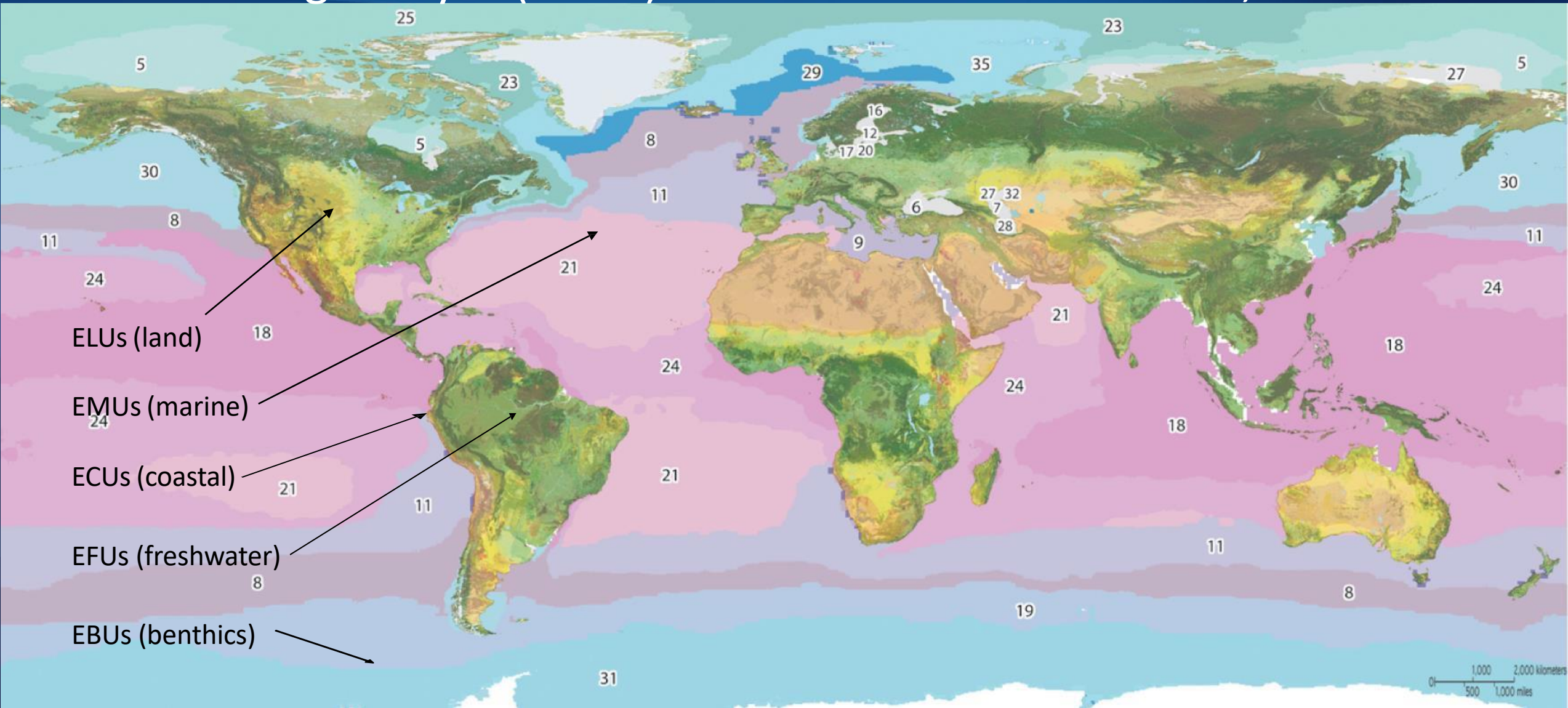


# Option 2 – USGS/Esri Globally Distinct Biophysical and Biogeographic Settings (GDBBS) aka World Ecological Settings (WESs)

Roger Sayre (USGS) 26 JUN 2019 Glen Cove, NY



# UN Sustainable Development Goals

*The need to conserve global ecosystems is mandated in three UN SDGs (below). To conserve them requires knowing where they are on the landscape and in the oceans, and thus the need for global ecosystem mapping.*



Terrestrial: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands. 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.



Freshwater: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.



