdLife International, and permission for their use should be obtained from Dr. L.A. Bennun [leon.bennun@birdlife.org.uk], Head of Science and Policy, BirdLife International. (The exception is the Ridgely et al. (2003) dataset, which is in the public domain.) The mammal and amphibian data are property of the IUCN-SSC/CI-CABS Biodiversity Assessment Unit, and permission for their use should be obtained from Dr. S.N. Stuart [s.stuart@conservation.org], Head of the IUCN-SSC/CI-CABS Biodiversity Assessment Unit.

See Maps 6a-c. Endemic Vertebrate Areas

Map 6a. Endemic Bird Areas of the world

Map 6b. Endemic Mammal Areas of the world

Map 6c. Endemic Amphibian Areas of the world

### **IV. Species Richness**

Rationale

- Large diversity of species
- Surrogate for complex species interactions
- Plant species richness by ecoregion may be a good surrogate for plant endemism for continental ecoregions

Data layers

- a. Plant species richness by ecoregion (U. of Bonn, Germany)
- b. Vertebrate species richness by ecoregion (WWF-WildFinder)

#### **a. Plant species richness by ecoregion** (U. of Bonn, Germany)

Abstract: We present the first global map of vascular plant species richness by ecoregion and compare these results with the published literature on global priorities for plant conservation (Kier et al. 2005). In so doing, we assess the status of floristic knowledge across ecoregions as described in floras, checklists, and other published documents and pinpoint geographic gaps in our understanding of the global vascular plant flora. Finally, we explore the relationship between plant species richness by ecoregion and our knowledge of the flora and between plant richness and the human footprint (sensu Sanderson et al. 2002), a spatially explicit measure of the loss and degradation of natural habitats and ecosystems as a result of human activities.

See Maps 7a-b: Plant richness

Map 7a. Plant species richness by ecoregion (Kier et al. 2005)



Map 7b. Highest species richness for vascular plants by ecoregion for each biome and biogeographic realm (Kier et al. 2005)

**b. Vertebrate species richness by ecoregion (WWF-WildFinder)**

Abstract: Global patterns of species richness for terrestrial vertebrates is now available through the WildFinder database. See above abstract for more details and Lamoreux et al. (in review) for scientific application.

See Maps 8a-e: Vertebrate species richness by ecoregion

Map 8a. Vertebrate species richness by ecoregion: Total (WWF-WildFinder)

Map 8b. Vertebrate species richness by ecoregion: Amphibians (WWF-WildFinder)

Map 8c. Vertebrate species richness by ecoregion: Birds (WWF-WildFinder)

Map 8d. Vertebrate species richness by ecoregion: Mammals (WWF-WildFinder)

Map 8e. Vertebrate species richness by ecoregion: Reptiles (WWF-WildFinder)

## V. Ecological Phenomena

### Rationale

- Once widespread, especially in tundra, boreal, and in temperate and tropical grasslands and now extremely rare
- Unique life histories requiring hemispheric protection
- Many species are seasonal altitudinal migrants

### Data layers

- Large mammal migrations (AMNH/WCS)

### **Mammal migrations with a conservation audit on movements in aggregations (AMNH/WCS)**

Abstract: Migration, the seasonal and round-trip movement of animals between discrete areas, is a behavior common to a diversity of taxa. Some migrations are obscure, such as those carried out by many insects. Other migrations are well known, like the movements made by massive herds of Serengeti wildebeest. Taken as a whole, our knowledge of migrations is low, our impacts on species and habitats high, and, combined, this places the ability of animals to migrate in global jeopardy.

Despite such concerns, there remains no comprehensive synthesis of the global status of migrations. This project begins to fill this void by focusing on the 18 large-bodied terrestrial mammals that migrate in aggregated movements. We offer four advances. First, information describing the location and dynamics of these migrants was collected, and maps illustrating their migration routes were created. Second, to determine the type of habitat migrating species use, we compared areas where species migrate against their historic distributions (Africa only). Overwhelmingly, these migrants occur in grasslands, confirming other site-specific studies. Third, for migrations accurately mapped, we quantified the amount of human influence they intersect, based on the “Human Footprint” dataset (Sanderson et al. 2002). Lastly, by combining layers of habitat and human influence, we evaluated the likelihood of undocumented yet extant aggregated migrations, plus locations where migrations may have potential for reestablishment. The

results of this synergy indicate one location within Zambia that may retain large bodied and migratory mammals. Otherwise, most grassland occurs in areas no longer considered “wild,” with the majority of migrations found in them.

Conserving the natural spectacle of aggregated migrations is challenging, for it relies on humans valuing the phenomenon, along with the species. Migratory behavior could cease (and for some has) without the migratory species going extinct. Conserving these migrations means managing huge tracks of land, enabling sufficient areas for species to range, and safeguarding bottlenecks where a number of migratory species pass and concentrate.

While this project takes the first steps toward providing information to aid conservation planning and possibly restoring migrations, more work is needed. Future research requires gathering migratory information covering a full breadth of biodiversity, to locate, map and gain a comprehensive look at species migrations at a global scale.

This manuscript is in preparation. The title is “Mammal migrations with a conservation audit on movements in aggregations.” This layer was produced by Grant Harris (American Museum of Natural History, now with US Forest Service) with direction from Joel Berger (Wildlife Conservation Society).

See Map 9: Extant Terrestrial Large mammal migrations (AMNH/WCS)

## VI. Rare Habitats

Rationale

- Concentration of unique habitats and adaptations (species)
- Limited geographic distributions

Data layers

- Rare Habitats from Terrestrial Ecoregions of the World (WWF)
- Cloud forests (IUCN) - availability pending; probably 2006

**Rare Habitats from Terrestrial Ecoregions of the World (WWF-Global 200)**

Abstract: Some terrestrial biomes and large habitats are so rare in spatial extent as to justify their inclusion in a global set of biodiversity features. We set a threshold of rarity for ecoregions to qualify as those that occupy less than 5% of the total number of ecoregions (Olson and Dinerstein 2000). These included: temperate rain forests, tropical dry forests, mangroves, and mediterranean-climate ecoregions. These ecoregions harbor many restricted endemics and also many species that show unique adaptations to climatic extremes. Conservation of rare habitats helps preserve unique evolutionary adaptations to climatic extremes and many species with limited geographic distributions.

See Map 10: Rare Habitats from Terrestrial Ecoregions of the World and the Global 200 (WWF)

## VII. Measures of Intactness

## Rationale

- Intact ecosystems becoming rare
- Full ecological functioning
- Areas where conservation can be proactive and often low cost

## Data layers

- a. Human footprint & wild areas (WCS)
- b. WILMA (WWF/GMA/Princeton U./WCS)
- c. Intactness/degree of protection of terrestrial ecoregions (TNC)

### **a. Human Footprint and Last of the Wild (WCS)**

Abstract: The human footprint is a map of human influence on Earth (Sanderson et al. 2002). It demonstrates that we are stewards of nature whether we like it or not. Our population, roads, land use and lights (bright enough to be seen by a satellite at night) touch 83% of the land's surface, and 98% of the places where we can grow wheat, corn or rice. If we believe in the integrity of life on Earth and want to see it continue as generations untold before us have, the most important factor to influence is us.

The Last of the Wild are the largest, wildest places left in all the biomes of the world. Derived by GIS from the human footprint map, the Last of the Wild map shows the places where conservation might occur with a minimum of conflict with existing human structures. Conservation in the least influenced places is likely to be cheaper, more successful and less contentious than conservation anywhere else.

See Maps 11a-b.

Map 11a. The Human Footprint

Map 11b. The Last of the Wild

### **b. Intact large mammal faunas as indicators of global human impacts (WWF/IUCN/Princeton U.)**

Abstract: Large mammals are of particular interest to ecologists because they play critical ecological roles within the ecosystems in which they occur and they are highly vulnerable to extirpation due to human activities. Their severe range contractions during the last several centuries mean that fully intact fauna within ecosystems are increasingly rare. Here, we identify the proportion of Earth's land area that still retains the full assemblage of large mammals that occurred there at the start of the 16th century. Using a new global dataset on current mammal distributions, we compared range maps of all 190 species of extant large mammals (>40 kg body mass) with their inferred distributions at approximately 1500 AD. Approximately 21% of the land area that contained large mammals 500 years ago still retains all of the large mammal species today. Intact mammal faunas occupy only 9% of their historic area in the Afrotropics, 1% in Indomalaya, 26% in the Nearctic, 35% in the Neotropics, and 16% in the Palearctic. The location of intact faunas offers another, ecologically-based measurement of human impact. Intact large mammal assemblages occupy the two extremes of land use: the least disturbed or the most intensively managed ecosystems on earth. At 7% of the land area,

these intact faunas are underrepresented in the world's network of parks and reserves, and a conservation priority (Morrison et al. in review).

See Map 12: World's Intact Large Mammal Assemblages (WWF/Global Mammal Assessment/Princeton U./WCS)

### **c. Intactness/degree of protection of world's terrestrial ecoregions (TNC)**

Abstract: Viewed globally, the world's biodiversity is distributed across biogeographic realms that reflect the evolutionary history of life on earth and large-scale environmental gradients that continue to shape the composition, structure, and dynamics of biological communities and ecosystems (Hoekstra et al. 2004). Unique regional-scale assemblages of biodiversity are described by ecoregions. Biodiversity in many of these ecoregions is at risk because of extensive habitat loss that has not been countered with adequate degrees of habitat protection. To identify ecoregions where biodiversity is especially at-risk, we calculated the extent of habitat loss due to wholesale land-use conversion, and the extent of protected area coverage in each of the world's terrestrial ecoregions. We then classified ecoregions according to the ratio between % area converted and % area protected (conversion: protection ratio). Ecoregions in which the extent of habitat loss exceeded 50% and the c:p ratio > 25 were classified as Critically Endangered. Ecoregions in which the extent of habitat loss exceeded 40% and the c:p ratio > 10 were classified as Endangered. Ecoregions in which the extent of habitat loss exceeded 20% and c:p ratio > 2 were classified as Vulnerable. The figure below shows the world's Critically Endangered, Endangered, and Vulnerable ecoregions where severe disparities between habitat loss and habitat protection leave biodiversity at-risk. The extent of habitat loss in each ecoregion was calculated from analyses of the Global Land Cover 2000 dataset. The extent of protected area coverage was calculated from summaries of the 2004 World Database on Protected Areas. These data sets are globally comprehensive, but could be improved by higher resolution remote-sensing to more accurately classify land cover, and by the addition of management effectiveness ratings to the protected area database so that "paper parks" could be factored out.

See Maps 13a-c.

Map13a. Percent area of ecoregion converted

Map13b. Percent area of ecoregion protected

Map13c. Ratio of converted land to protected area by ecoregion

## **II. Supporting the establishment of national site-scale biodiversity priorities within countries and regions**

The second of the major activities undertaken as part of this grant involved work on biodiversity priorities at sub-global scales. Global biodiversity conservation prioritization exercises are extremely important in mobilizing globally flexible conservation resources (e.g., from the multilateral and bilateral organizations). However, most conservation investment and action will always be local. For example, the fact that Madagascar is a 'hotspot' does not inform where within Madagascar conservation should occur. It is essential therefore that the conservation community identify on-the-ground targets for the conservation of those biodiversity features for

which site scale conservation is essential – the Key Biodiversity Areas approach. The process of identification must be bottom-up and locally-owned if it is to be accepted and implemented successfully, and follow global standards and criteria if it is to be comparable and consistent, allowing effective allocation of resources within and among countries. Such an approach has deep roots, dating back more than two decades as the identification of Important Bird Areas (IBAs) in Europe (Osieck & Mörzer Bruyns 1981). Moreover, with the recent acceleration of species assessments, it has now become possible to move from IBAs to Key Biodiversity Areas (KBAs), incorporating multiple taxonomic groups (Eken et al. 2004). Here, we present some subsets of KBA data globally, as well as a more comprehensive regional example.

The process of identifying IBAs is led by the ~100 national NGOs representing the BirdLife International Partnership. IBAs are identified, based on standard criteria and thresholds, as sites of international significance for the conservation of: a) globally threatened species; b) restricted-range species; c) congregatory species; and d) biome-restricted assemblages. More than 6,500 globally significant Important Bird Areas have been identified to date (BirdLife International 2004), and the process is underway to complete these for the New World. These will form a perfect subset of KBAs (i.e., KBAs for birds).

While these examples give a good impression of the global scope of KBAs, implementation in its entirety will not be completed for a number of years. For some nations and regions, however, KBAs have been identified across multiple taxonomic groups (plants, fishes, and some invertebrates, as well as terrestrial vertebrates), allowing for the comprehensive presentation of KBA data. In the example here, showing the 141 KBAs identified for threatened species in Madagascar, the size of the locality points represents the number of threatened species for which the KBA has been identified (1: 1–4; 2: 5–10; 3: 11–18; 4: 19–33; 5: 34–58). Such KBA data can already form the basis for gap analysis of national protected area systems. We are grateful to the following people and organizations for providing these datasets; permission for reproduction or use of these data should be sought directly from the respective organizations: the BirdLife International partnership (IBA dataset); and the Conservation International Madagascar Center for Biodiversity Conservation (Madagascar KBAs dataset).

See Map 14. Important Bird Areas.

See Map 15. Key Biodiversity Areas for Madagascar

### **III. Outreach and Product Development**

In the original proposal we suggested that we would plan to fund a meeting with the Cambridge Conservation Forum at the end of this project. Several members of IWG have kept in close contact with the CCF – in fact we share a member in Leon Bennum of BirdLife. We have shared products with them and cooperated on a variety of fronts. As we were not able to complete the revision of our synthesis document, which was to have been the subject of a meeting, we have postponed a joint meeting. The money allocated for this has been expended in preparation of data layers.

#### **IV. Future Steps**

The IWG is interested in discussing with the MacArthur Foundation the possibility of a second round of support. If this were possible, we would like to consider requesting support for preparation of missing data layers (under consideration are: marine; freshwater; better mapping of ecosystem services; ecosystems of the world; evolutionary potential; and endemic mammal and endemic amphibian areas); support for completion of a set of synthesis documents; and support for collaborative work with the Cambridge Conservation Forum.

