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## How well to protected areas cover Ecosystem Assets?

A contribution towards measuring Aichi target 11 element on 'of particular importance for Ecosystem Services'

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# Definitions

**Natural Capital**: Natural Capital is the natural assets that provide natural resource inputs and environmental services for economic production. Natural capital includes land, minerals and fossil fuels, solar energy, water, living organisms, and the services provided by the interactions of all these elements in ecological systems (UNEP 2012).

**Ecosystem Assets**: Ecosystem assets have the capacity to generate a basket of ecosystem services, and this capacity can be understood as a function of the extent (quantity) and condition (quality) of the ecosystem.

**Final ecosystem services** are the *contributions* that ecosystems make to human well-being. These services are final in that they are the outputs of ecosystems (whether natural, semi-natural or artificial) that most directly affect the well-being of people. A fundamental characteristic is that they retain a connection to the underlying ecosystem functions, processes and structures that generate them.

# Ecosystem Assets

Ecosystem Service	Description	Spatial Resolution	Units	Reference	Webpage
Carbon (Vegetation)	A global map of biomass carbon stored in above and below ground living vegetation for the year 2000 created using the International Panel on Climate Change (IPCC) Good Practice Guidance for reporting national greenhouse gas inventories.	0.0089 decimal degrees (~1km by ~1km)	0.01 tonnes of biomass carbon per hectare	(Ruesch & Gibbs 2008)	<a href="http://cdiac.ornl.gov/epubs/ndp/global_carbon/carbon_documentation.html">http://cdiac.ornl.gov/epubs/ndp/global_carbon/carbon_documentation.html</a>
Carbon (Soil)	A global map of estimated soil carbon stocks to 1m depth generated based on the soil organic carbon and bulk density values included in the Harmonized World Soil Database (HWSD).	30 arc seconds (~1km by ~1km)	t/ha*100 (tonnes of carbon per hectare)	(Hiederer & Köchy 2012)	<a href="http://eusoils.jrc.ec.europa.eu/esdb_archive/octop/Global.html">http://eusoils.jrc.ec.europa.eu/esdb_archive/octop/Global.html</a>
Water	A <i>global map of soil-water balance</i> describing actual evapo-transpiration (averaged over a period of 1950-2000) and soil water deficit utilizing the WorldClim and Global-PET database as primary input.	30 arc seconds (~1km by ~1km)	mm/year	(Trabucco & Zomer 2010)	<a href="http://www.cgiar-csi.org/data/global-high-resolution-soil-water-balance">http://www.cgiar-csi.org/data/global-high-resolution-soil-water-balance</a>
Agricultural Suitability	A global map of agricultural suitability to grow 16 of the most important food and energy crops for the time period 1981-2010, according to the climatic, soil and topographic conditions.	30 arc seconds (~1km by ~1km)	Suitability scored out of 0 (not suitable) -100 (high suitable)	(Zabel, Putzenlechner, & Mauser 2014)	<a href="http://tiny.cc/suitability">http://tiny.cc/suitability</a>
Vertebrate Species Richness	Global maps of terrestrial vertebrate diversity based on species range maps (July 2013 update) from the IUCN (mammals and amphibians) and BirdLife International and NatureServe (birds).	10x10km grid	Number of species	(Jenkins, Pimm, & Joppa 2013)	<a href="http://biodiversitymapping.org">http://biodiversitymapping.org</a>

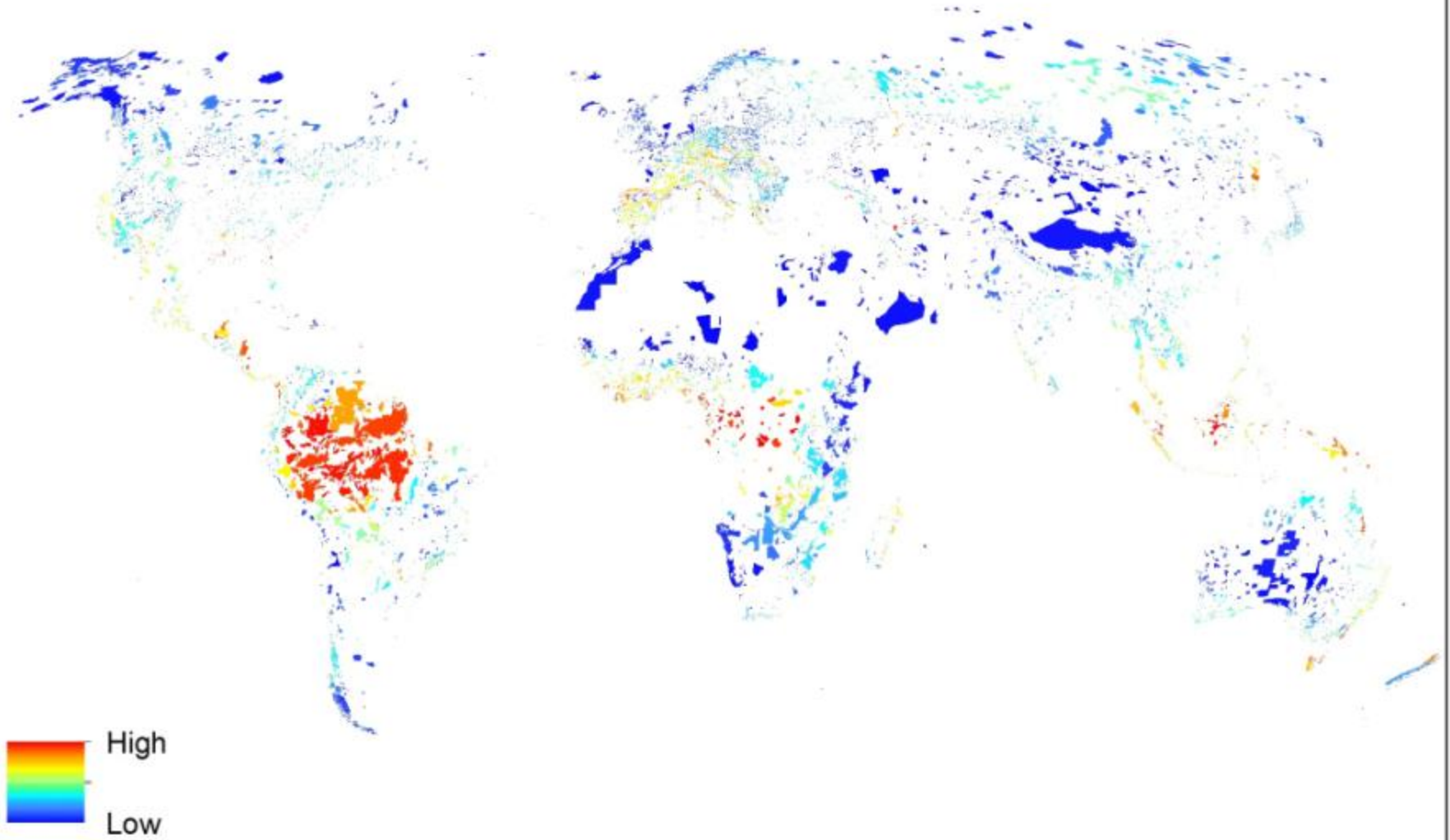
# Analysis Part 1: Ecosystem Assets in PA network

- Overlay protected areas from WDPA with datasets listed in table 1.
- Summarise values of the Ecosystem Assets within protected area using 'Zonal Statistics' spatial analyst tool within ArcGIS version 10.1.