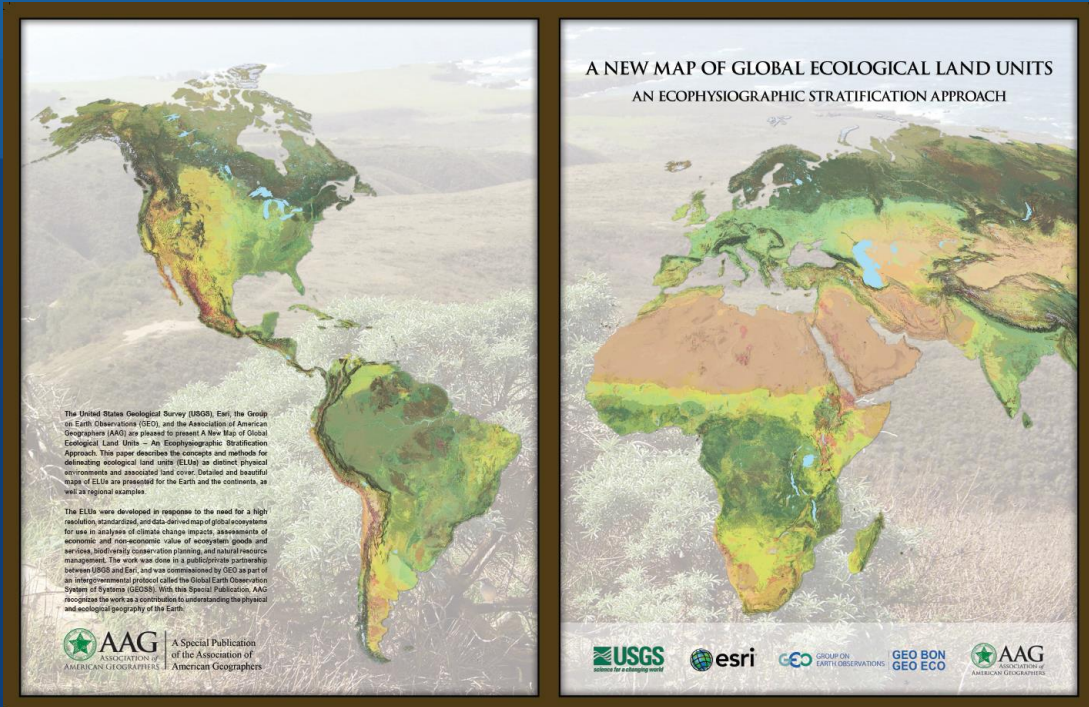
Marine: By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans. By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.

# GEO ECOSYSTEMS Initiative: Global Ecosystem Mapping

Develop a standardized, robust, and practical global ecosystems classification and map for the planet's *terrestrial*, *freshwater*, and *marine* ecosystems.





[illegible]

The figure consists of two world maps and a legend. The left map displays the spatial distribution of 12 climate variables, and the right map displays the spatial distribution of 12 climate variables. The legend at the bottom explains the color coding for each variable.

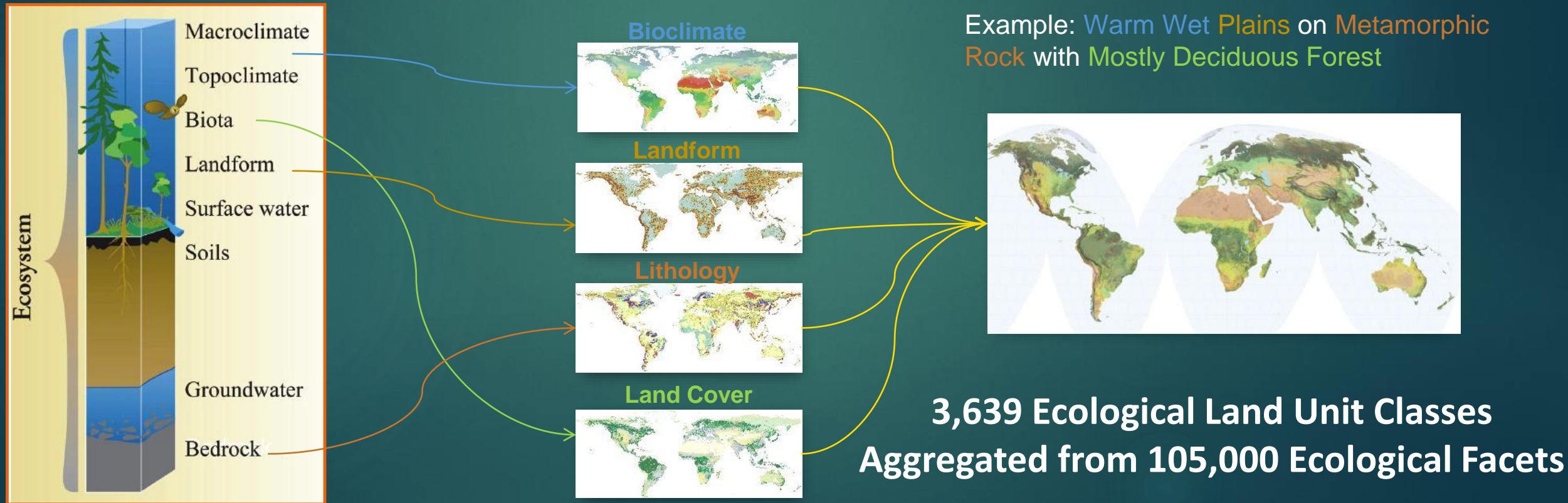
Variable	Color
Precipitation (mm)	Light Blue
Temperature (°C)	Dark Blue
Humidity (%)	Light Green
Wind Speed (m/s)	Dark Green
Solar Radiation (W/m²)	Light Yellow
Cloud Cover (%)	Dark Yellow
Relative Humidity (%)	Light Orange
Temperature (°C)	Dark Orange
Humidity (%)	Light Red
Wind Speed (m/s)	Dark Red
Solar Radiation (W/m²)	Light Purple
Cloud Cover (%)	Dark Purple

