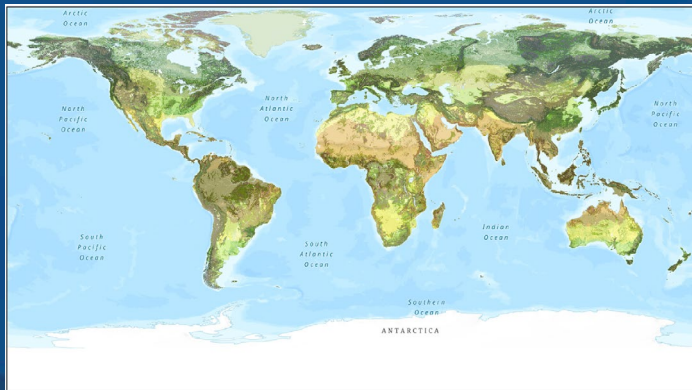
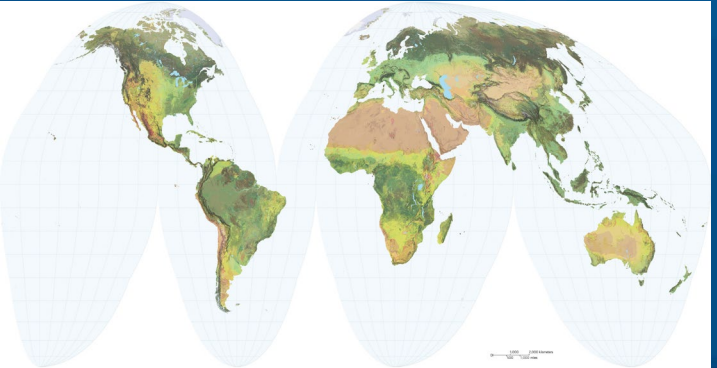


The utility of global ecosystem maps for national ecosystem reporting - a focus on the World Terrestrial Ecosystems

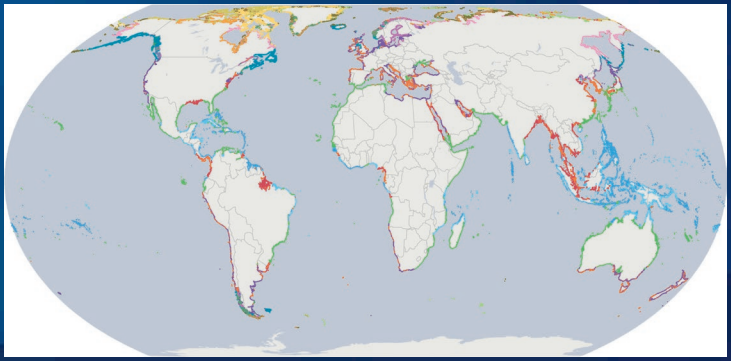
Roger Sayre (U.S. Geological Survey) 11 FEB 2025 BioSpace25 Frascati, Italy



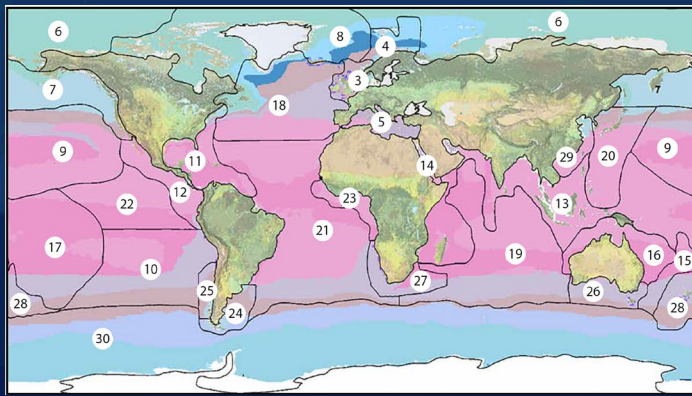
World Terrestrial Ecosystems (WTEs)