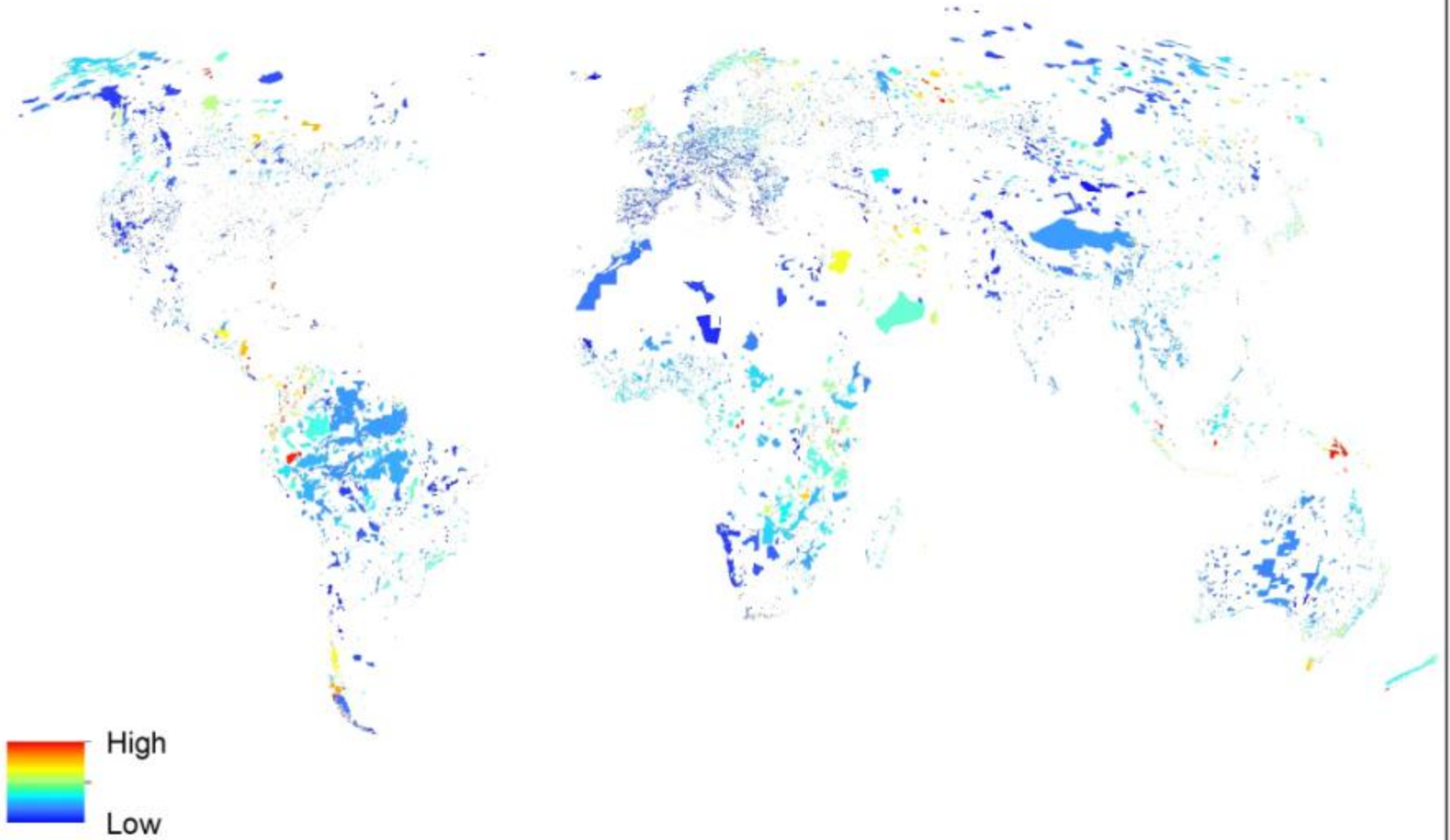
**NOTE:** Protected areas smaller than the individual cells within each ES raster (e.g. 1 km<sup>2</sup> for carbon, water and agricultural suitability and 10 km<sup>2</sup> for species richness) are omitted.