The figure consists of two world maps showing the global distribution of major plant groups. The left map shows the distribution of Gymnosperms, Angiosperms, and Ferns. The right map shows the distribution of Basidiomycetes, Ascomycetes, and Zygomycetes. A legend at the bottom identifies the colors for each group.

Gymnosperms	Angiosperms	Ferns	Basidiomycetes	Ascomycetes	Zygomycetes
Green	Yellow	Red	Blue	Orange	Purple

# Ecological Land Units (ELUs)

## The Ecophysiographic Stratification Approach



# USGS/Esri Global Ecosystem Mapping Approach

Ecological Domains (4)

Ecosystem Classes (20)

Level One Ecosystems (hundreds)

Level Two Ecosystems (thousands)

Level Three Ecosystems.....

- Hierarchical
- Domain comprehensive (terrestrial, freshwater, marine)
- Mutually exclusive, exhaustive, ecologically meaningful
- Rigorous, standardized, practical
- Compatible with major ecological and ecoregional classification concepts



# USGS/Esri Global Ecosystem Mapping Approach

Highest Order Ecosystem  
Complexes at Biome Level

Ecological Domains (4)

Ecosystem Classes (20)

Level One Ecosystems (hundreds)

Level Two Ecosystems (thousands)

Level Three Ecosystems.....

# Highest Order Ecosystem Complexes (20)

- *Terrestrial Domain (6)*

Forests, Shrublands, Grasslands, Croplands, Barrenlands (sparsely or non-vegetated), Built Environment

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- *Freshwater Domain (3)*

Lakes and Ponds, Rivers and Streams, Wetlands

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- *Coastal Domain (5)*

Coastal Lands, Nearshore Waters, Nearshore Seafloor, Offshore Waters, Offshore Seafloor

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- *Oceanic Domain (6)*

Sunlit Waters, Twilight Waters, Deep Waters, Slope Seafloor, Abyssal Seafloor, and Hadal Seafloor



# Rolling Up the Global Ecological Units

- *Terrestrial Domain (6)*

Forests, Shrublands, Grasslands, Croplands,  
Barrenlands (sparsely or non-vegetated), Built  
Environment

ELUs

- *Freshwater Domain (3)*

Lakes and Ponds, Rivers and Streams, Wetlands

EFUs

- *Coastal Domain (5)*

Coastal Lands, Nearshore Waters, Nearshore Seafloor,  
Offshore Waters, Offshore Seafloor