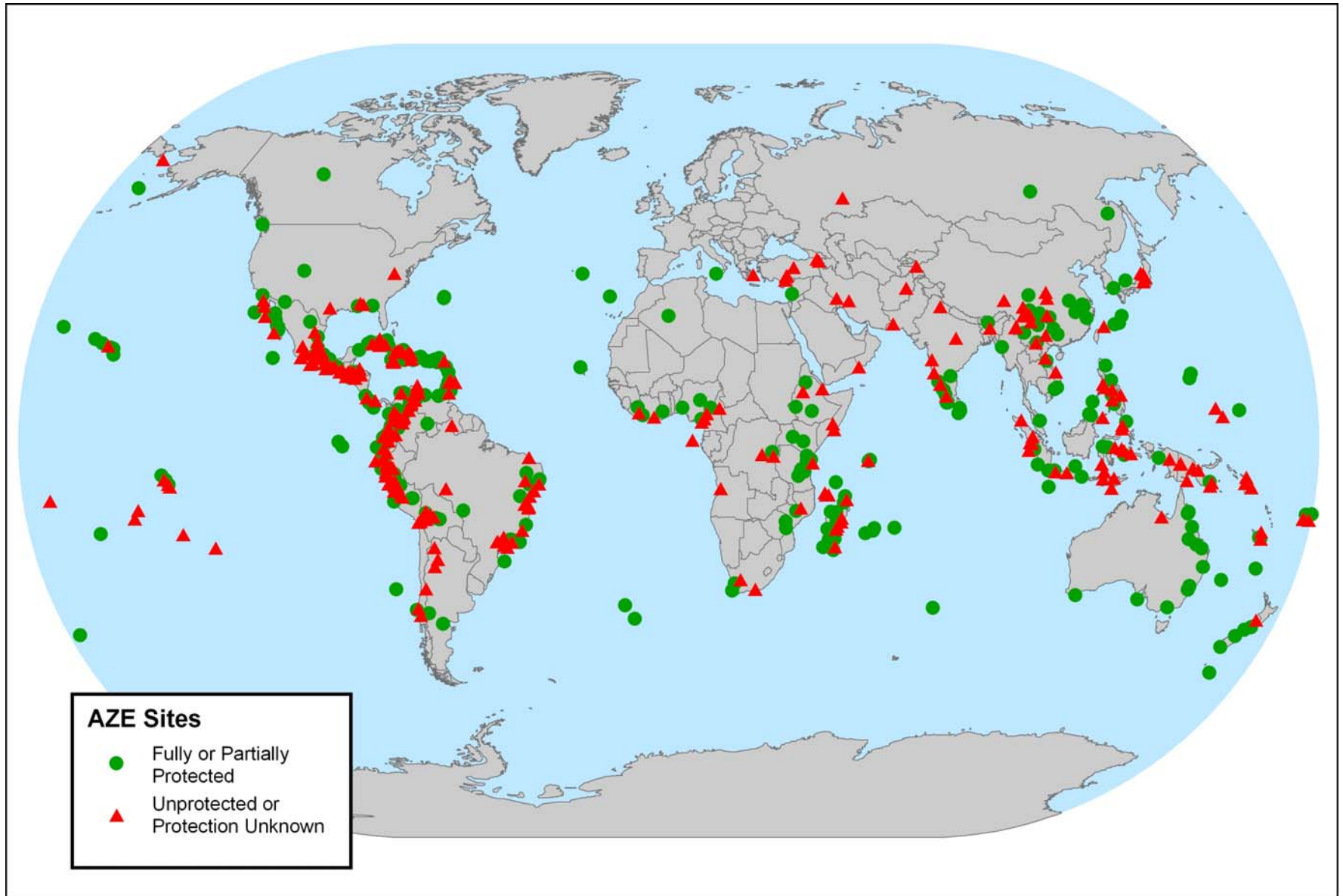
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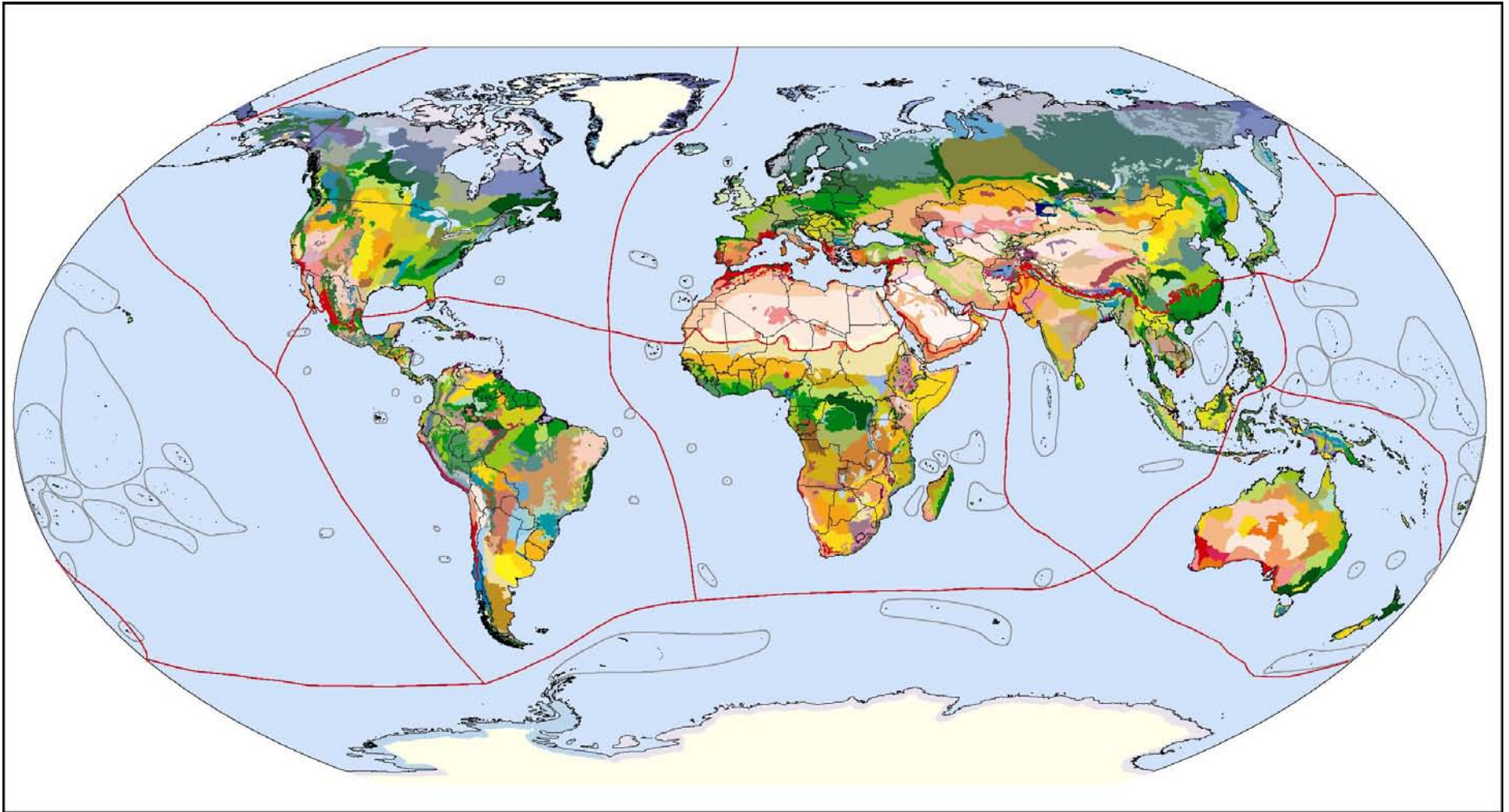
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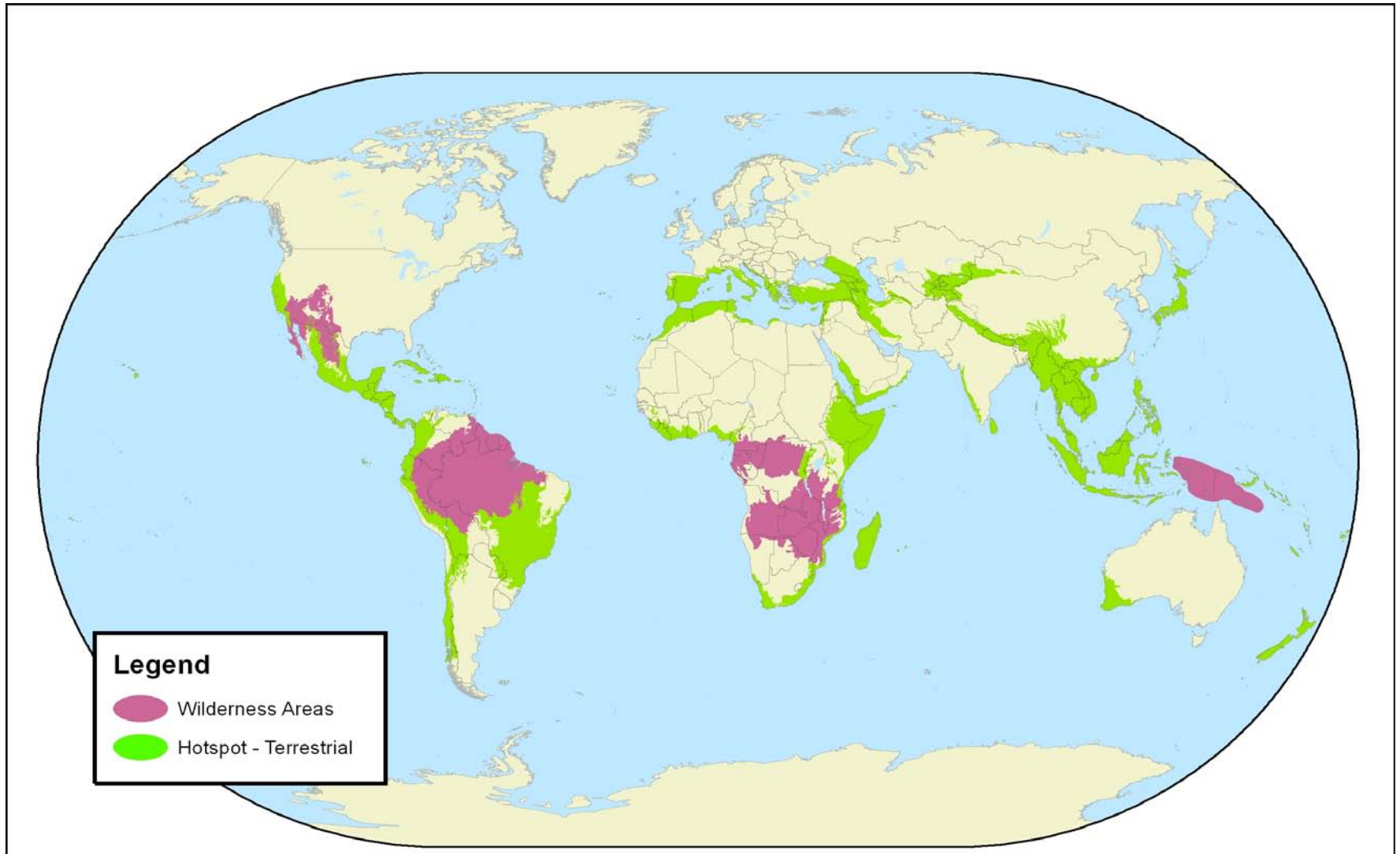
## **Appendix: Maps**



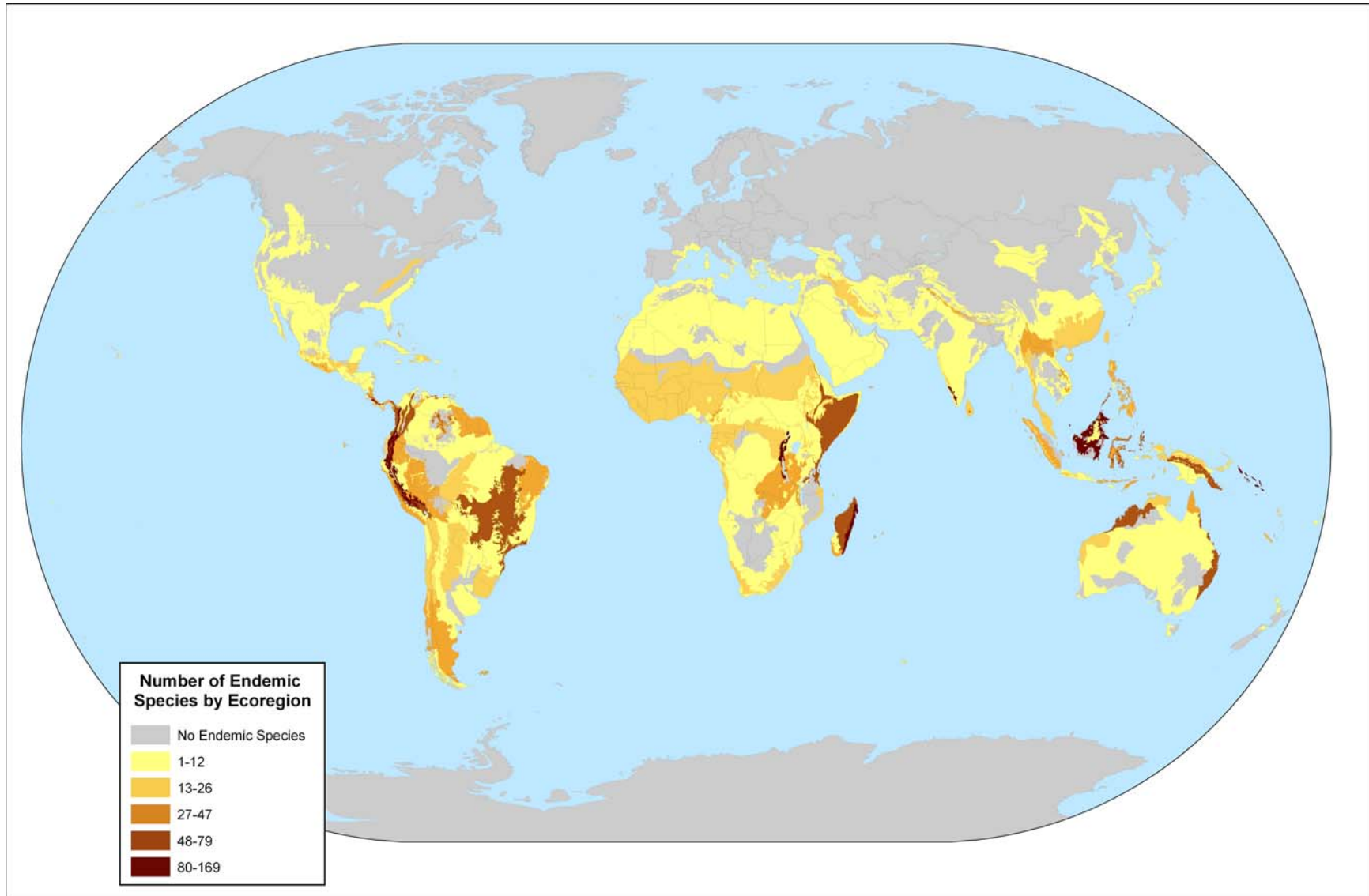
Map 1: Single population species (AZE) (Ricketts et al. in review.)



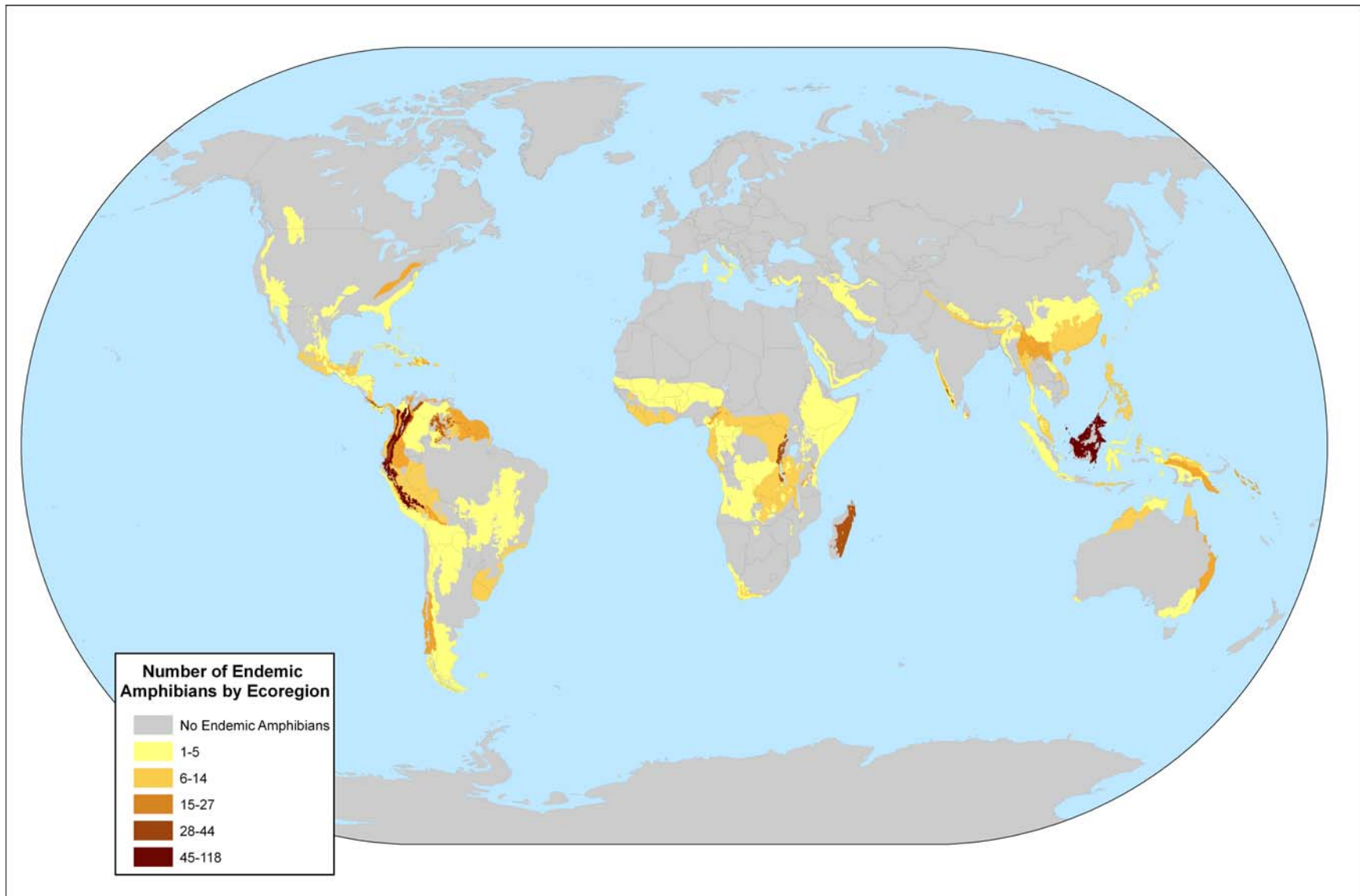
Map 2: Terrestrial Ecoregions of the World (WWF)