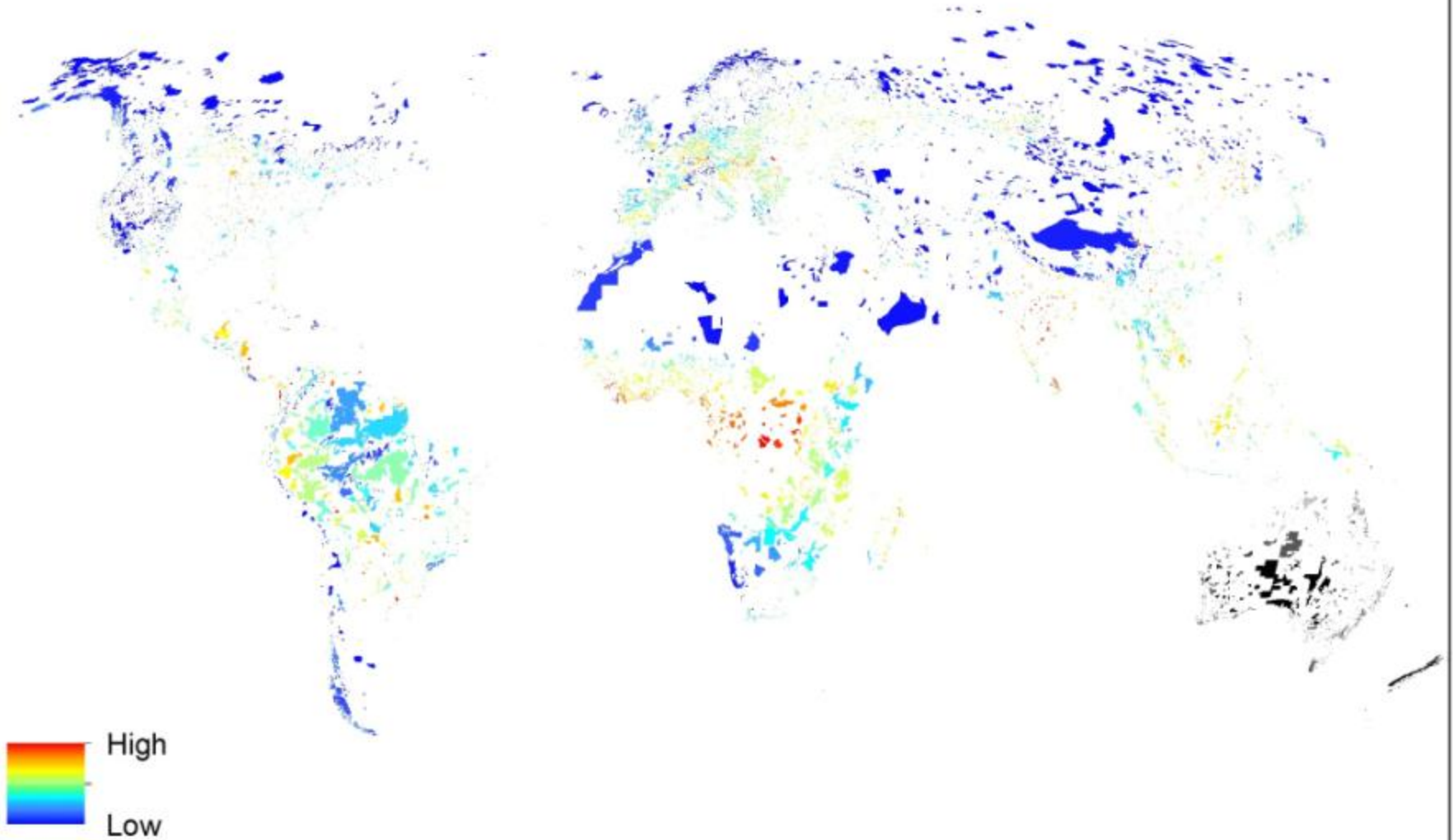
## Global Distribution of Carbon (Vegetation) Within Protected Areas