ECUs

EBUs

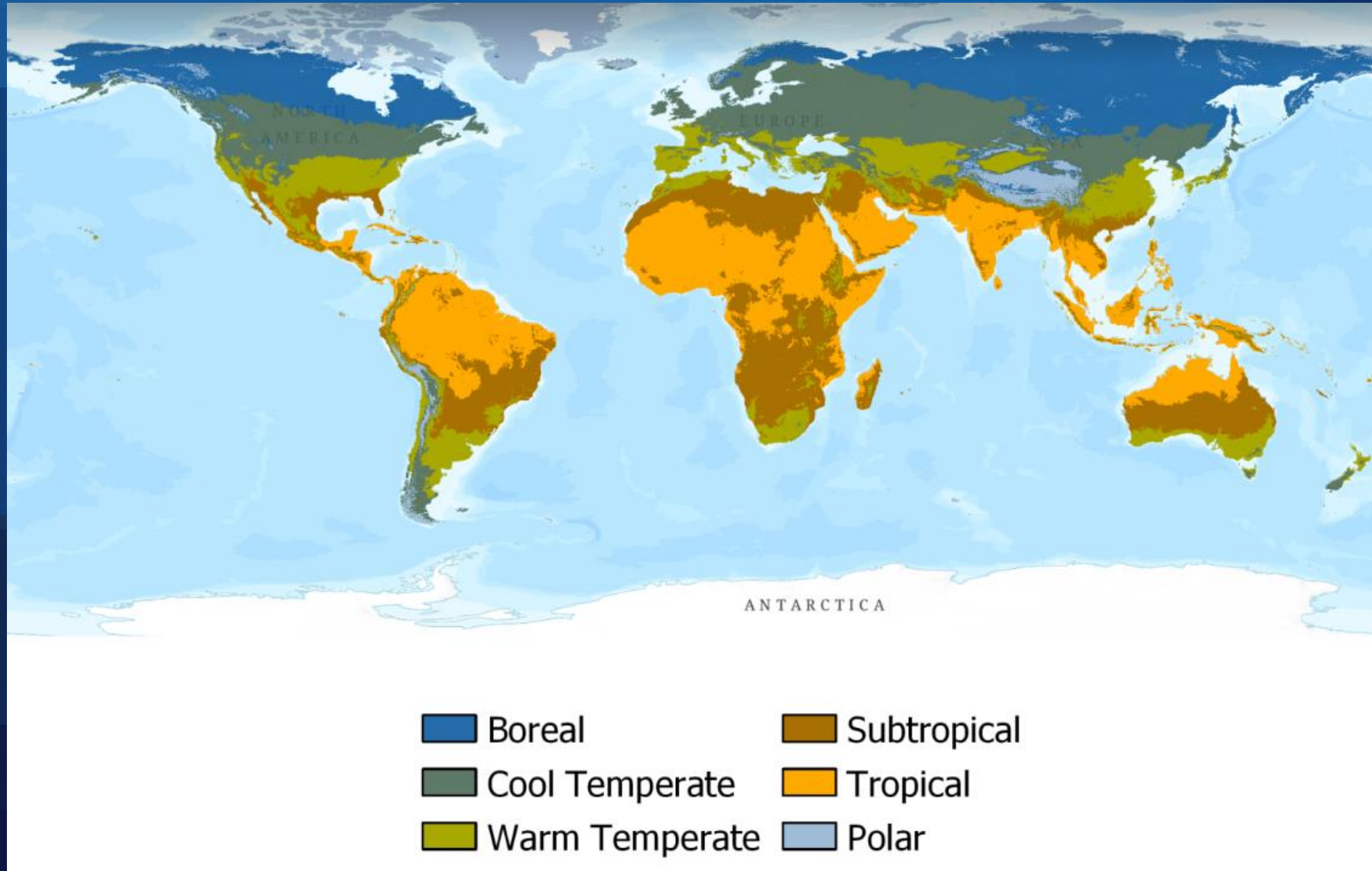
- *Oceanic Domain (6)*

Sunlit Waters, Twilight Waters, Deep Waters, Slope  
Seafloor, Abyssal Seafloor, and Hadal Seafloor