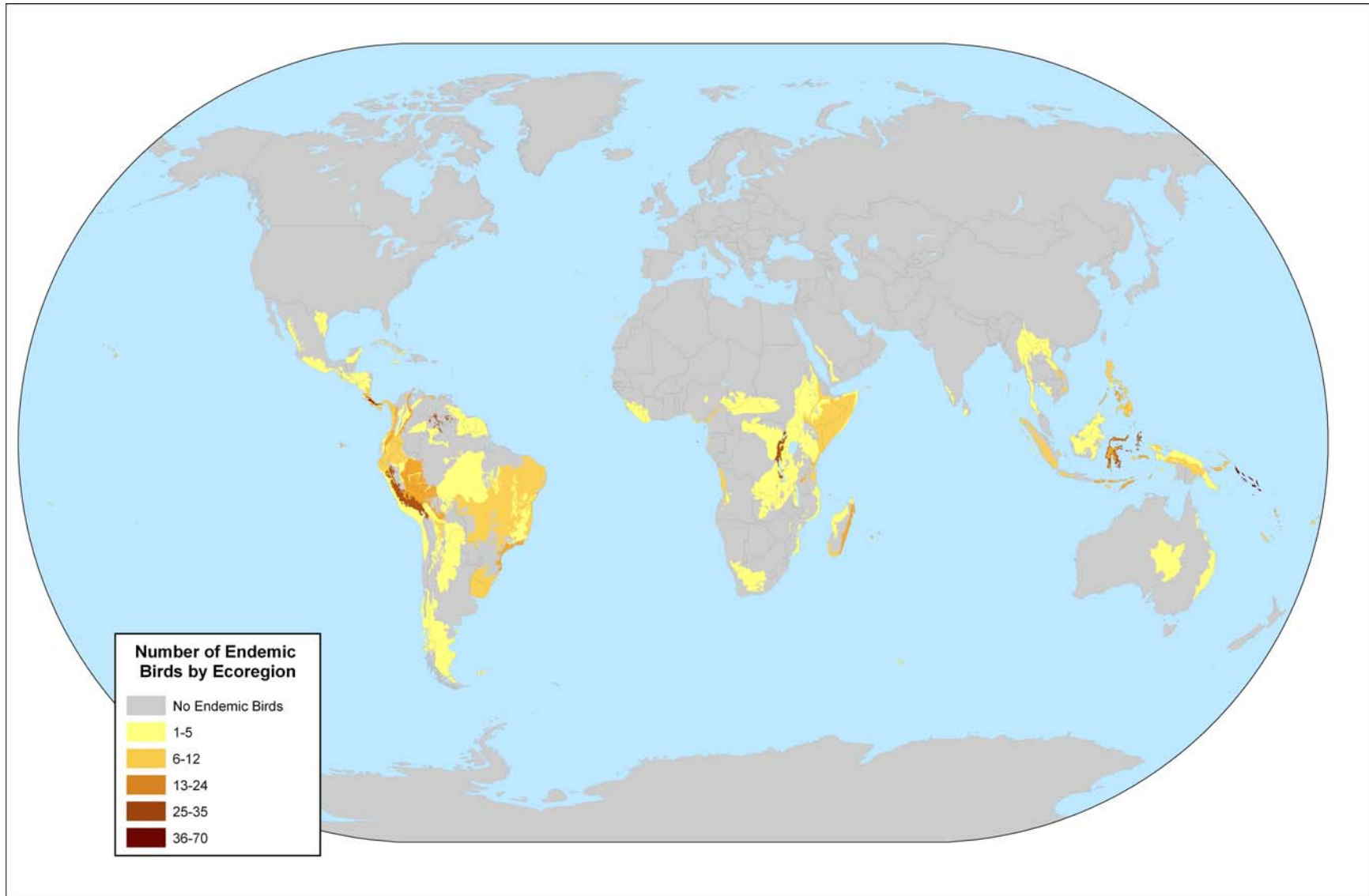
Map 3: Expanded Hotspots and High-biodiversity wilderness areas (CI- Plants)



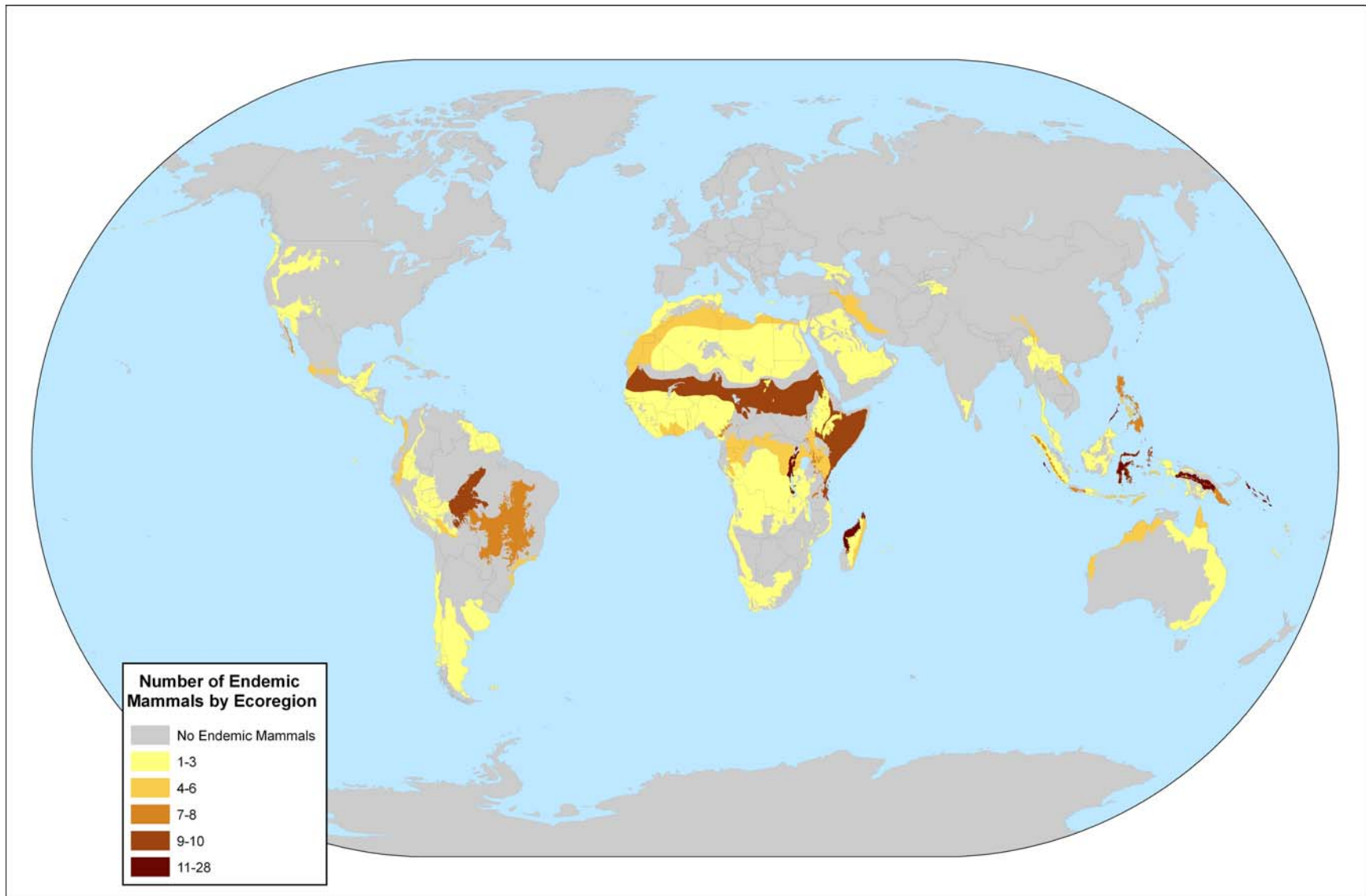
Map 4a. Vertebrate species endemism by ecoregions: Total