## Global Distribution of Carbon (Soil) Within Protected Areas

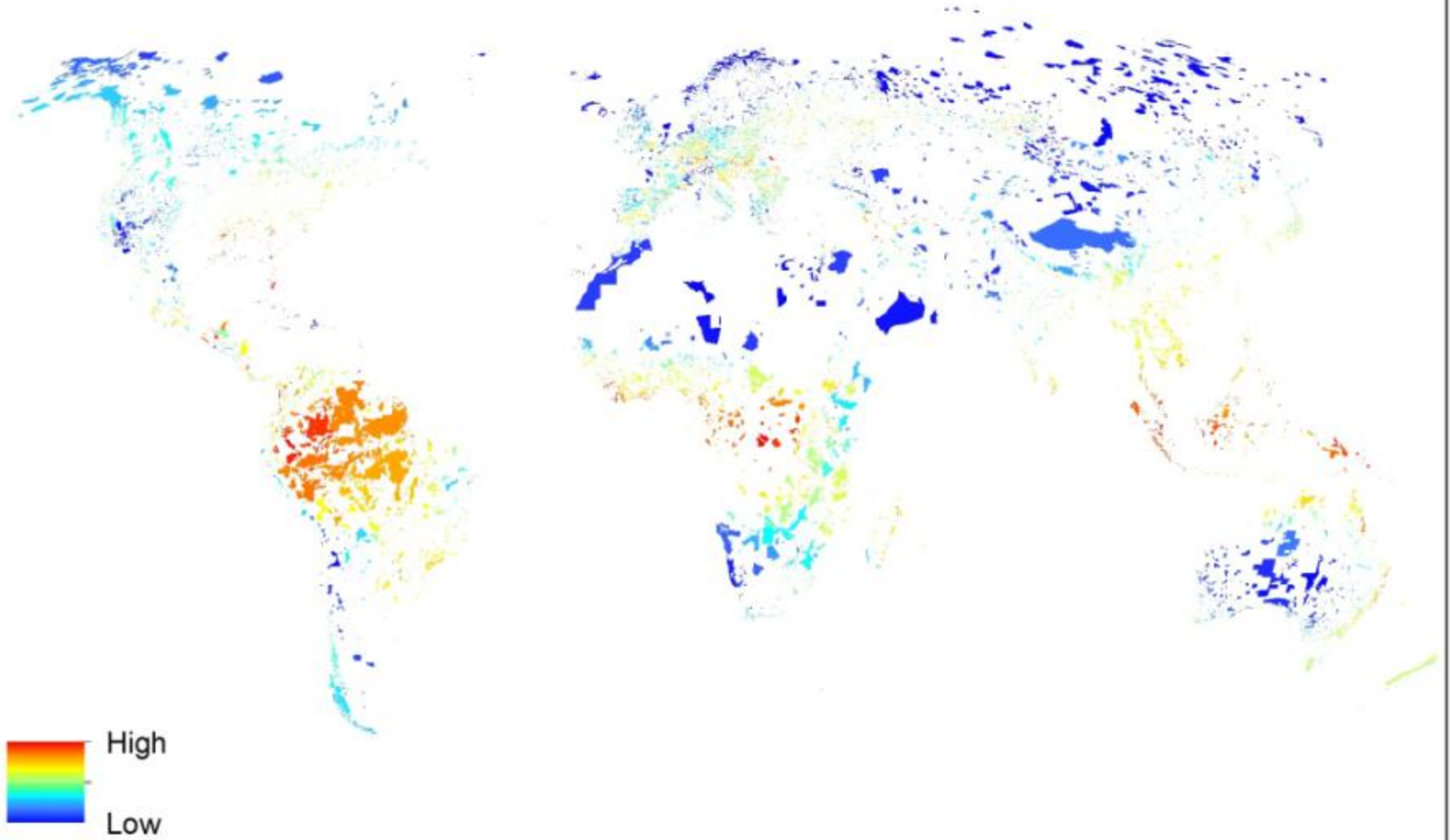


## Global Distribution of Agricultural Suitability Within Protected Areas



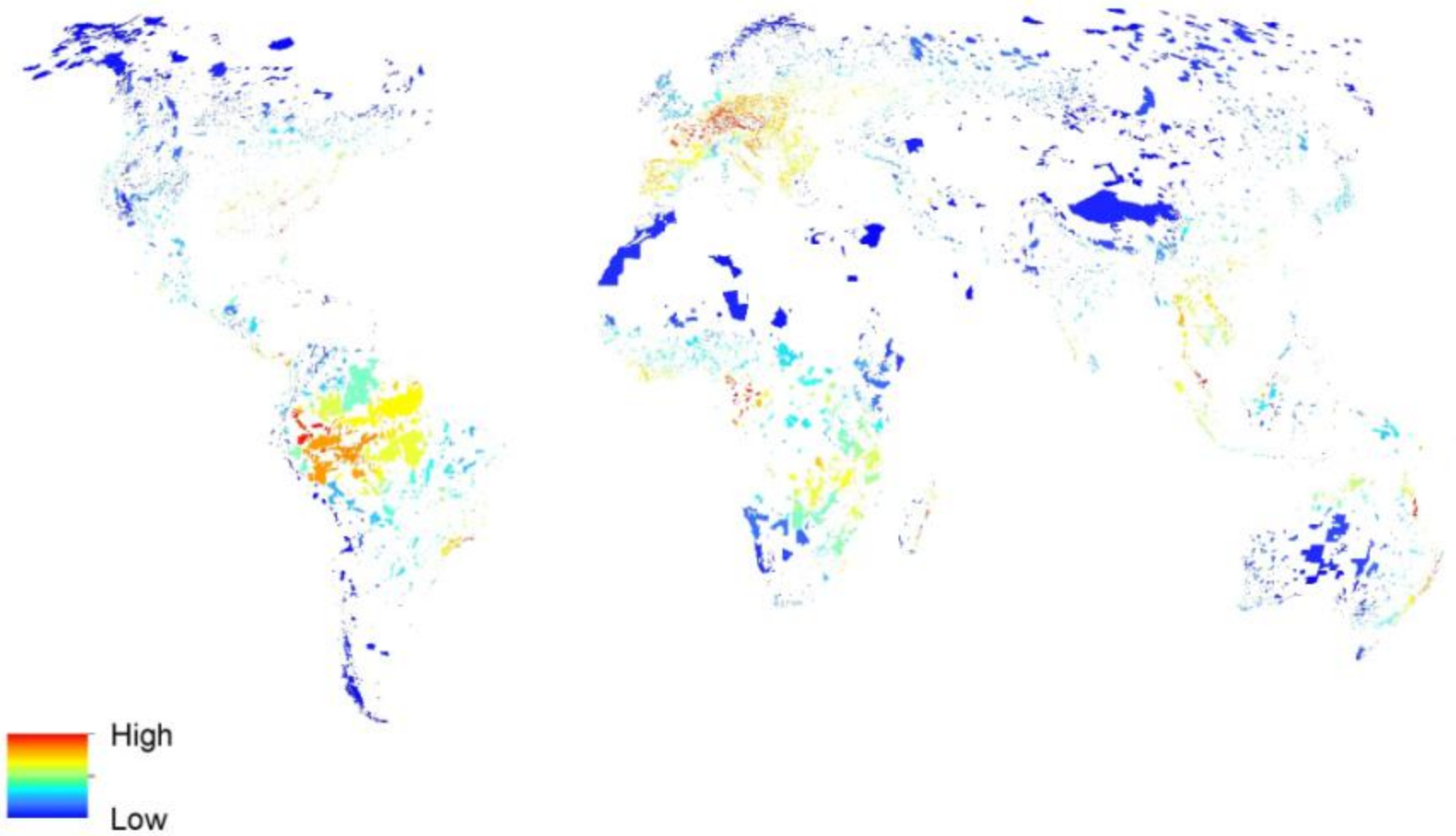


## Global Distribution of Water Within Protected Areas





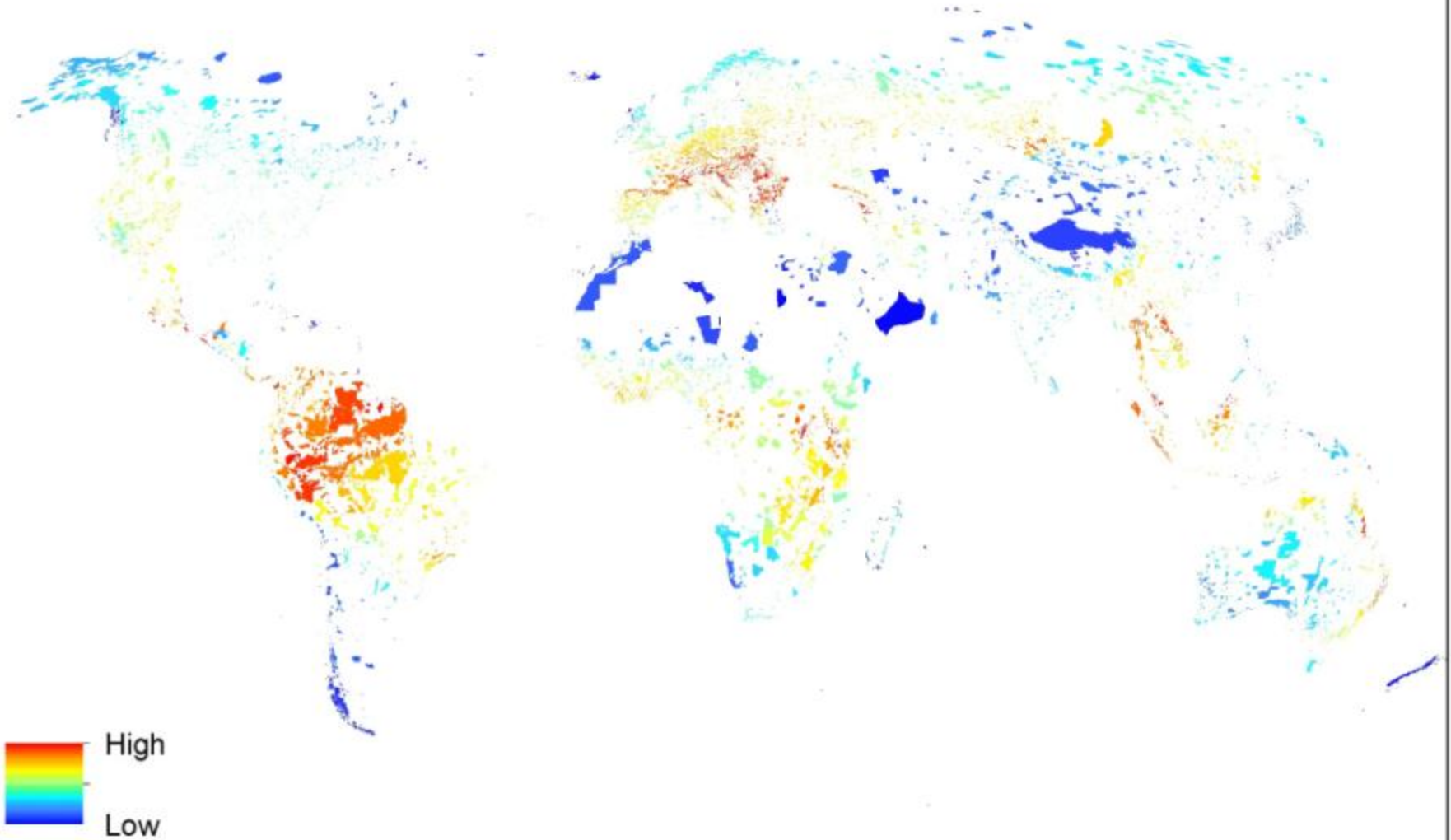
## Global Distribution of Amphibian Species Richness Within Protected Areas