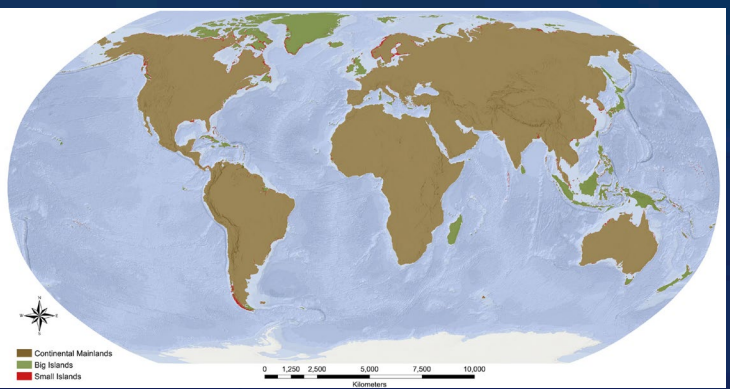
Ecological Land Units (ELUs)



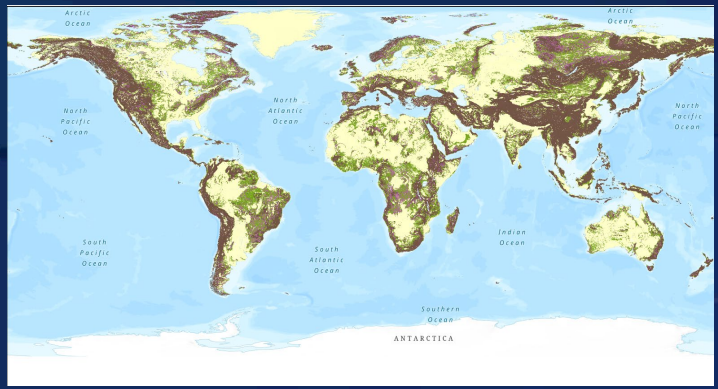
Ecological Coastal Units (ECUs)



Ecological Marine Units (EMUs)



Global Islands



World Landforms

CHARGE

Commissioning Entity: Group on Earth Observations (GEO)

Commission: GEO Global Ecosystems Mapping Task 2005 - 2023

*Develop standardized, robust, and practical global ecosystems classifications and maps for the planet's **terrestrial**, **freshwater**, and **marine** ecosystems.*

VISION: WORLD ECOSYSTEMS = WTEs + WFEs + WCMEs

World Terrestrial
Ecosystems
(WTEs)

← ELUs - Ecological Land Units ✓

+

World Freshwater
Ecosystems
(WFEs)

← EFUs - Ecological Freshwater Units

{ Rivers and Streams (GloRiC) ✓
Lakes and Ponds (HydroLakes) ✓
Wetlands (Global Wetlands)

+

World Coastal
and Marine
Ecosystems
(WCMEs)

← { EMUs - Ecological Marine Units ✓
ECUs - Ecological Coastal Units ✓
EBUs - Ecological Benthic Units