Map 4b. Vertebrate species endemism by ecoregions: Amphibians

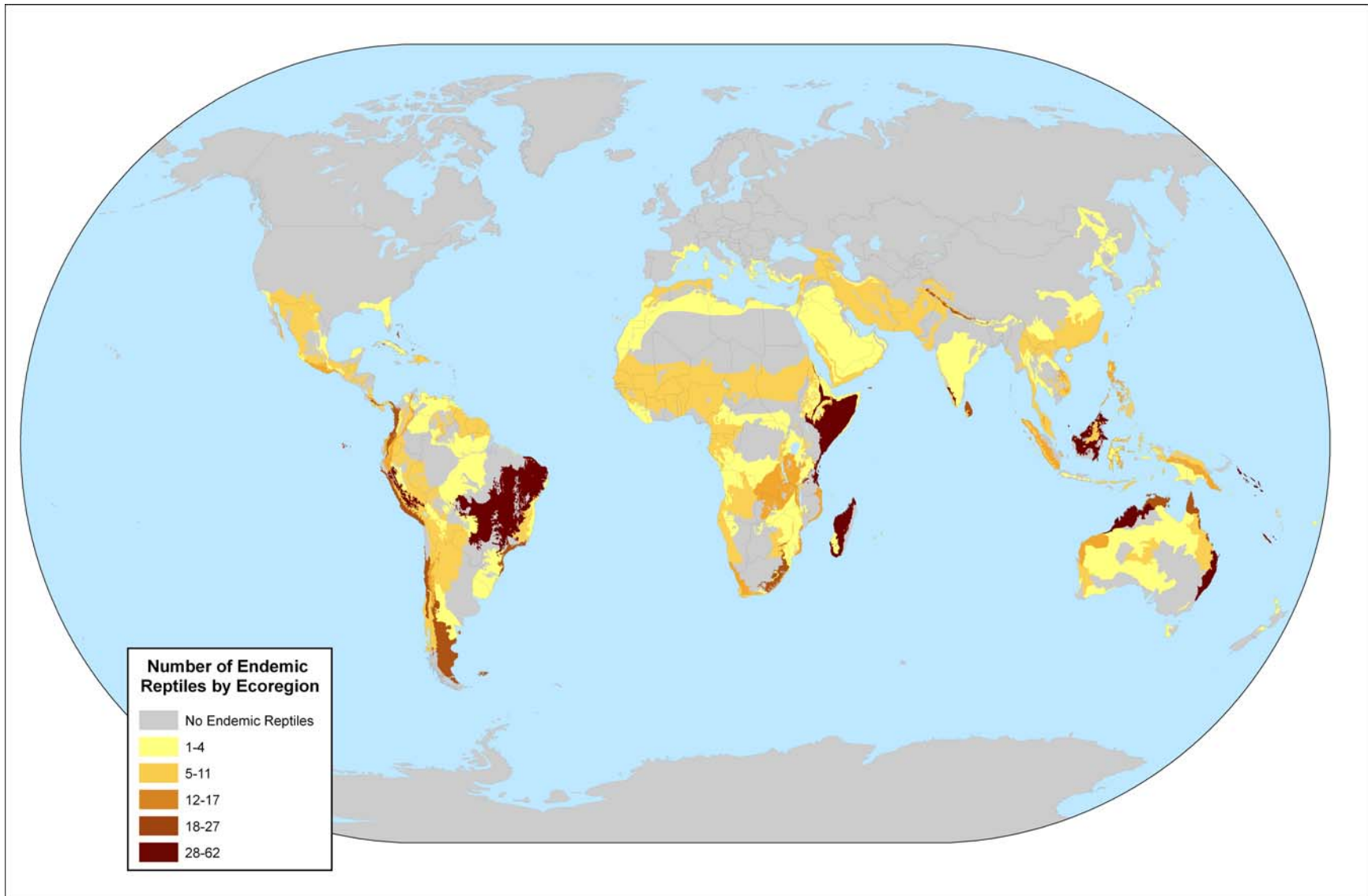


Map 4c. Vertebrate species endemism by ecoregions: Birds

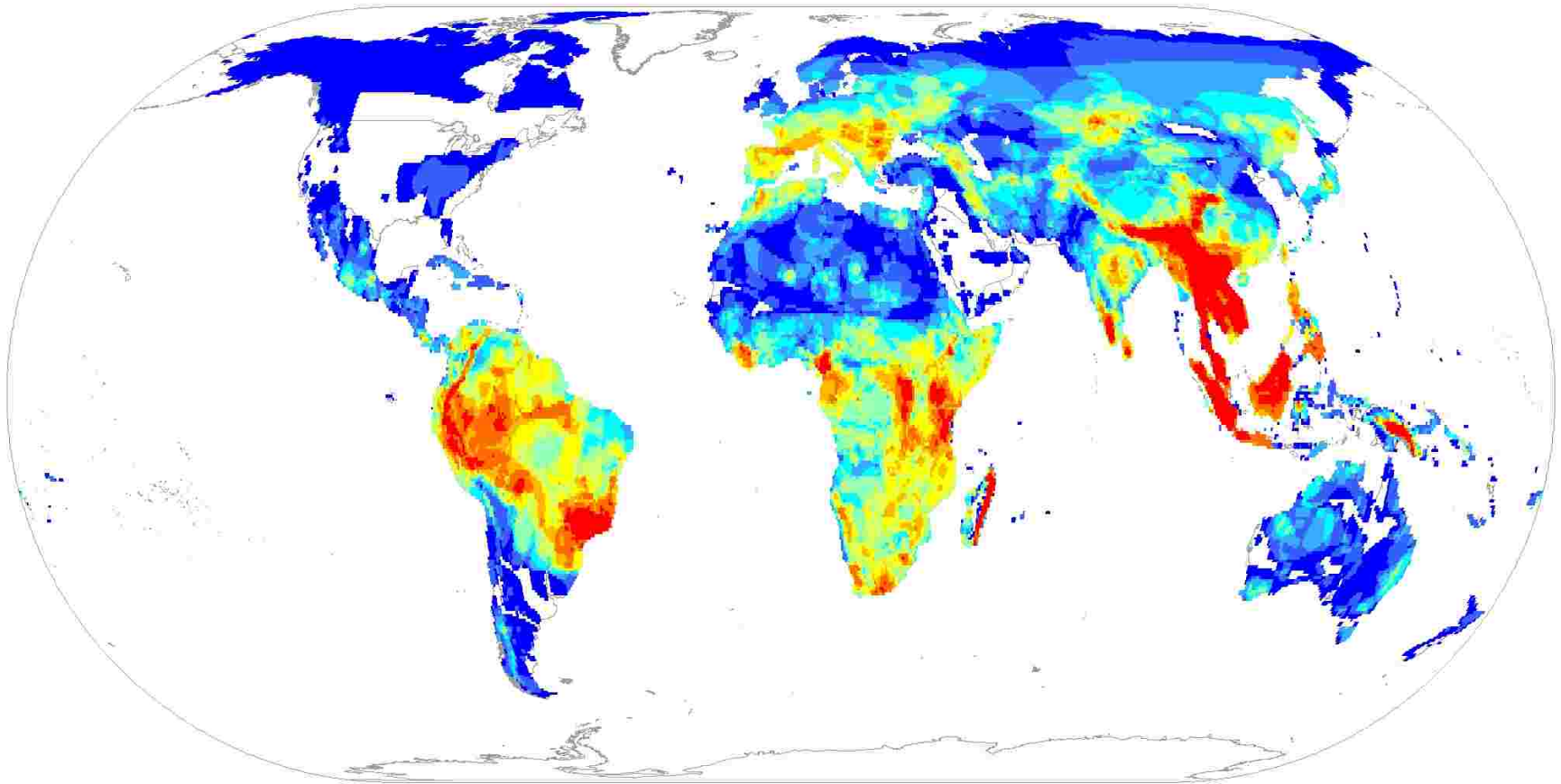


Map 4d. Vertebrate species endemism by ecoregions: Mammals

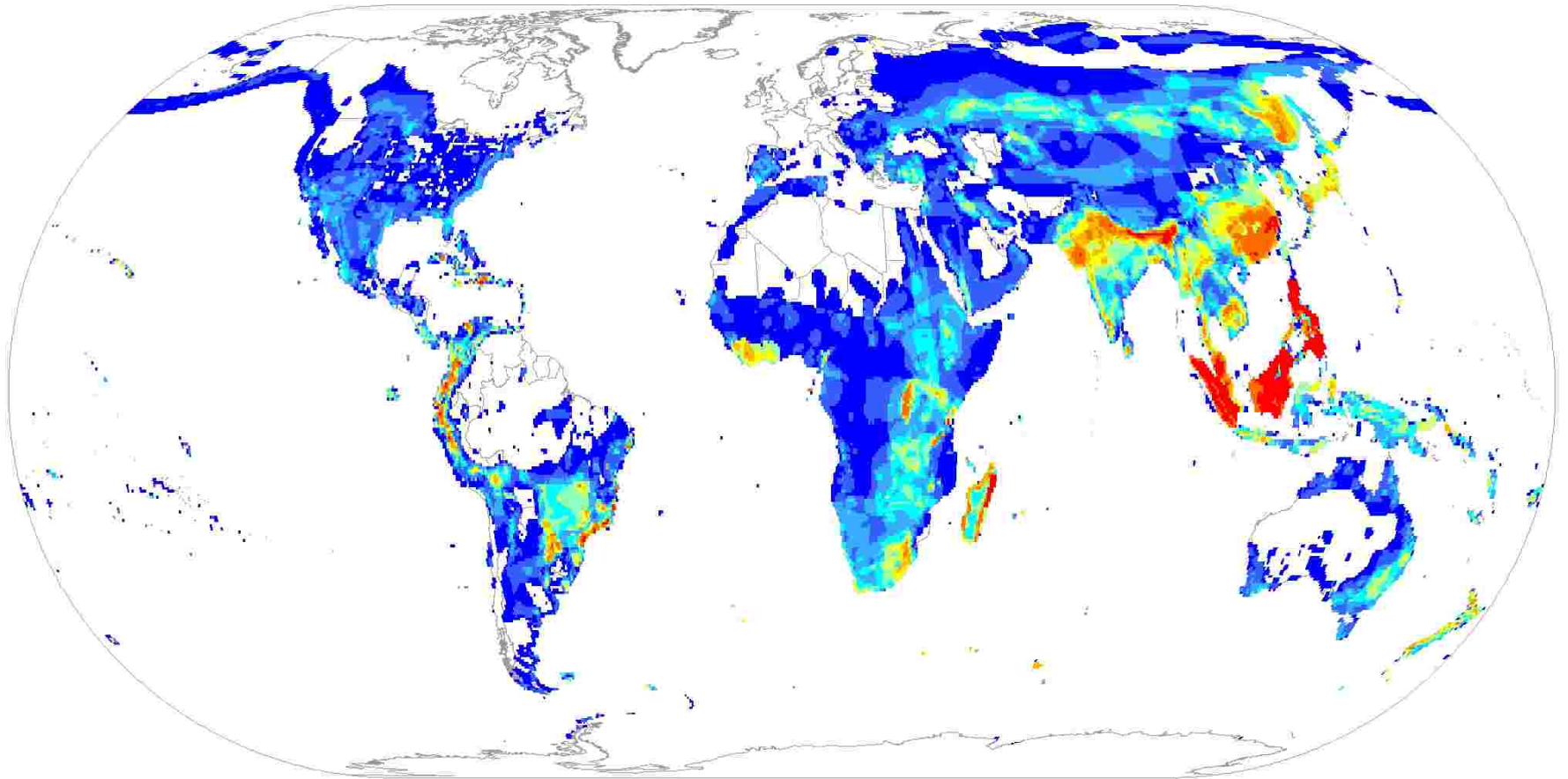




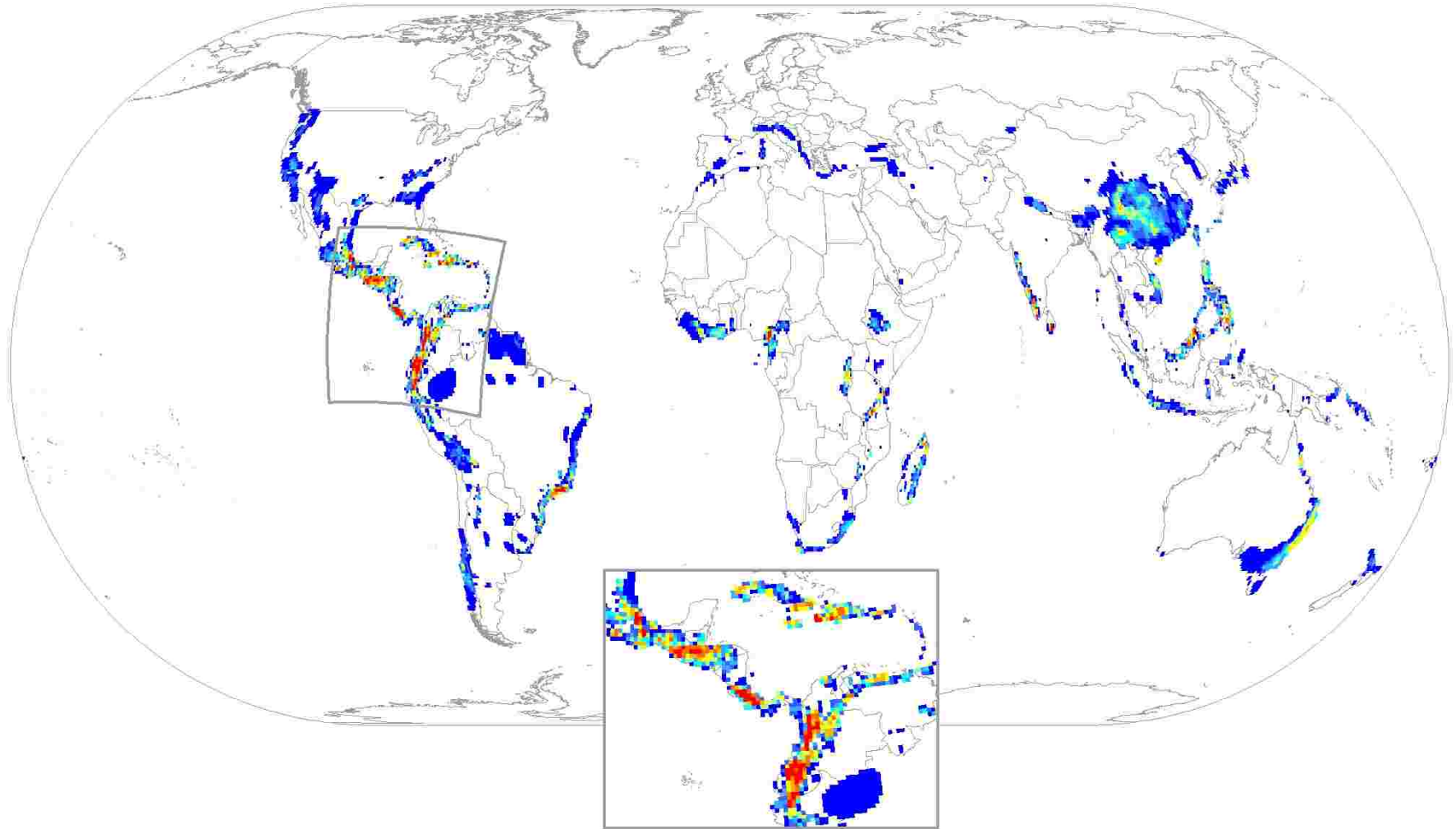
Map 4e. Vertebrate species endemism by ecoregions: Reptiles



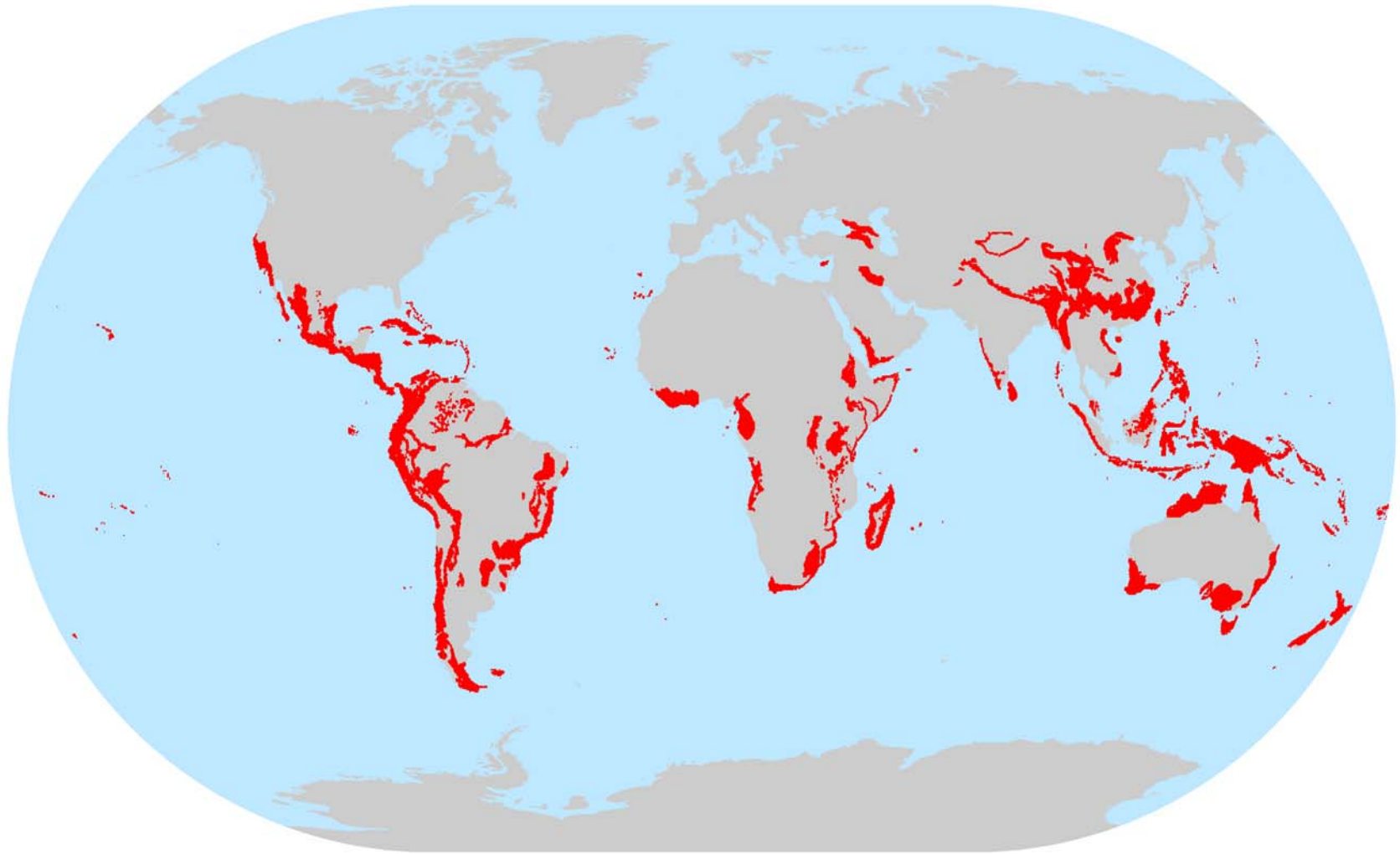
Map 5a. Distribution of threatened mammal species



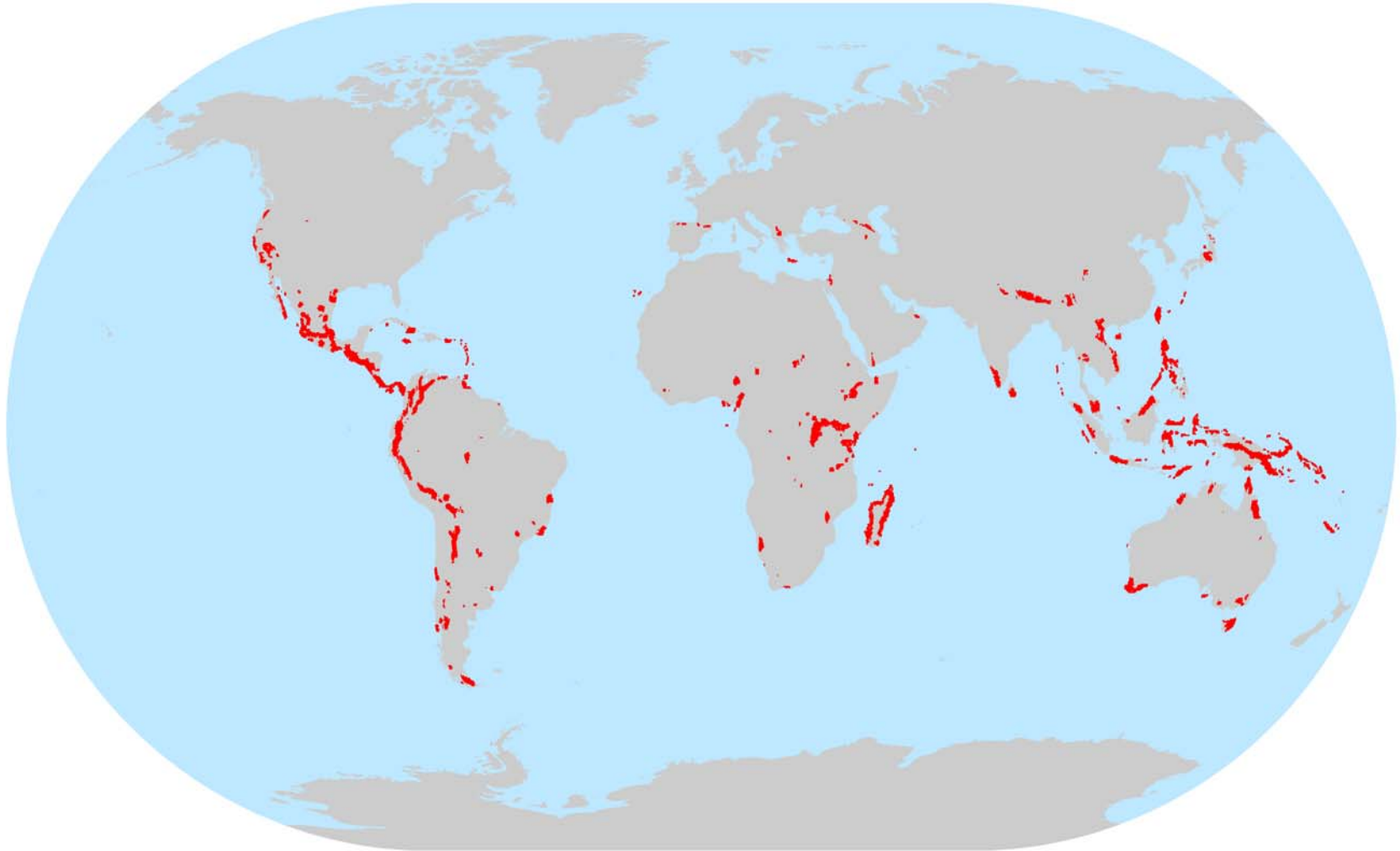
Map 5b. Distribution of threatened bird species