## Global Distribution of Bird Species Richness Within Protected Areas



## Global Distribution of Mammal Species Richness Within Protected Areas

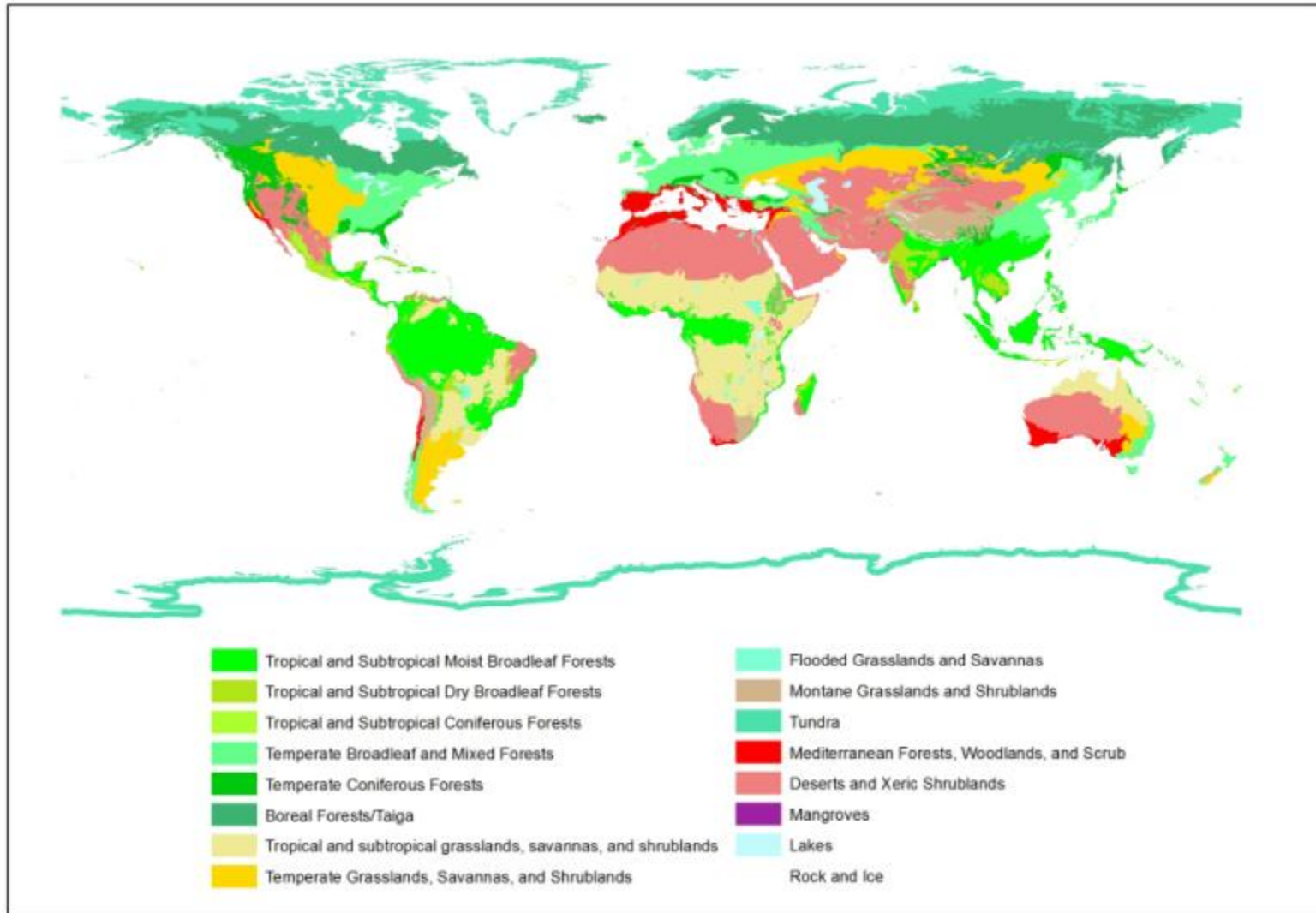


# Analysis Part 2 : Ecosystem Assets within protected areas

In different

- Regions
- Biomes
- PA network

# Global Biomes (WWF)

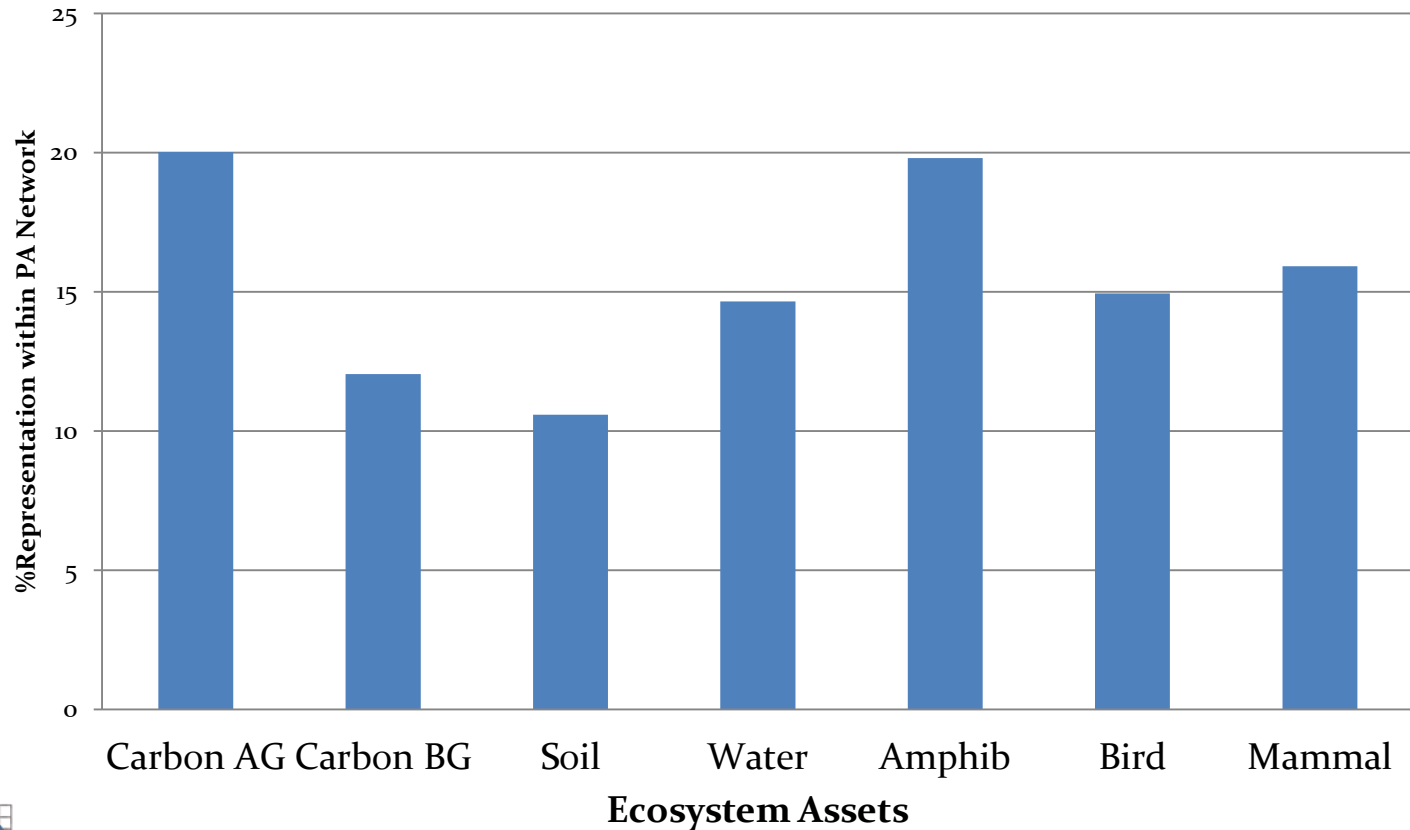