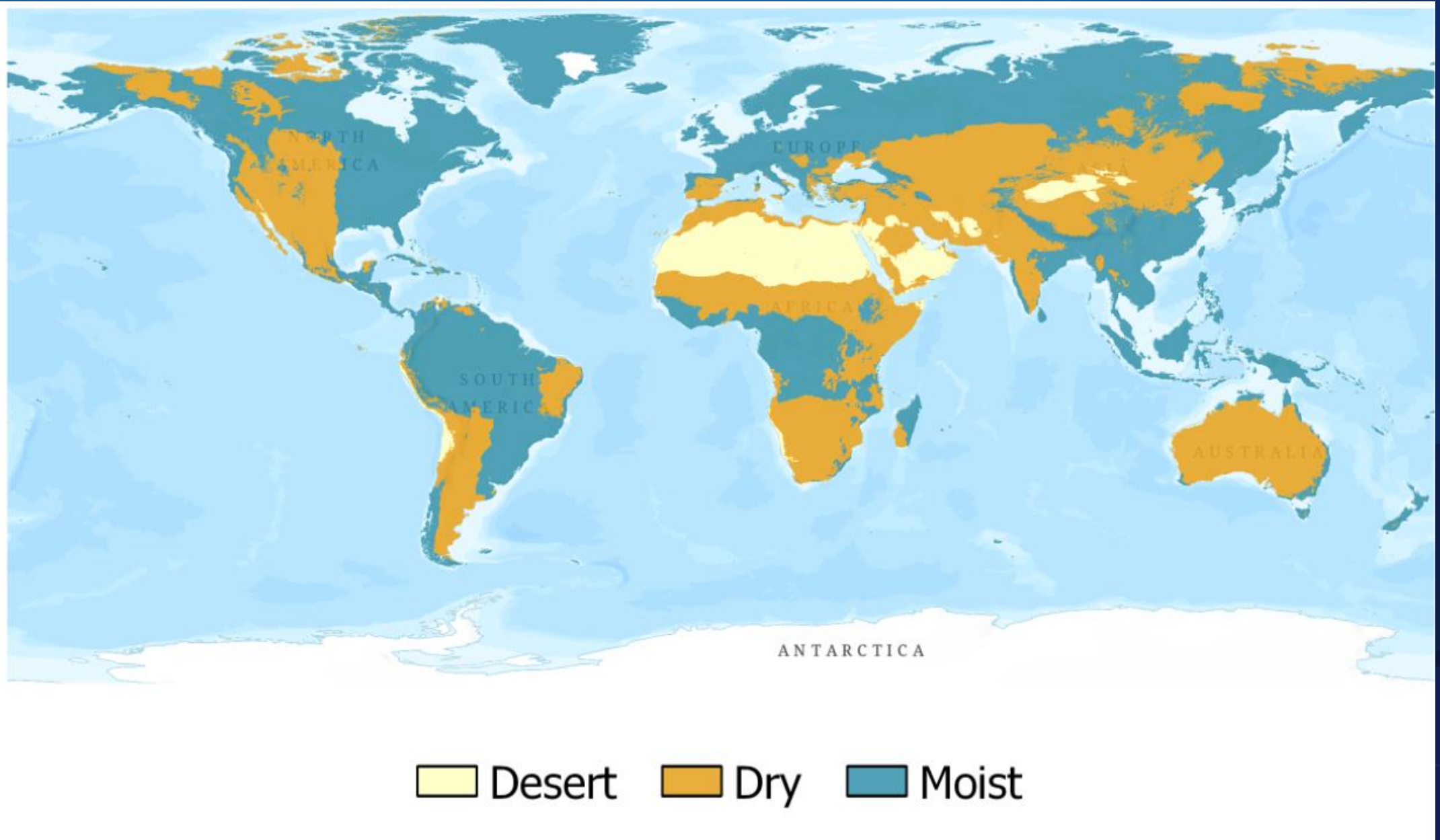
EMUs

EBUs

# World Temperature Domains

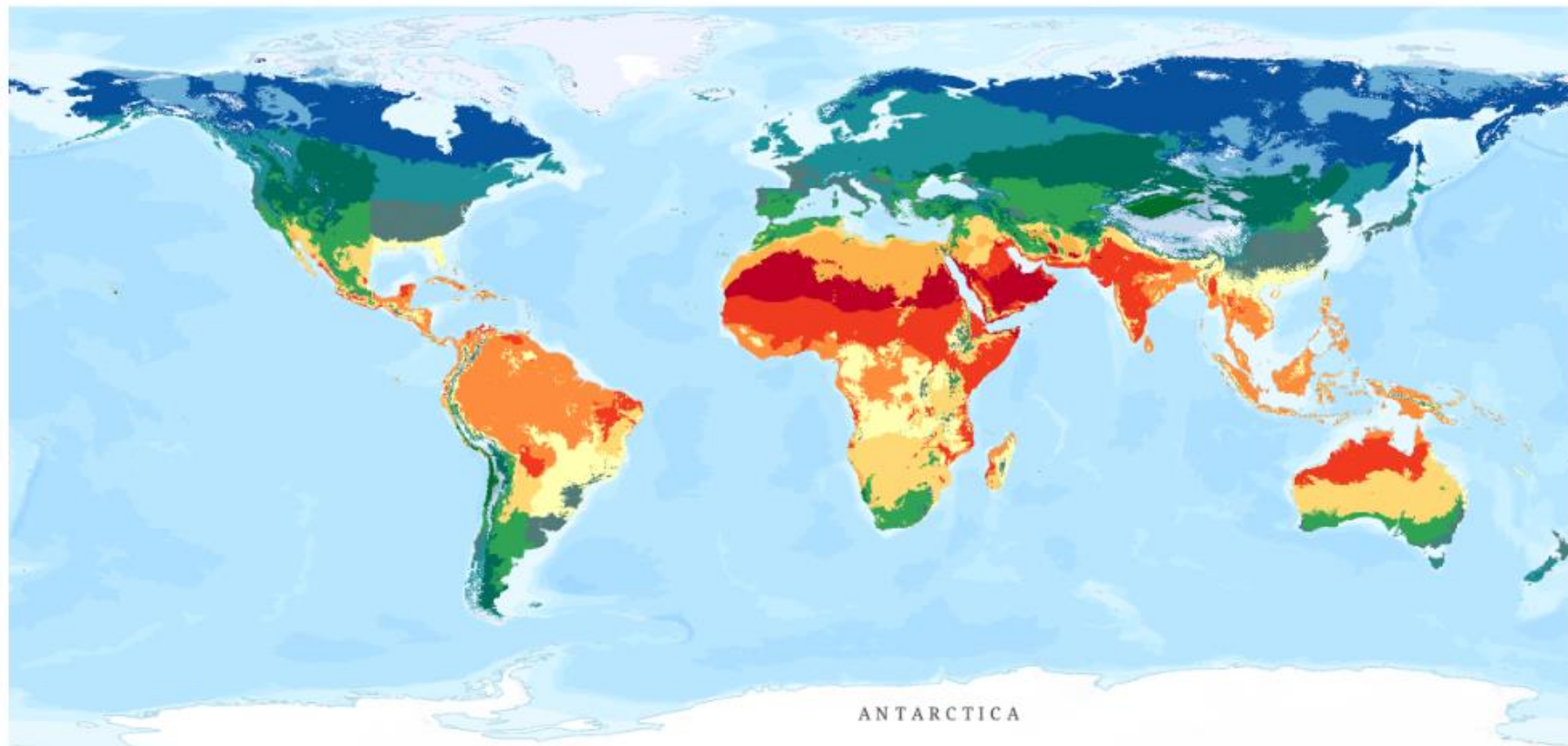


# World Moisture Domains





# World Climate Regions



Polar Moist

Polar Dry

Boreal Moist

Boreal Dry

Cool Temperate Moist

Cool Temperate Dry

Warm Temperate Moist

Warm Temperate Dry

Cool Temperate Desert

Warm Temperate Desert

Boreal Desert