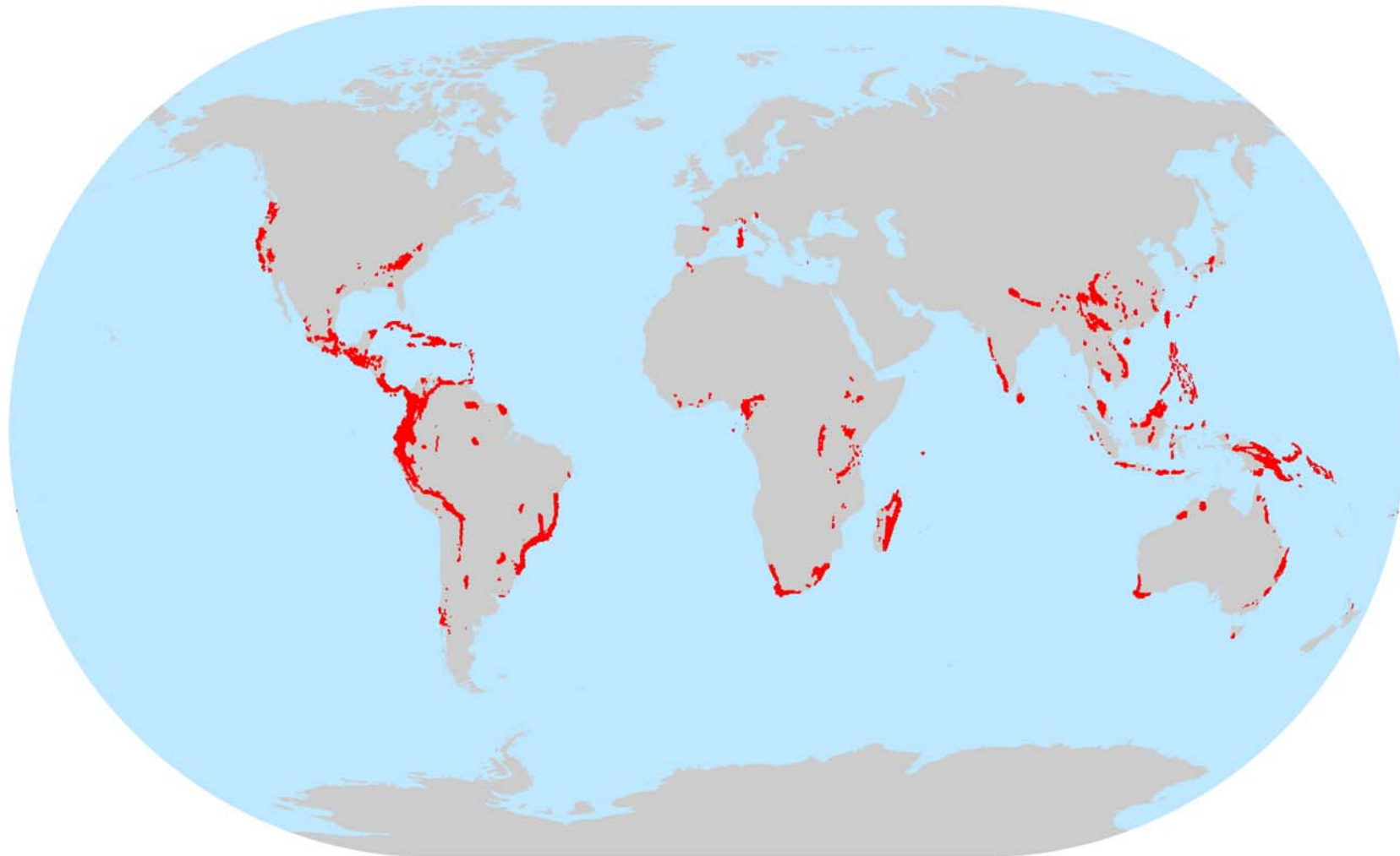
Map 5c. Distribution of threatened amphibian species



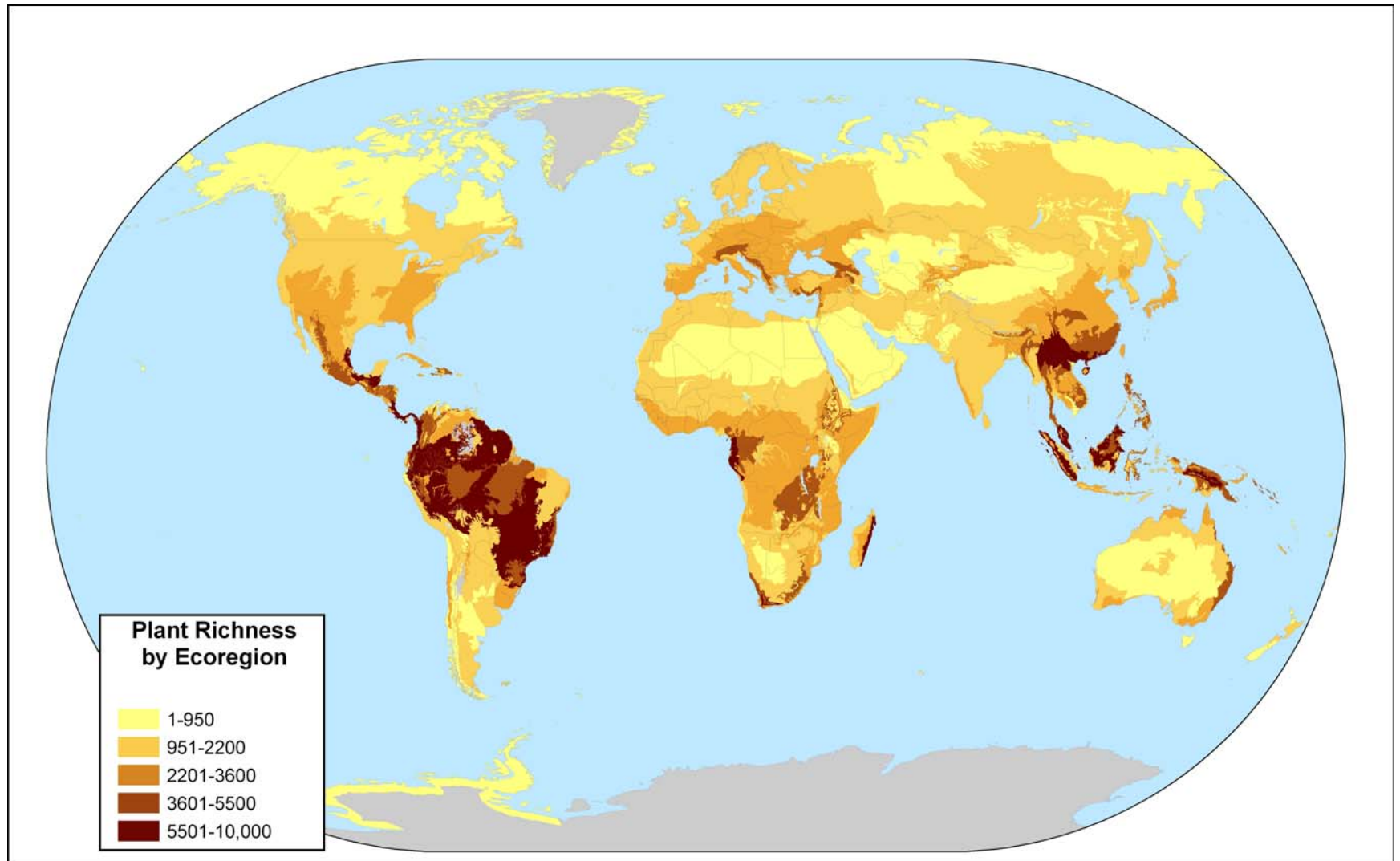
Map 6a. Endemic Bird Areas of the world



Map 6b. Endemic Mammal Areas of the world

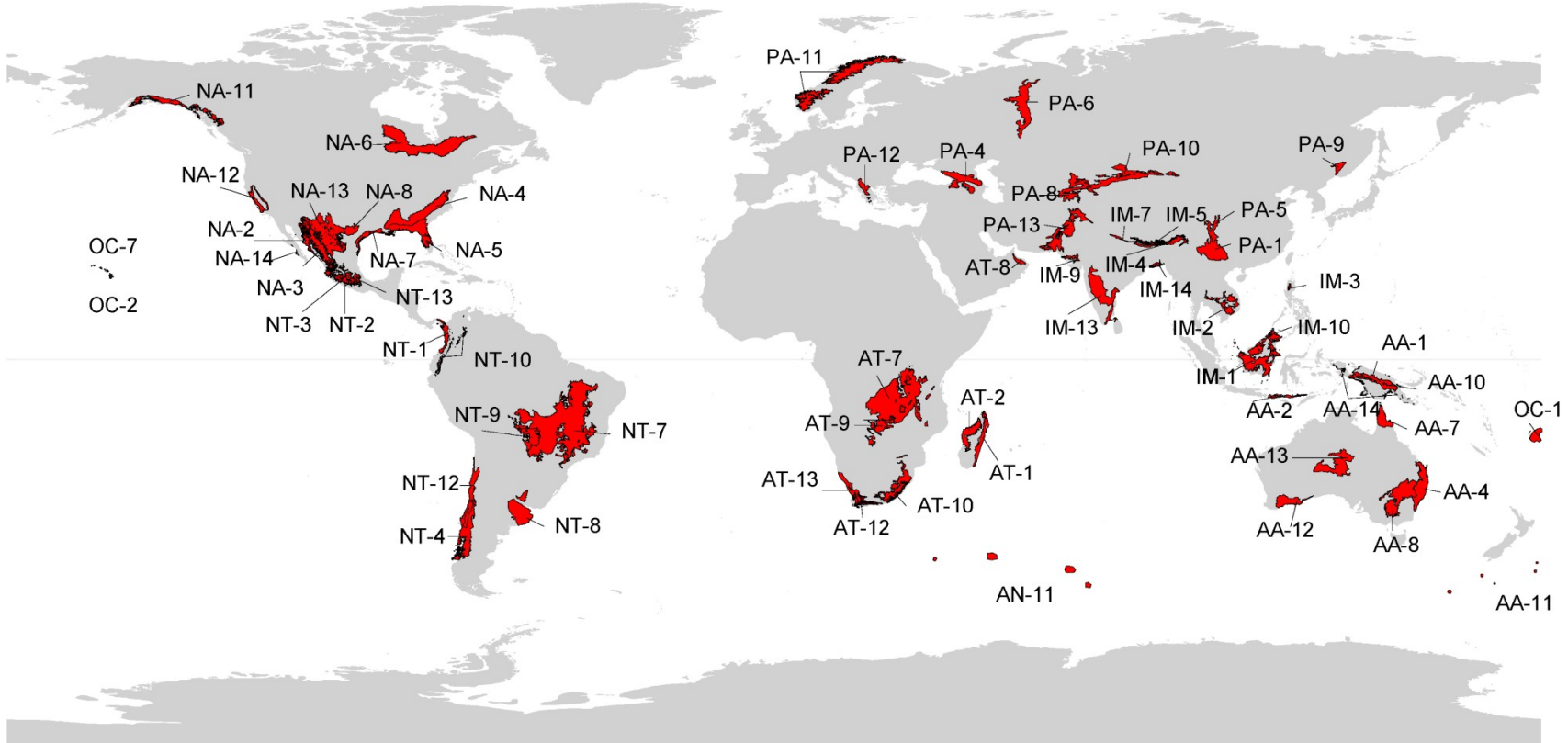


Map 6c. Endemic Amphibian Areas of the world

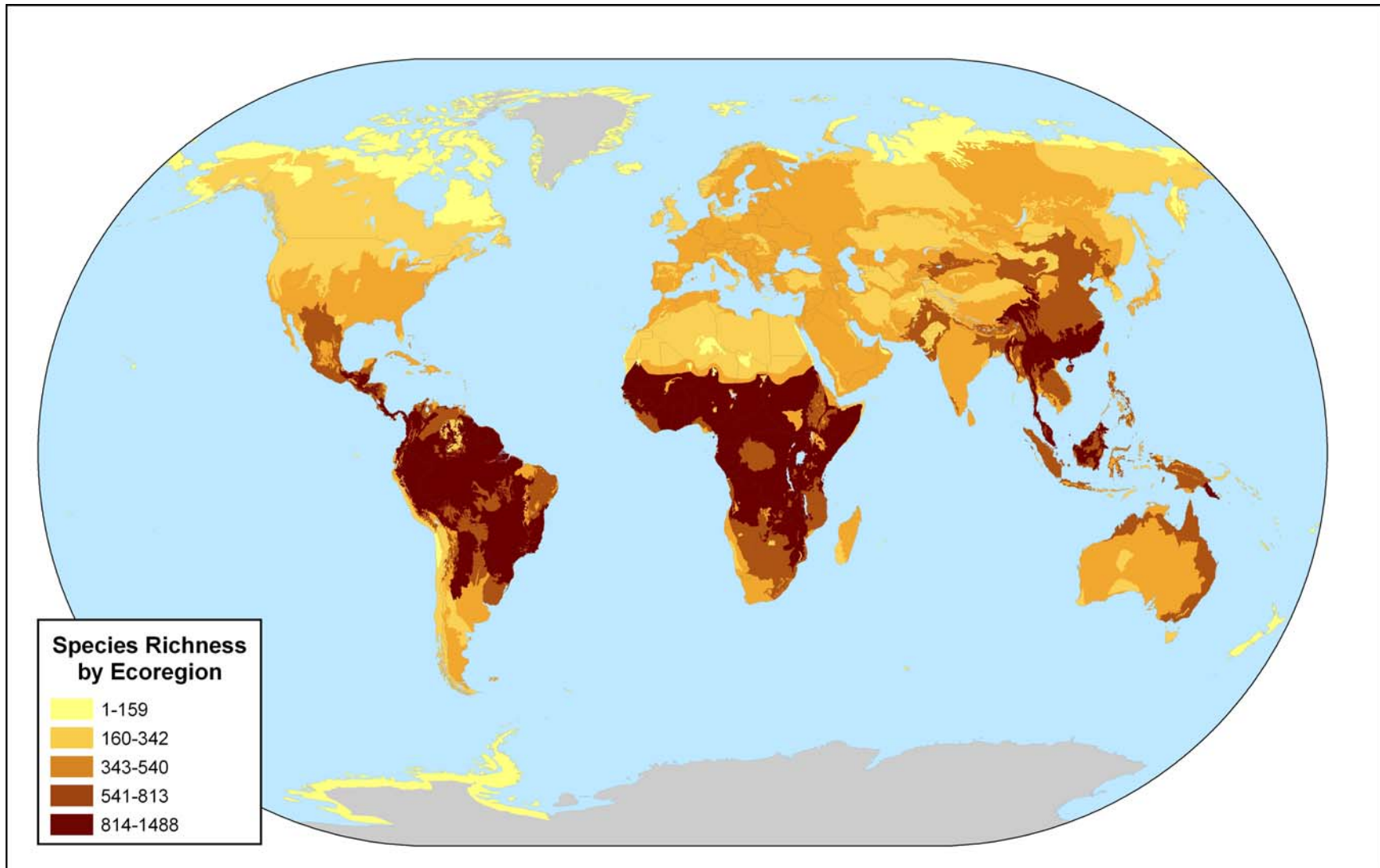


Map 7a. Plant species richness by ecoregion (*Kier et al. 2005*)