# IUCN Protected Area Categories and Definitions

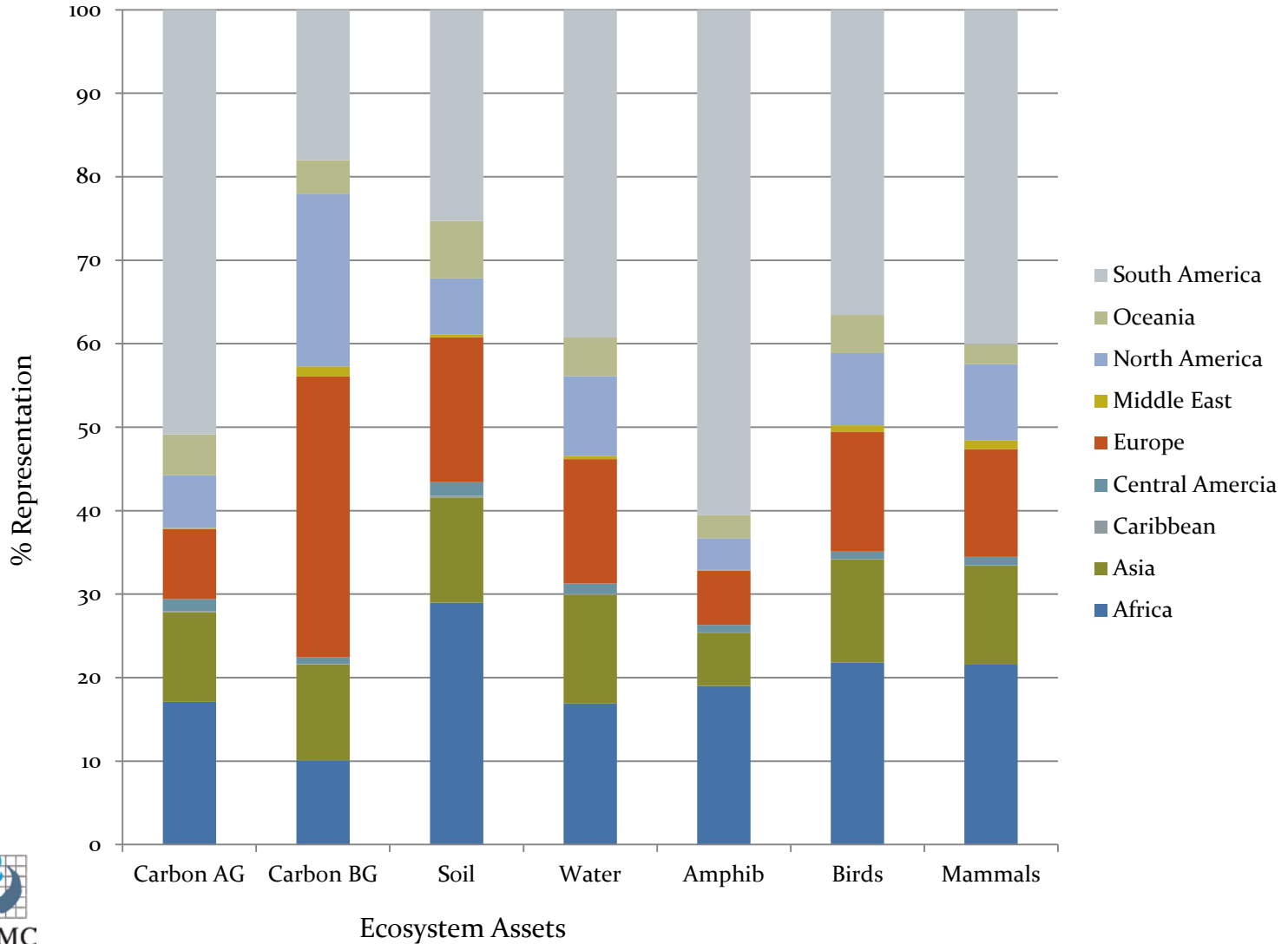
<b>IUCN Category</b>	<b>Definition</b>
<b>Ia</b>	Strict Nature Reserve
<b>Ib</b>	Wilderness Area
<b>II</b>	National Park
<b>III</b>	Natural Monument or Feature
<b>IV</b>	Habitat/Species Management Area
<b>V</b>	Protected Landscape/ Seascape
<b>VI</b>	Protected area with sustainable use of natural resources