Subtropical Moist

Subtropical Dry

Polar Desert

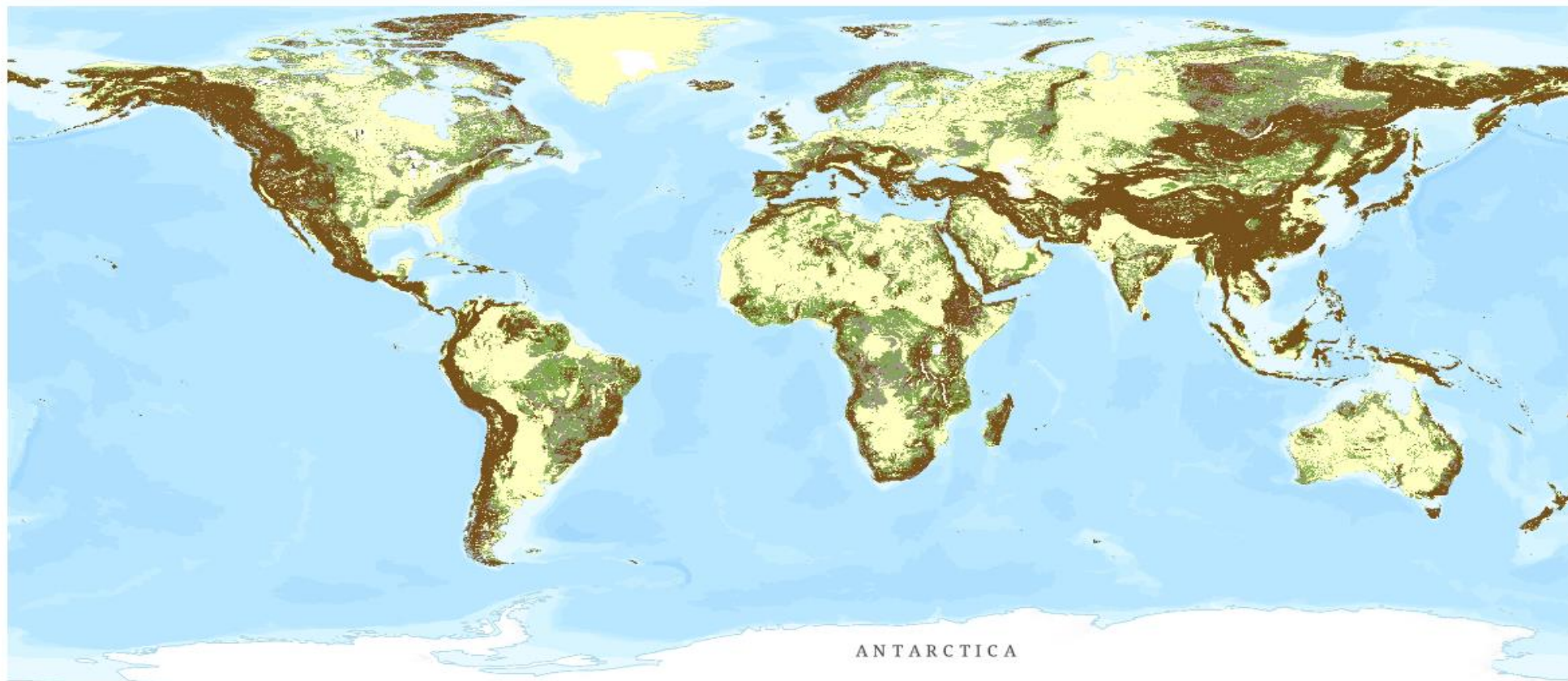
Subtropical Desert

Tropical Dry

Tropical Desert

Tropical Moist

# World Landforms



Mountains

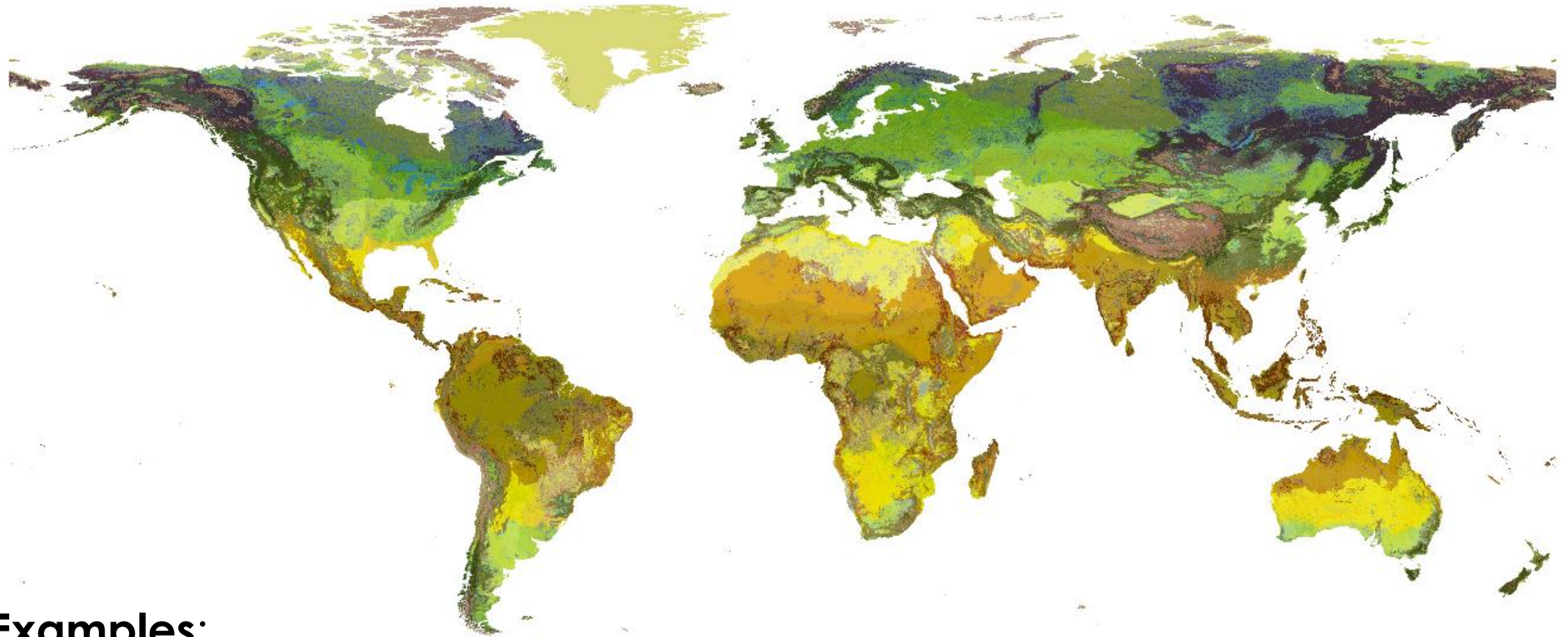
Hills

Tablelands

Plains



# Globally Distinct Biophysical Settings (GDBS) (431) (250 m)

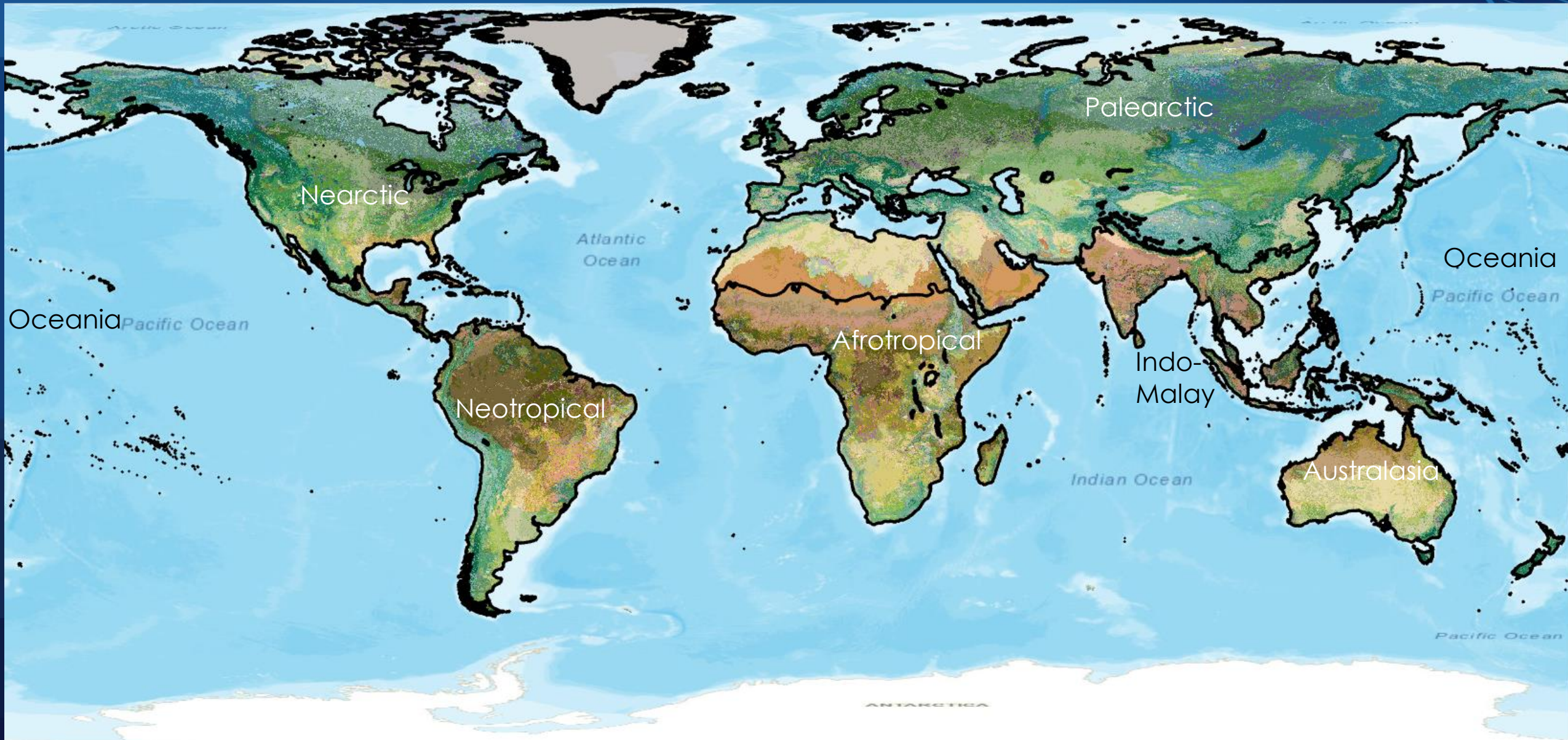


## **Examples:**

Tropical Dry Shrublands on Plains, Cool Temperate Moist Forests on Mountains, Subtropical Desert Barrenlands on Hills



# Globally Distinct Biophysical and Biogeographic Settings (GDBBS) aka World Ecological Settings (WESs) (~2500)



# Next Steps for World Ecological Settings

- Publication Terrestrial WESs
- Put Terrestrial WES data in public domain and Esri Living Atlas
- Finish mapping ECUs, publish them as Coastal WES
- Put Coastal WES data in public domain and Esri Living Atlas
- Finish mapping EFUs, publish them as Freshwater WES
- Put Freshwater WES data in public domain and Esri Living Atlas
- Commence mapping EBU...
- Integrate all into one global WES map...

## Also Consider:

- Reconcile USGS/Esri units with IUCN RLE units