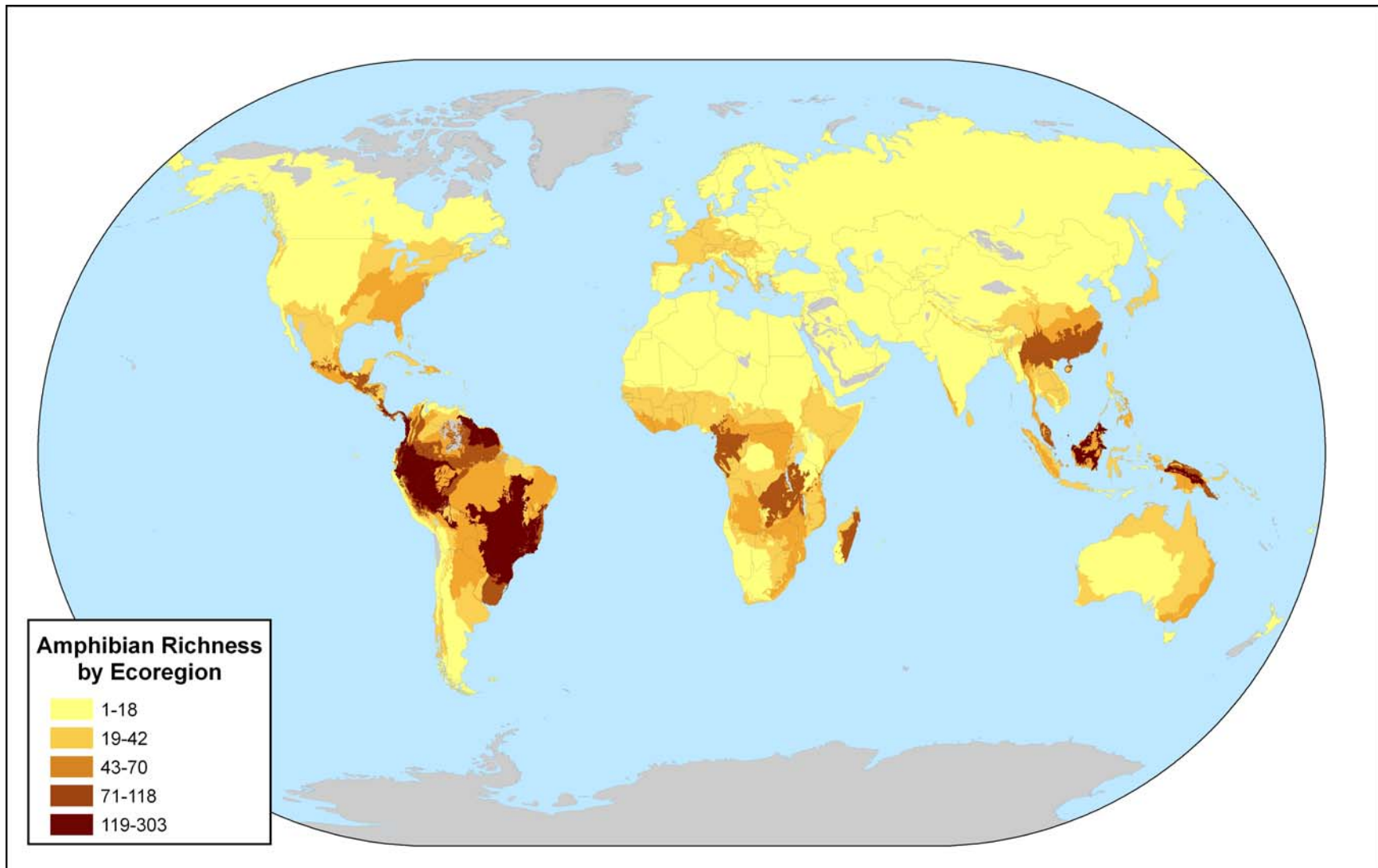




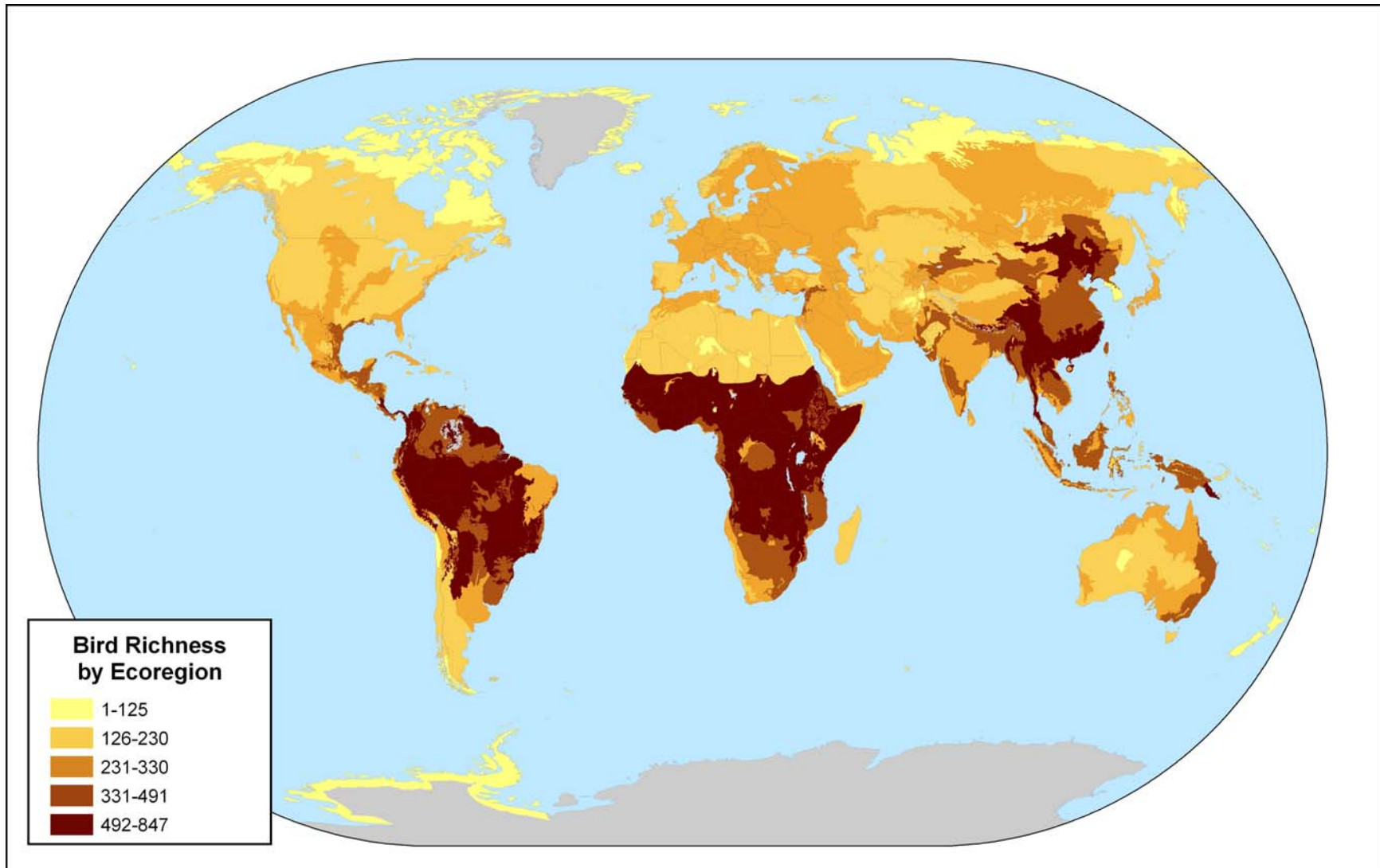
Map 7b. Highest species richness for vascular plants by ecoregion for each biome and biogeographic realm. (*Kier et al. 2005*)



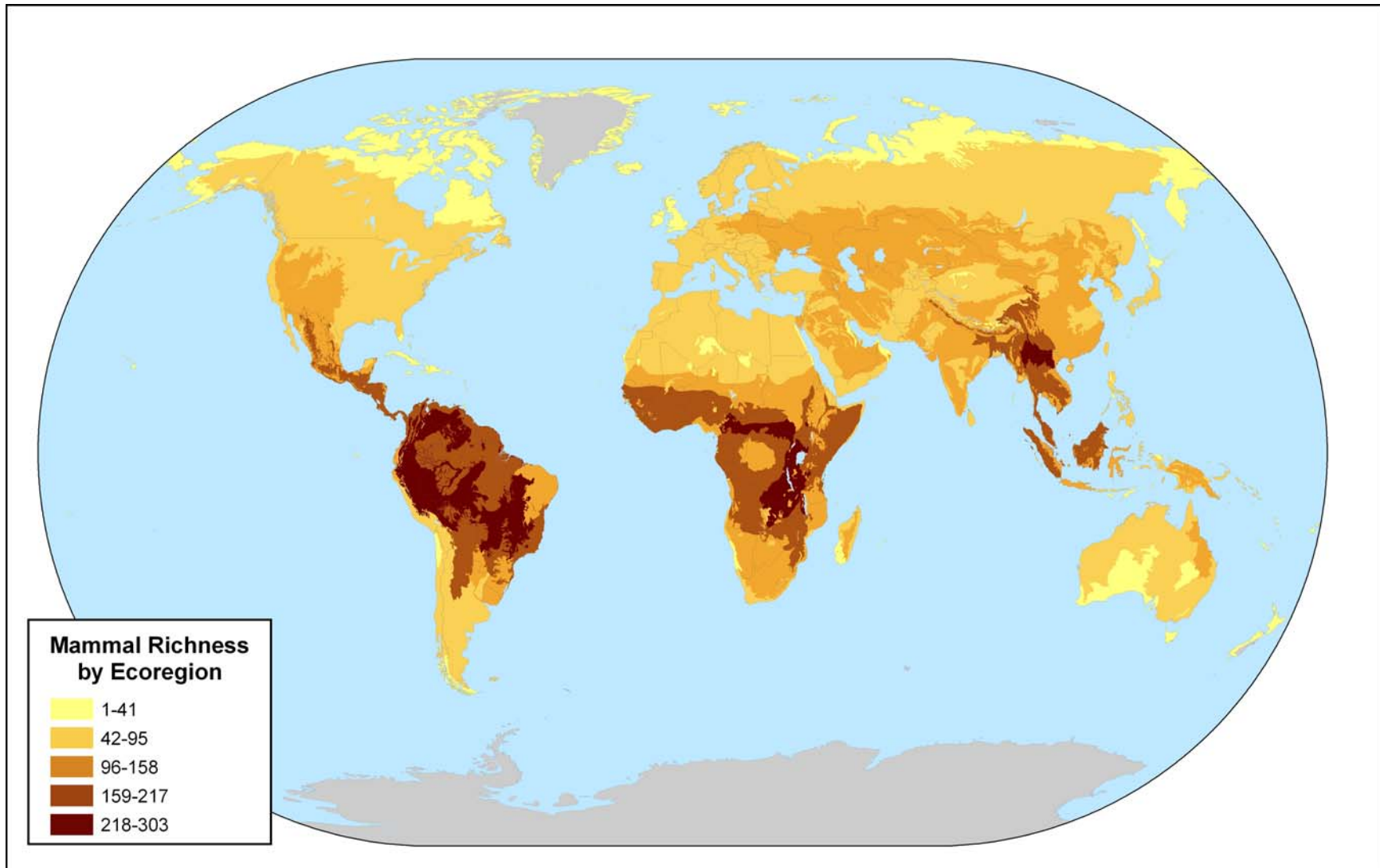
Map 8a. Vertebrate species richness by ecoregion: Total (WWF-WildFinder)



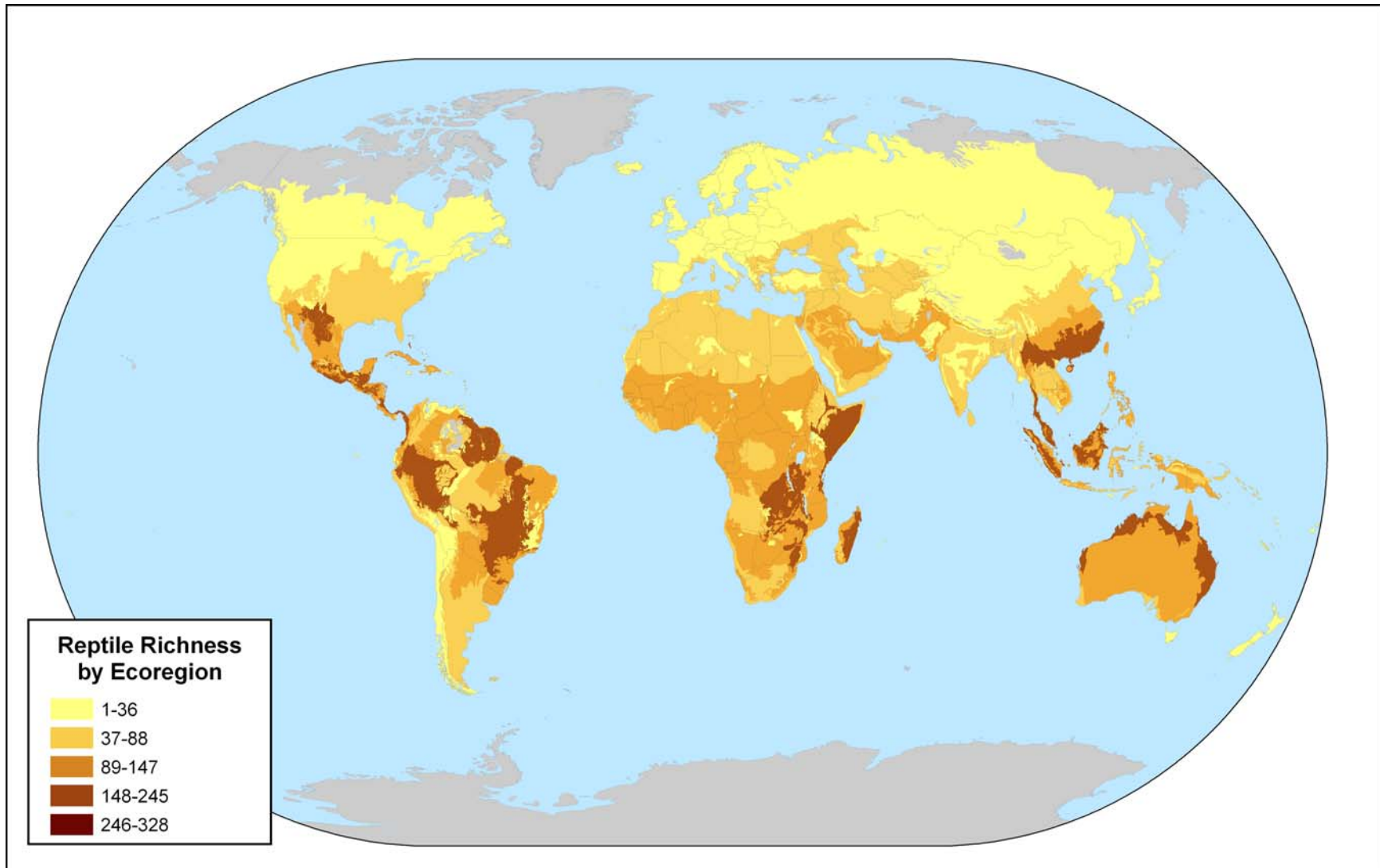
Map 8b. Vertebrate species richness by ecoregion: Amphibians (WWF-WildFinder)



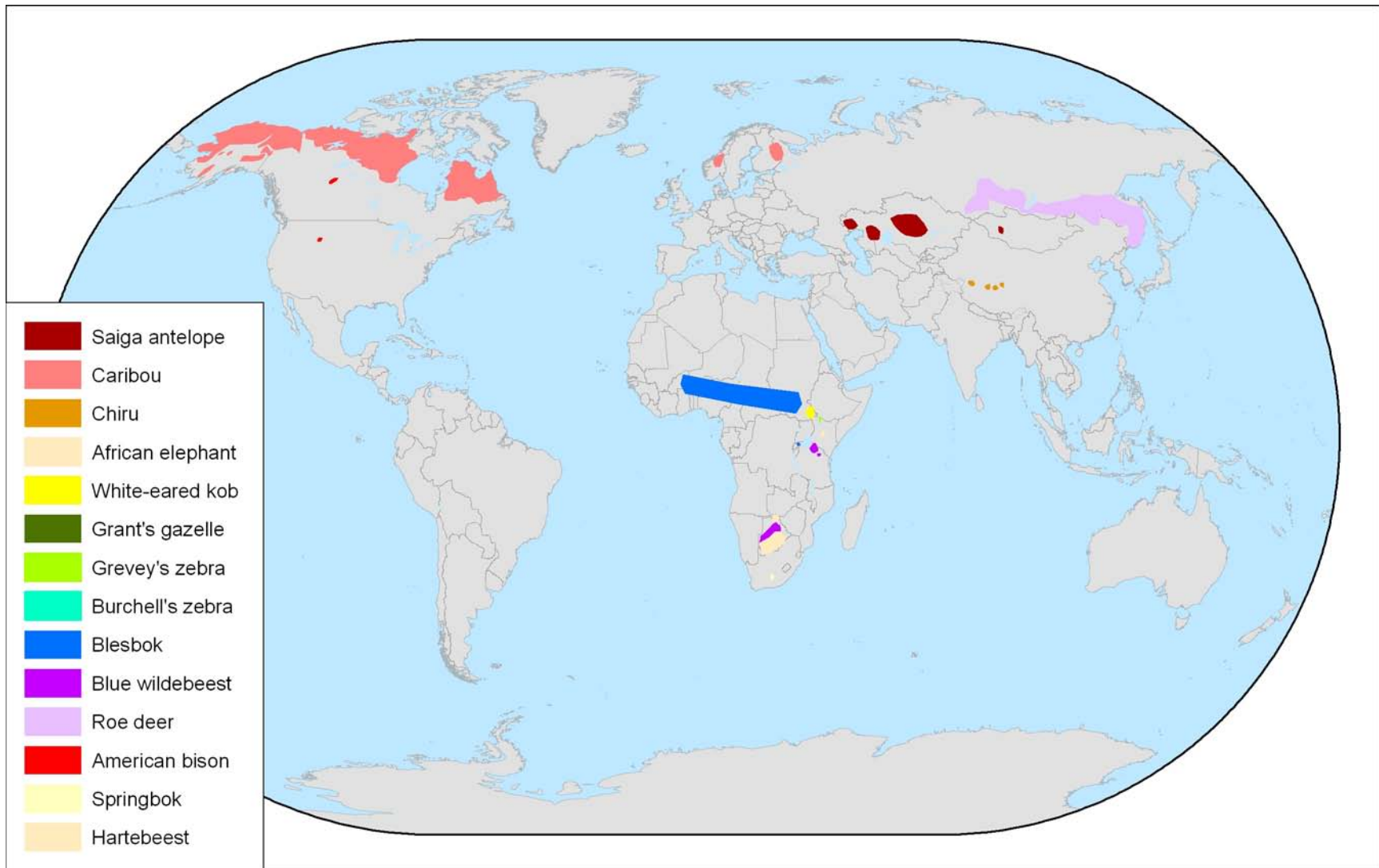
Map 8c. Vertebrate species richness by ecoregion: Birds (WWF-WildFinder)