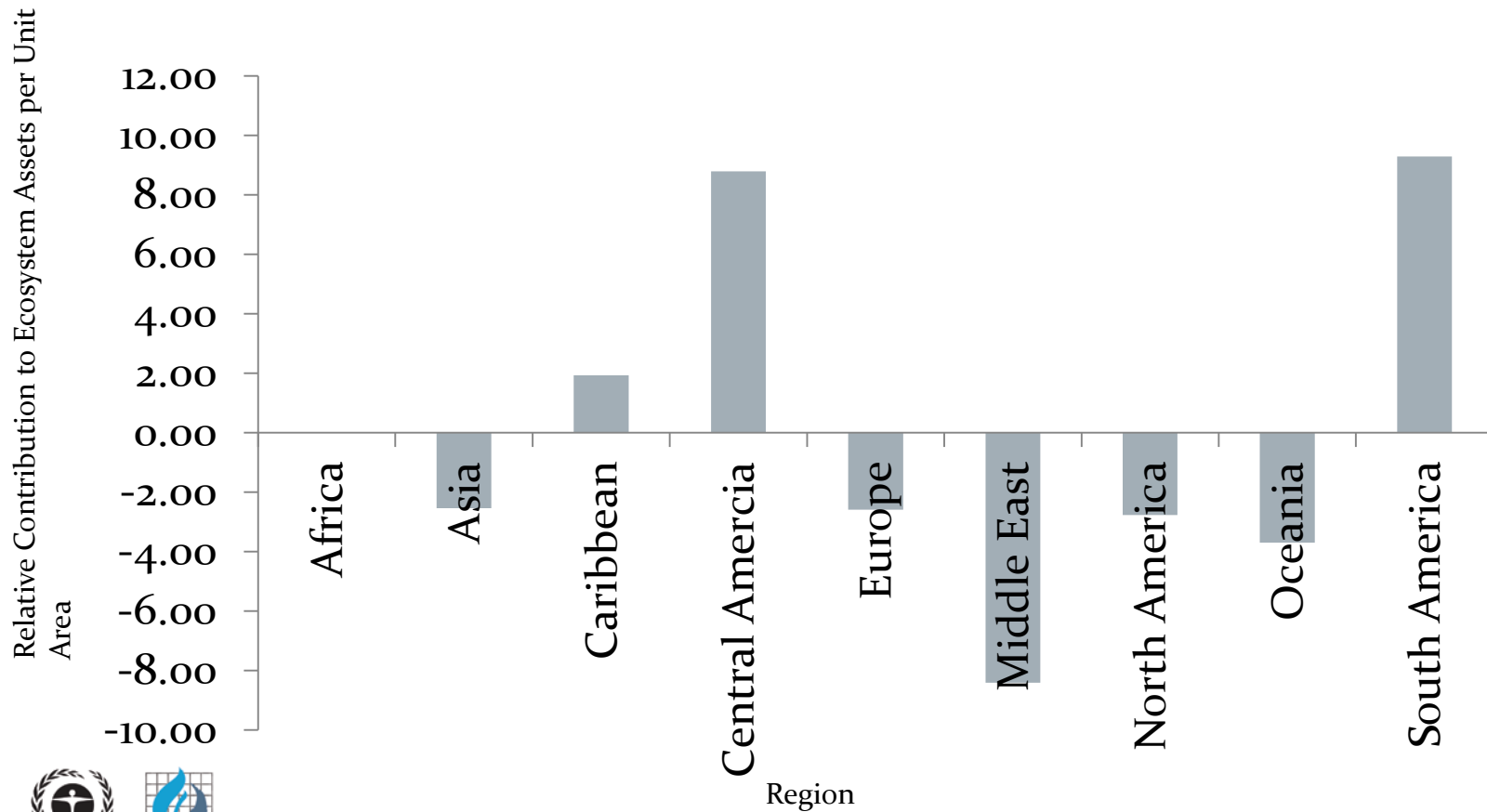
# Example: Percentage Representation of Ecosystem Assets within in the global network of Protected Areas