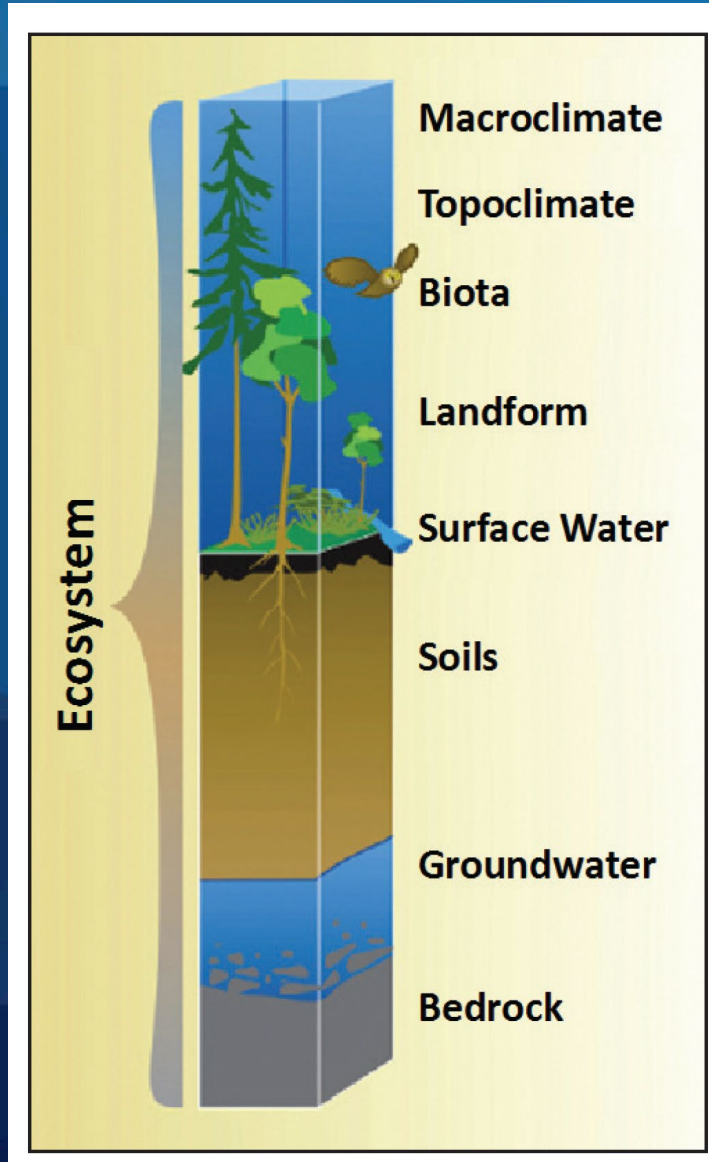
WHAT IS AN ECOSYSTEM?

So many definitions....

HOW ARE ECOSYSTEMS MAPPED?

So many approaches....

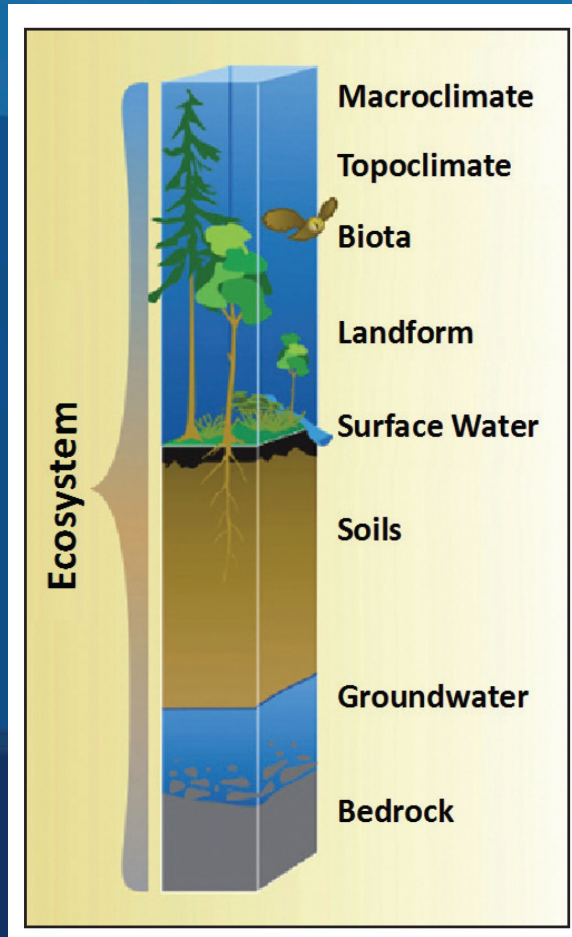
WHAT IS AN ECOSYSTEM?



HOW ARE ECOSYSTEMS MAPPED?