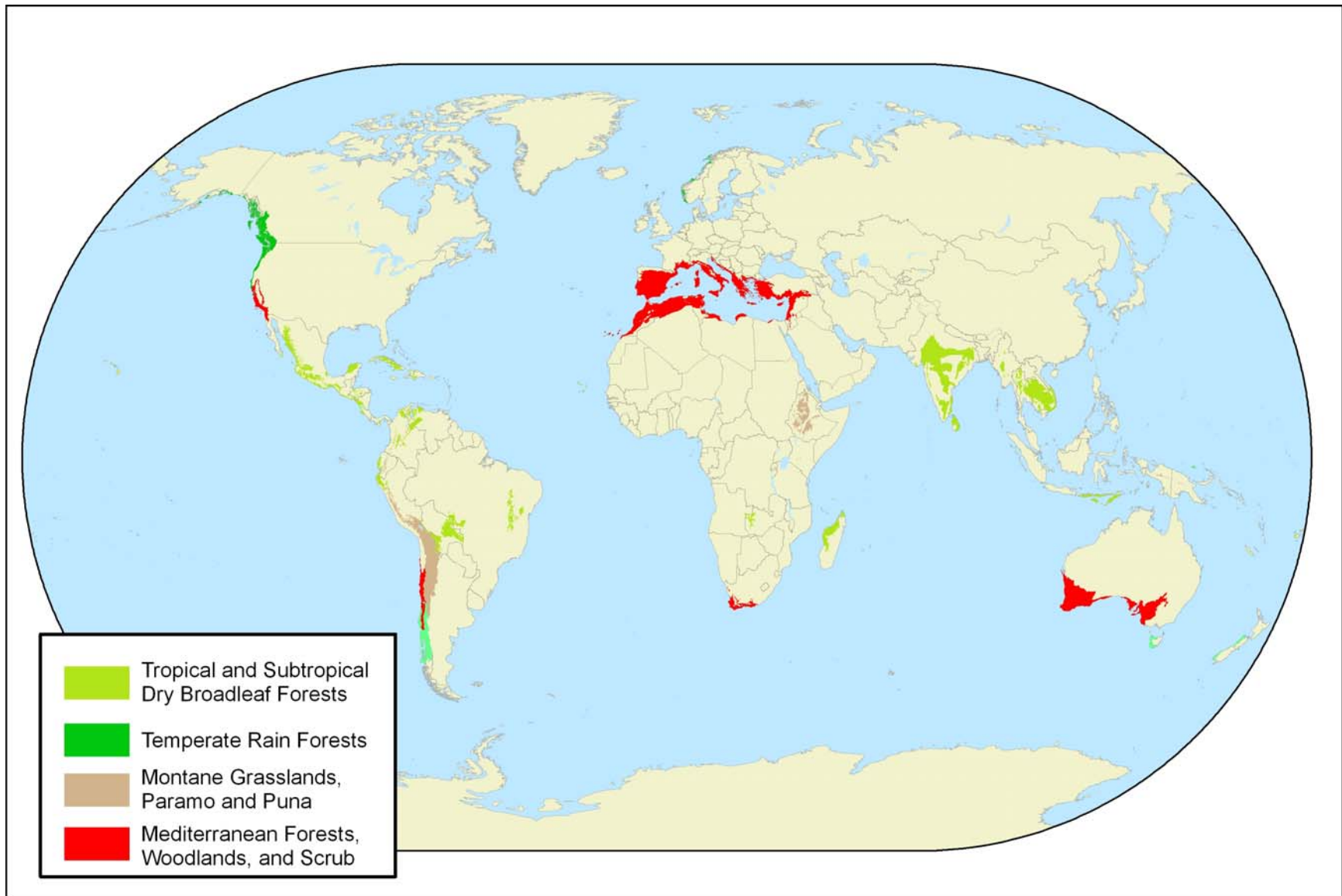
Map 8d. Vertebrate species richness by ecoregion: Mammals (WWF-WildFinder)



Map 8e. Vertebrate species richness by ecoregion: Reptiles (WWF-WildFinder)

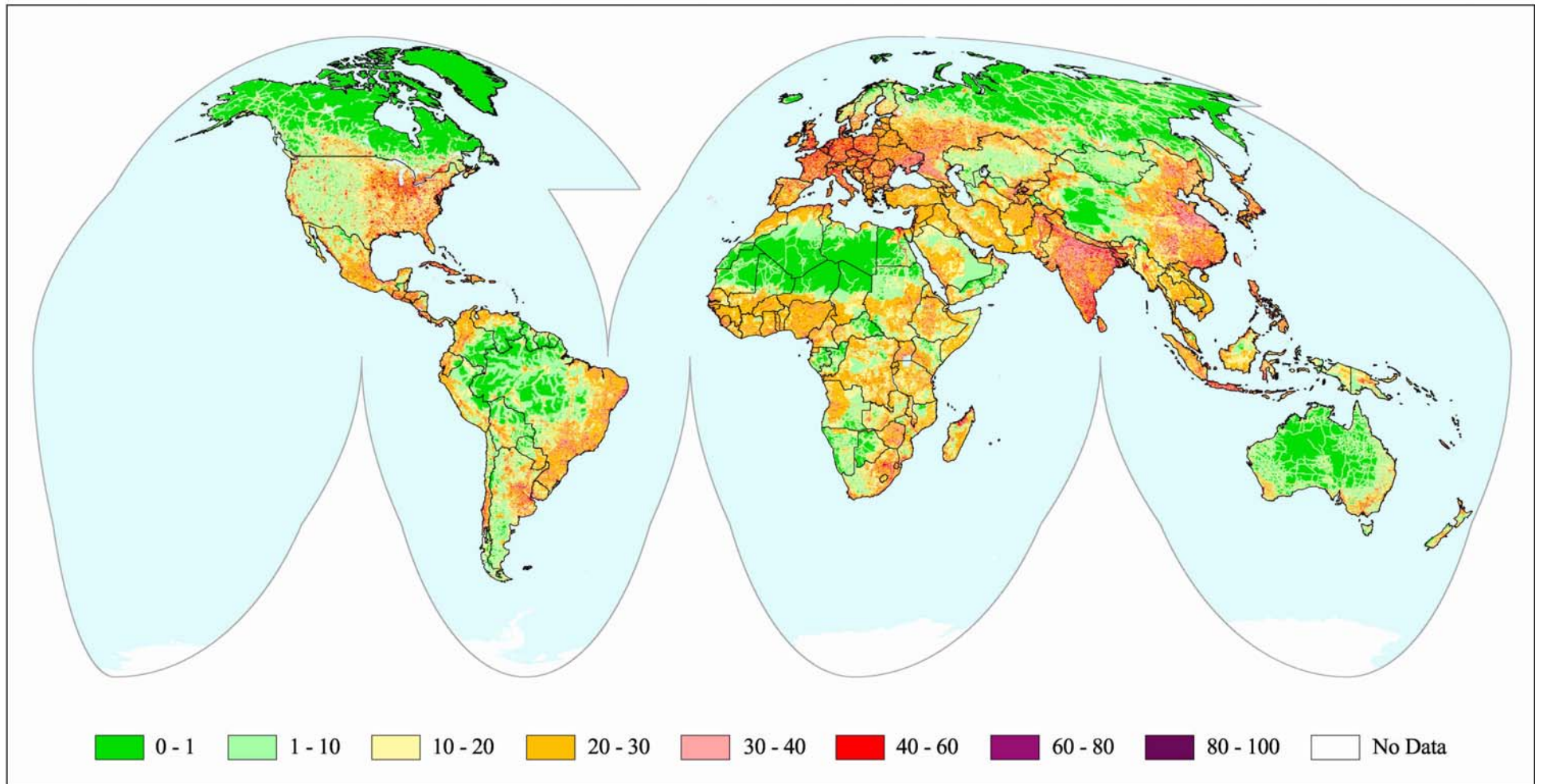


Map 9: Extant Terrestrial Large mammal migrations (AMNH/WCS)

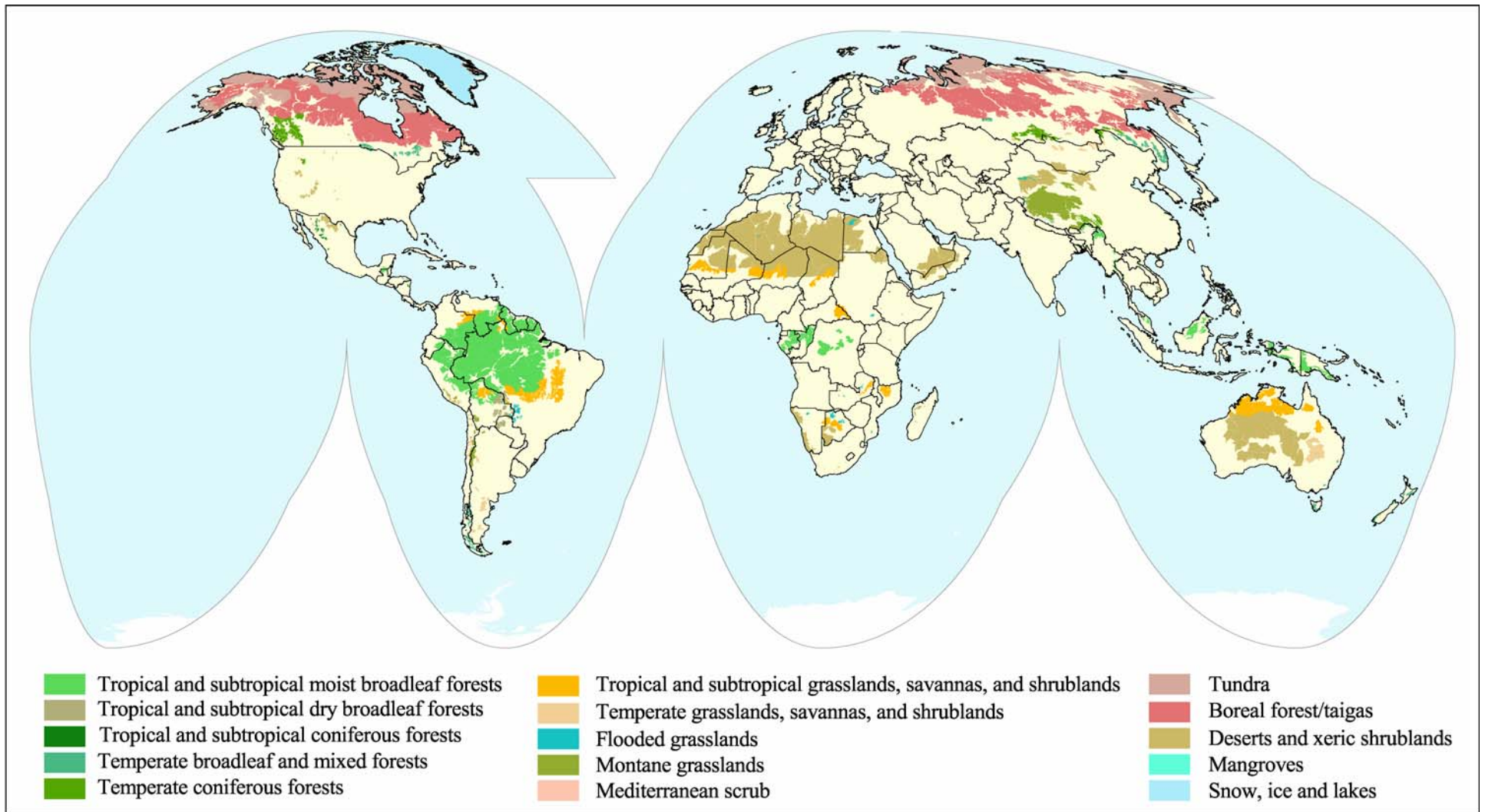


Map 10: Rare Habitats from Terrestrial Ecoregions of the world and the Global 200. (WWF)