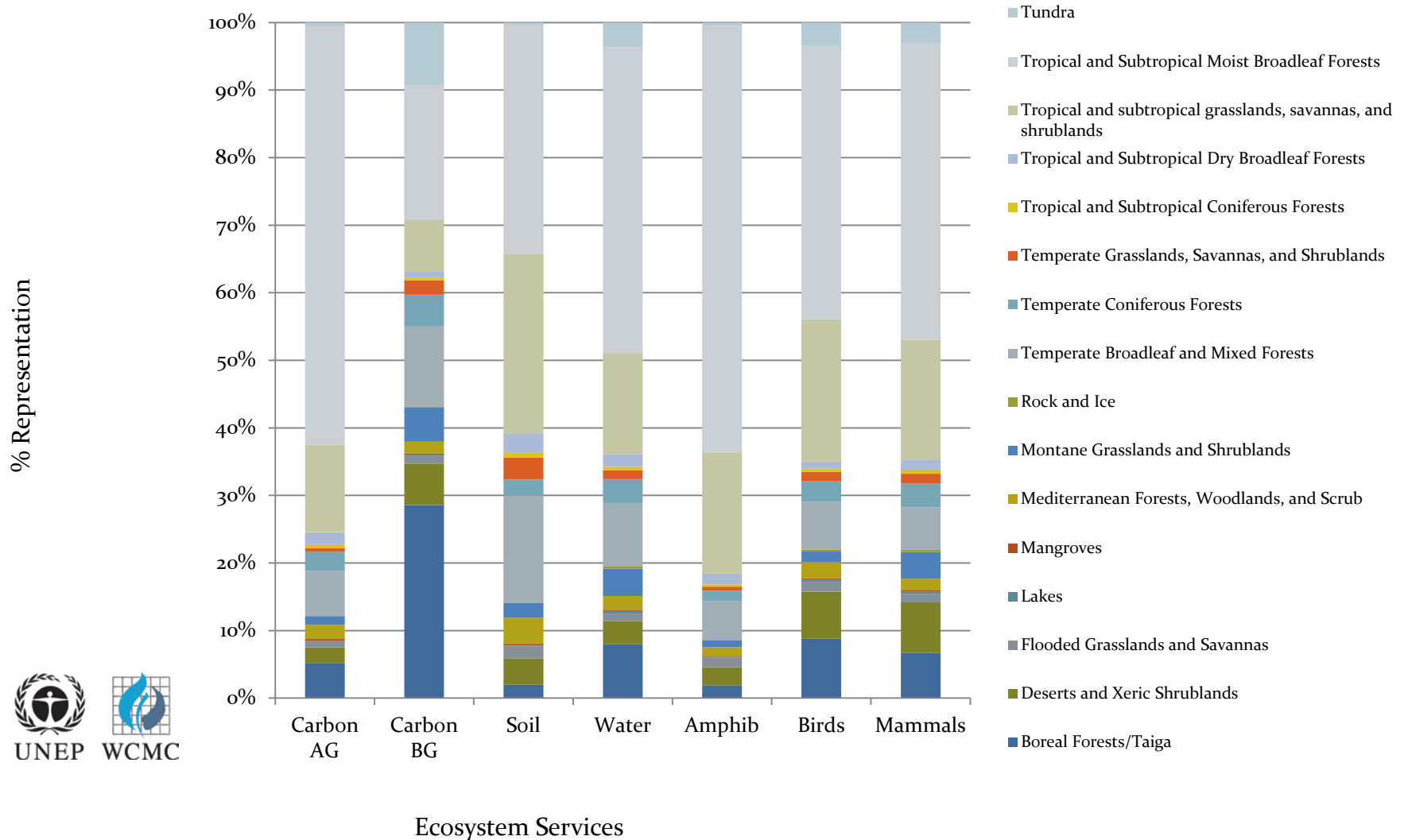
# The Proportion of Ecosystem Assets with regions



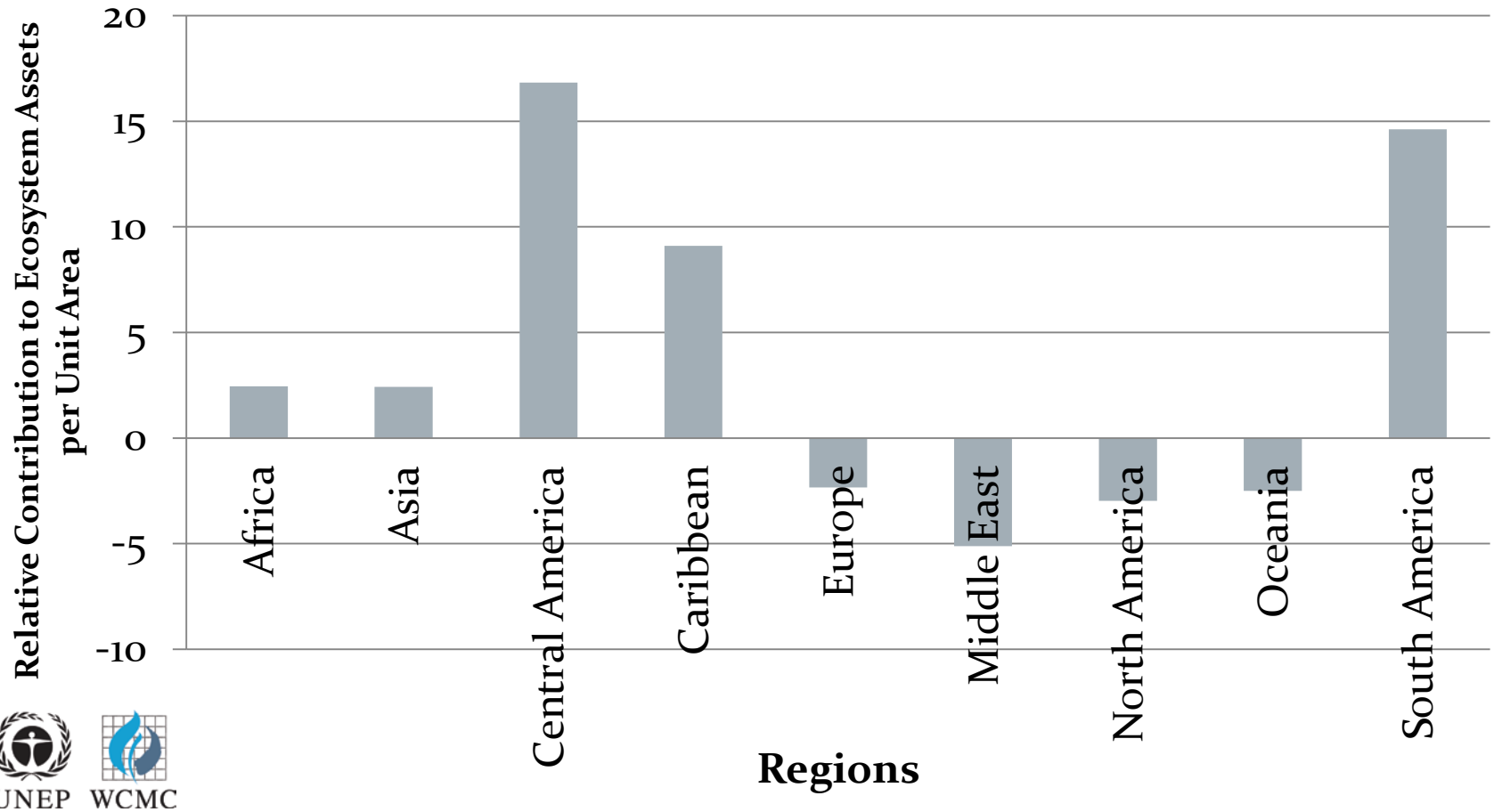
# Example: Ecosystem Assets per unit area in different regions



# Example: The proportion of Ecosystem Assets within biomes



# Example: Standardised index of Ecosystem Assets from PA within biomes in different regions



# Conclusions

- Mapping Ecosystem Assets within the global PA network is fairly straightforward
- Turning these Ecosystem Assets into Ecosystem Services is much harder as need to consider
  - human populations,
  - human use
  - flows,
  - costs and benefits,
  - sustainability
- Measuring the ES provision by PA under Aichi Target 11 is tricky...
- Measuring the trends in this element of Aichi 11 will is really very tricky