1. Structure-based
2. Function-based
3. Composition-based
4. Mixed

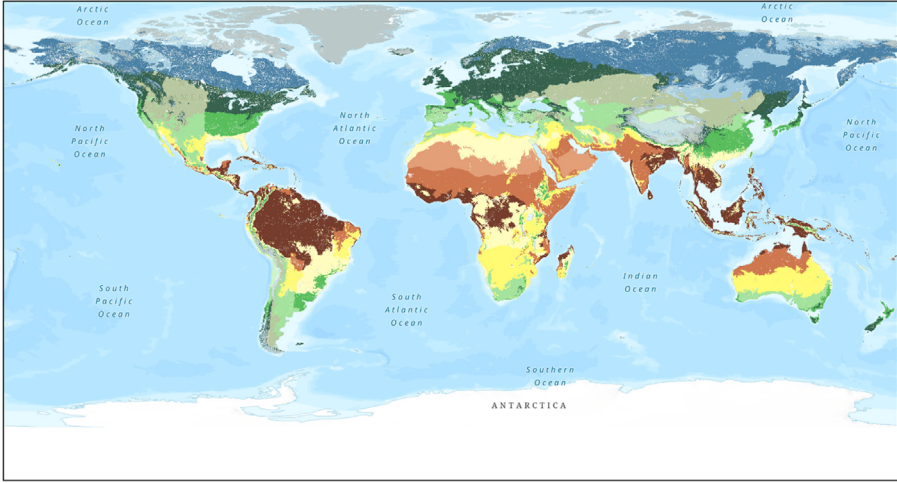
WHAT IS AN ECOSYSTEM?



HOW ARE ECOSYSTEMS MAPPED?

1. Structure-based
2. Function-based
3. Composition-based
4. Mixed

Figure 1. The vertical structure of an ecosystem, showing the spatial integration of biological and non-living components. Reproduced with permission from Robert G. Bailey (1996).



World Climate Regions (18)

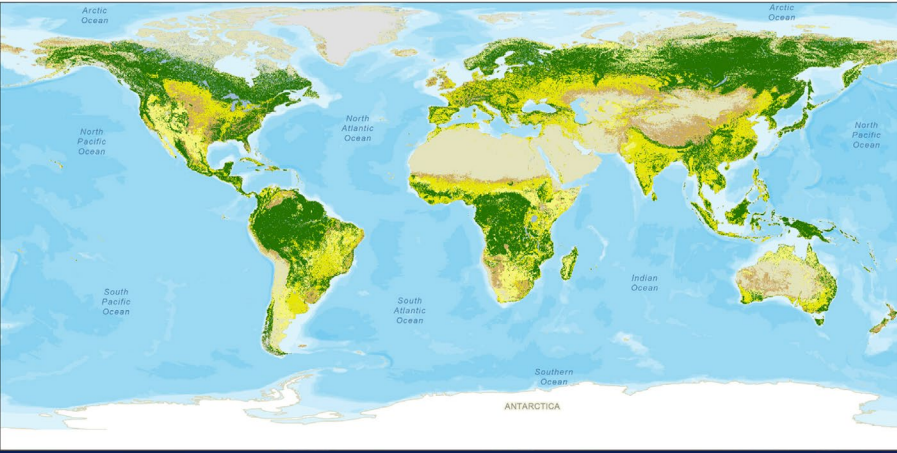
SIX TEMPERATURE ZONES:
 Polar, Boreal, Cold Temperate, Warm Temperate, Subtropical, Tropical

THREE MOISTURE ZONES:
 Moist, Dry, Very Dry (Desertic)



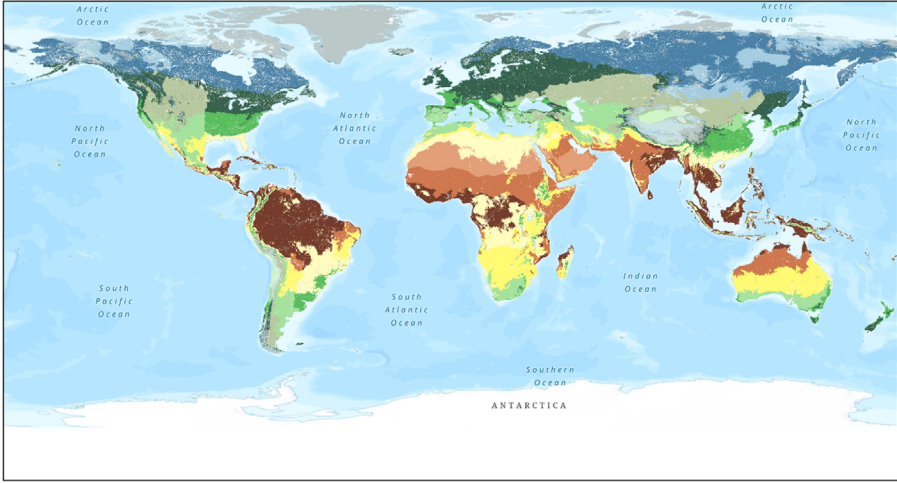
World Landforms (4)