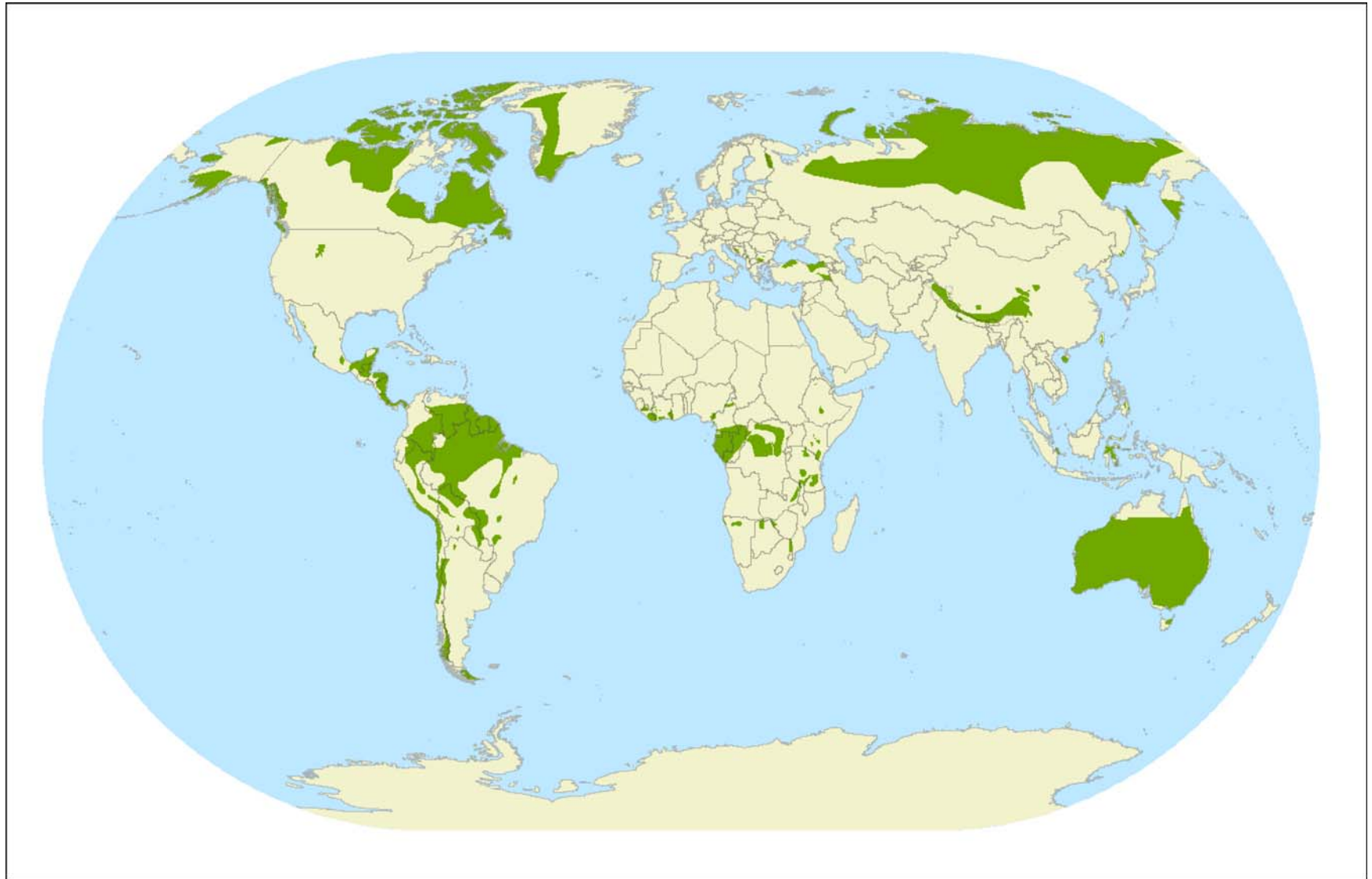




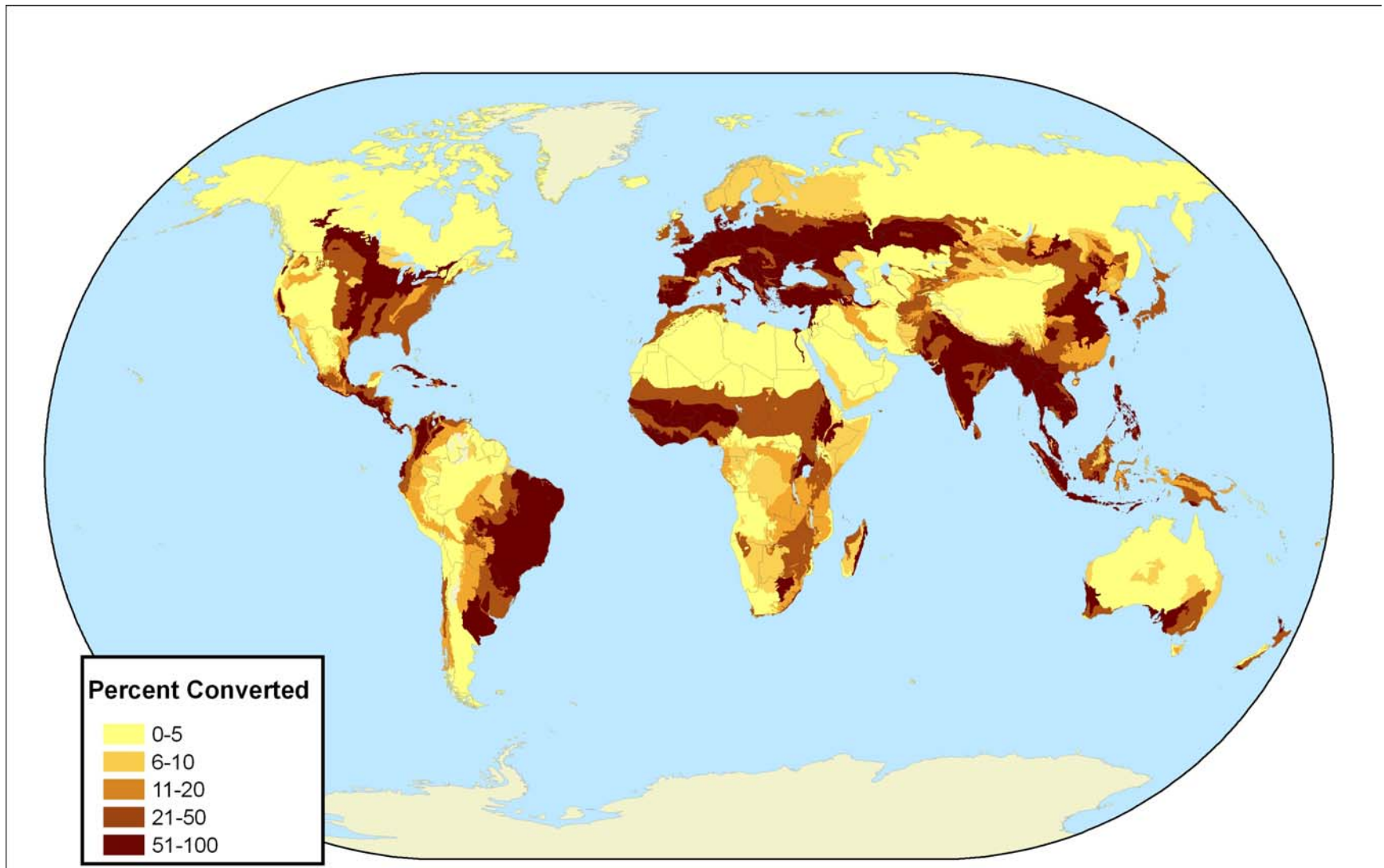
Map 11a. The Human Footprint



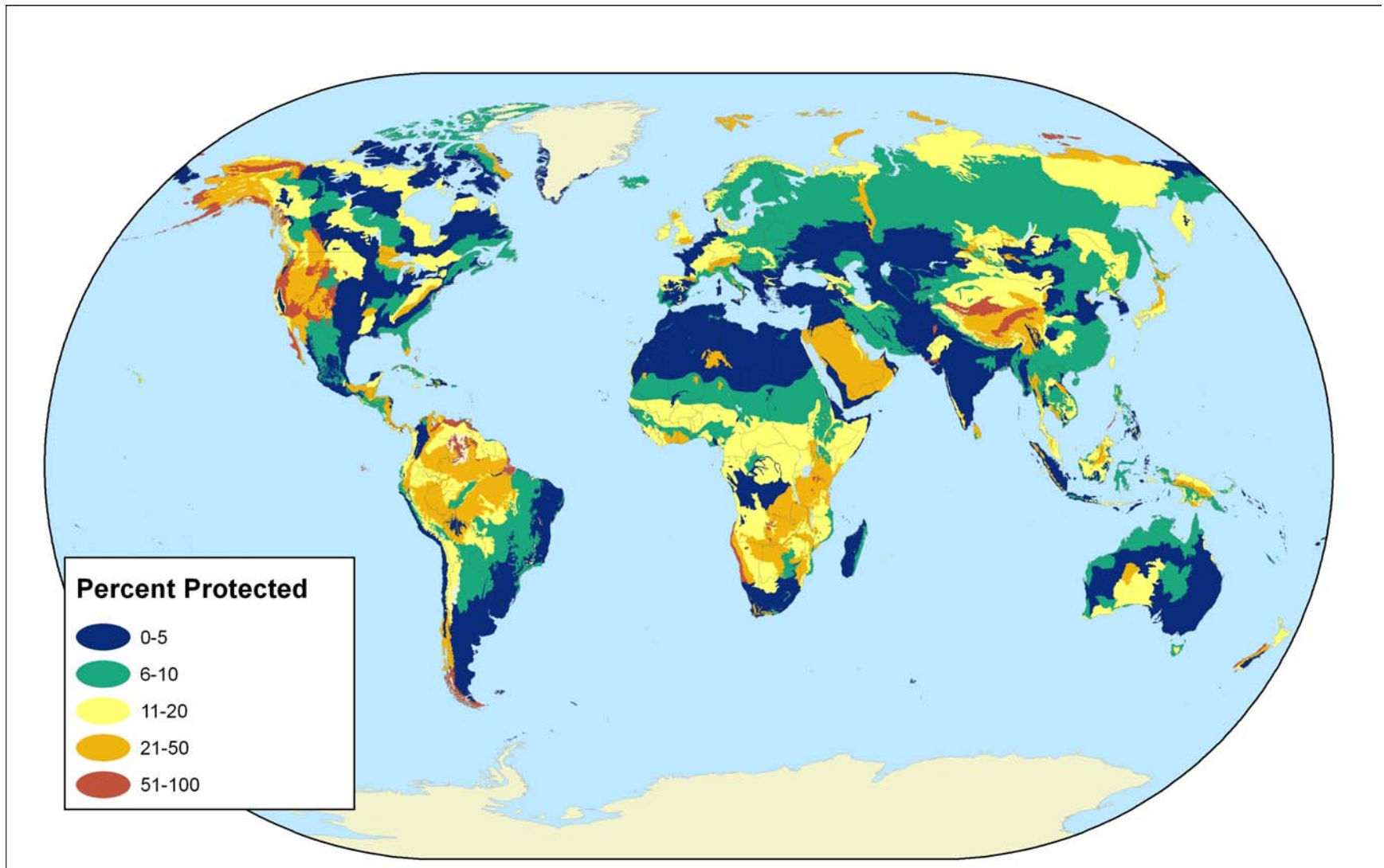
Map 11b. The Last of the Wild



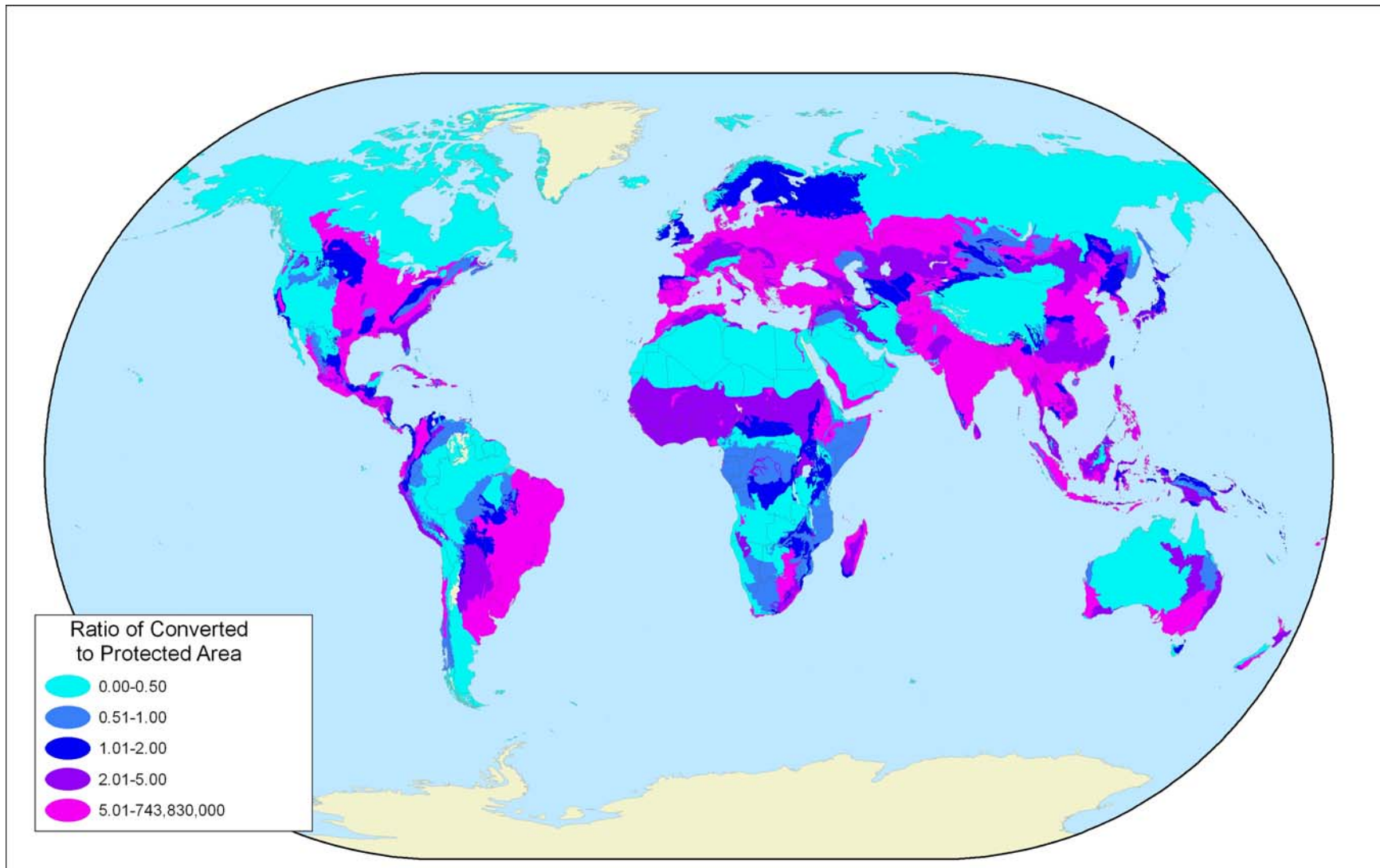
Map 12: World's Intact Large Mammal Assemblages (WWF/Global Mammal Assessment/Princeton U./WCS)



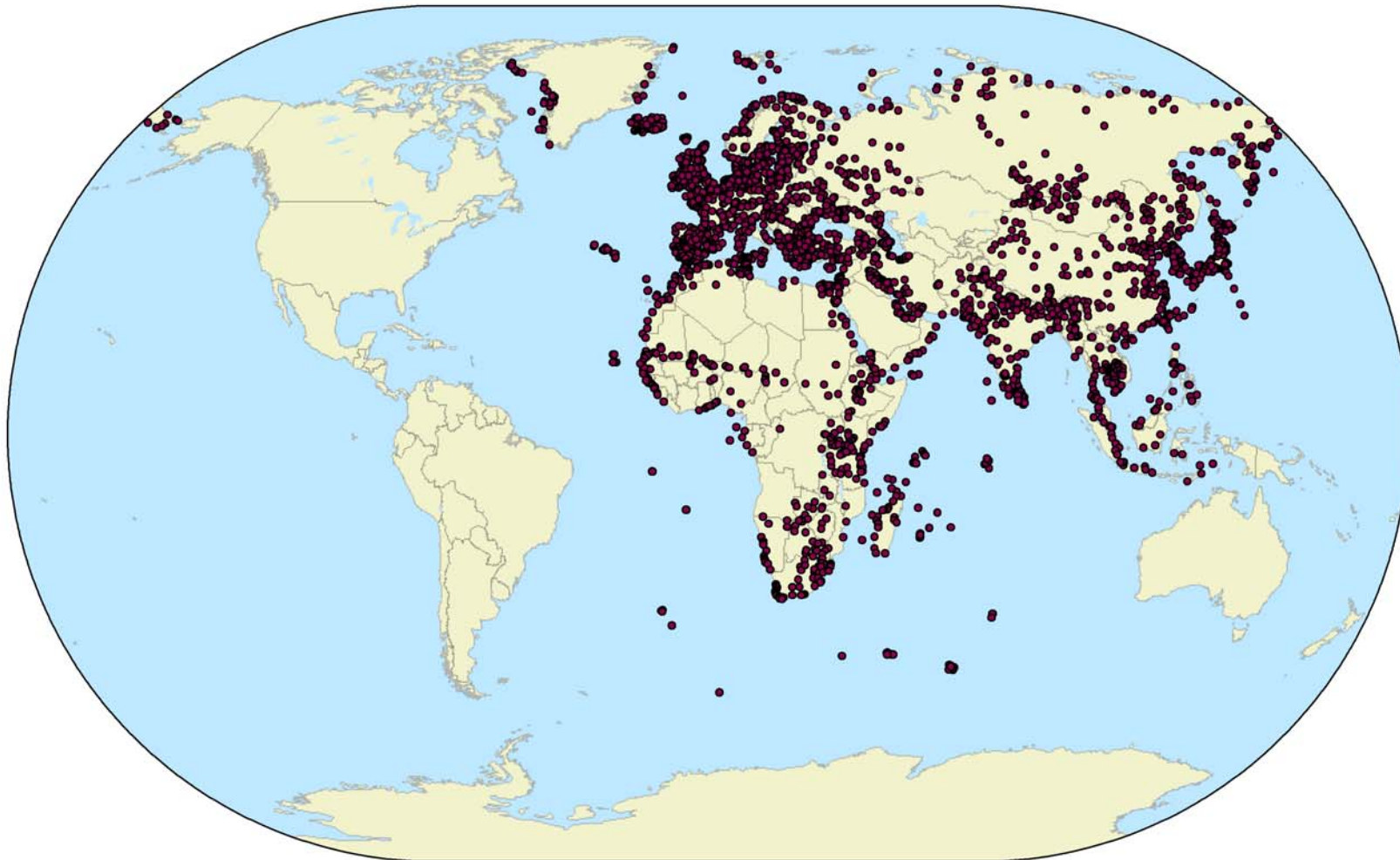
Map13a. – Percent area of ecoregion converted



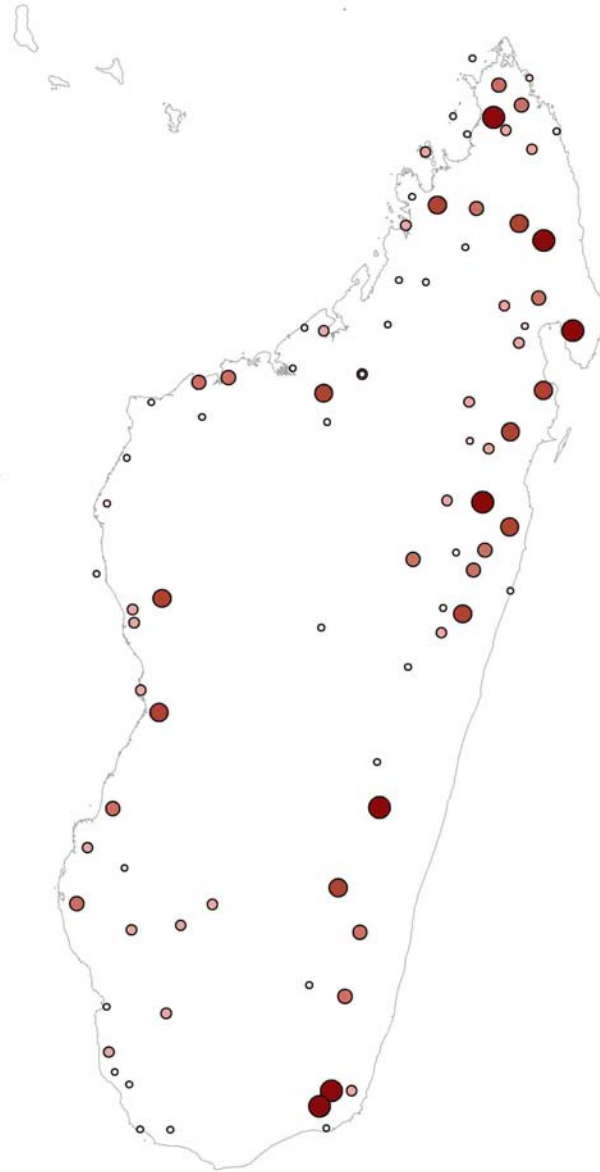
Map13b. – Percent area of ecoregion protected



Map13c. – Ratio of converted land to protected area by ecoregion



Map 14. Important Bird Areas.



Map 15. Key Biodiversity Areas  
for Madagascar