FOUR LANDFORMS:
 Plains, Hills, Mountains, Tablelands



World Biomes (8)

EIGHT BIOME CLASSES:
 Forests, Shrublands, Grasslands, Barelands, Croplands, Water, Snow and Ice, Built Environment



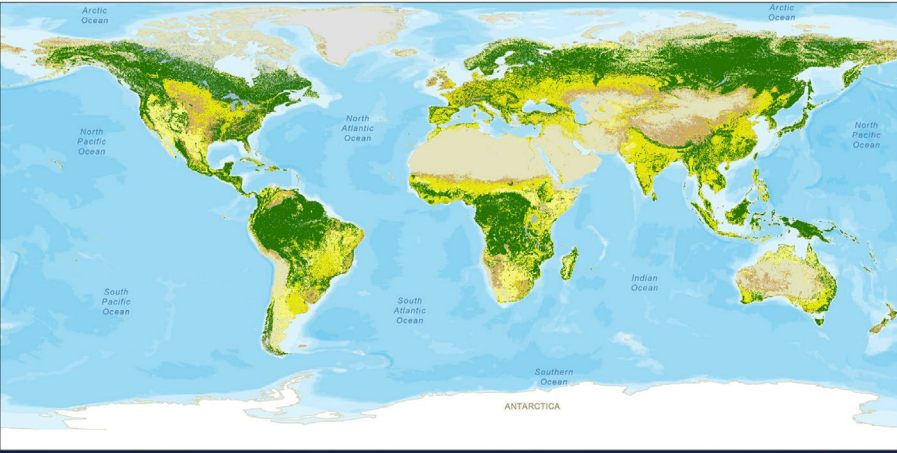
**World Climate
Regions (18)**

+

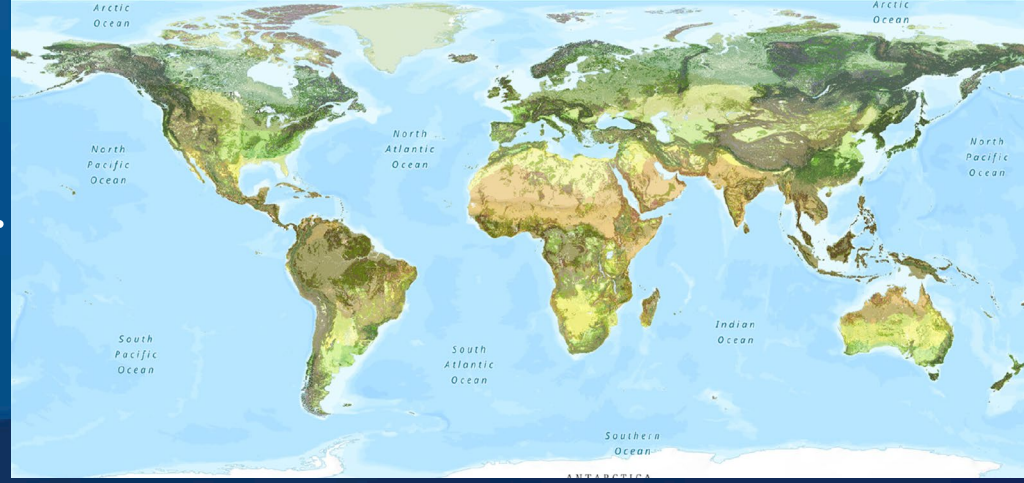


**World
Landforms (4)**

+

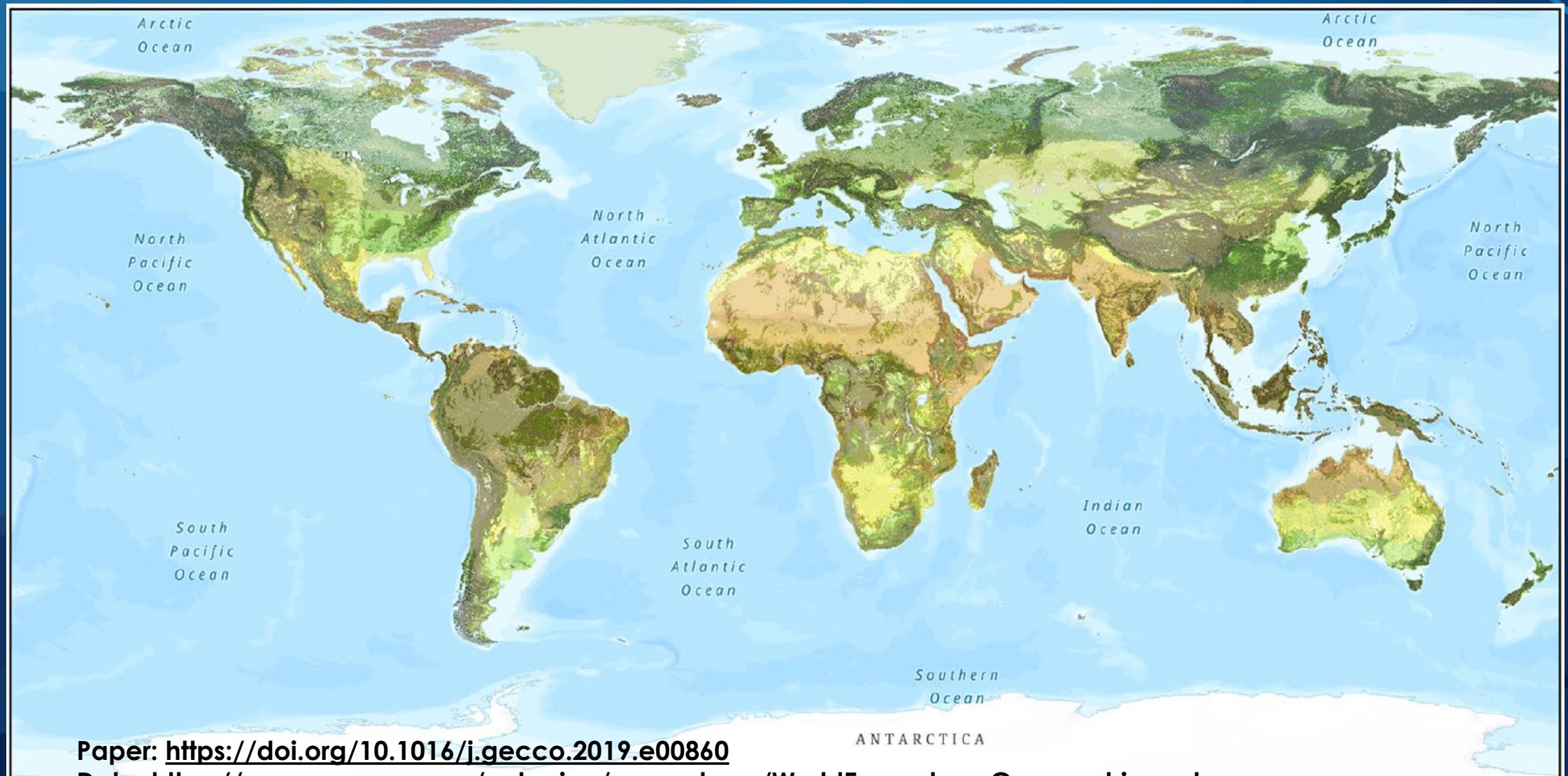


**World Biomes
(8)**



**2015 World Terrestrial Ecosystems
(431)**

2015 World Terrestrial Ecosystems (WTEs; n=431)



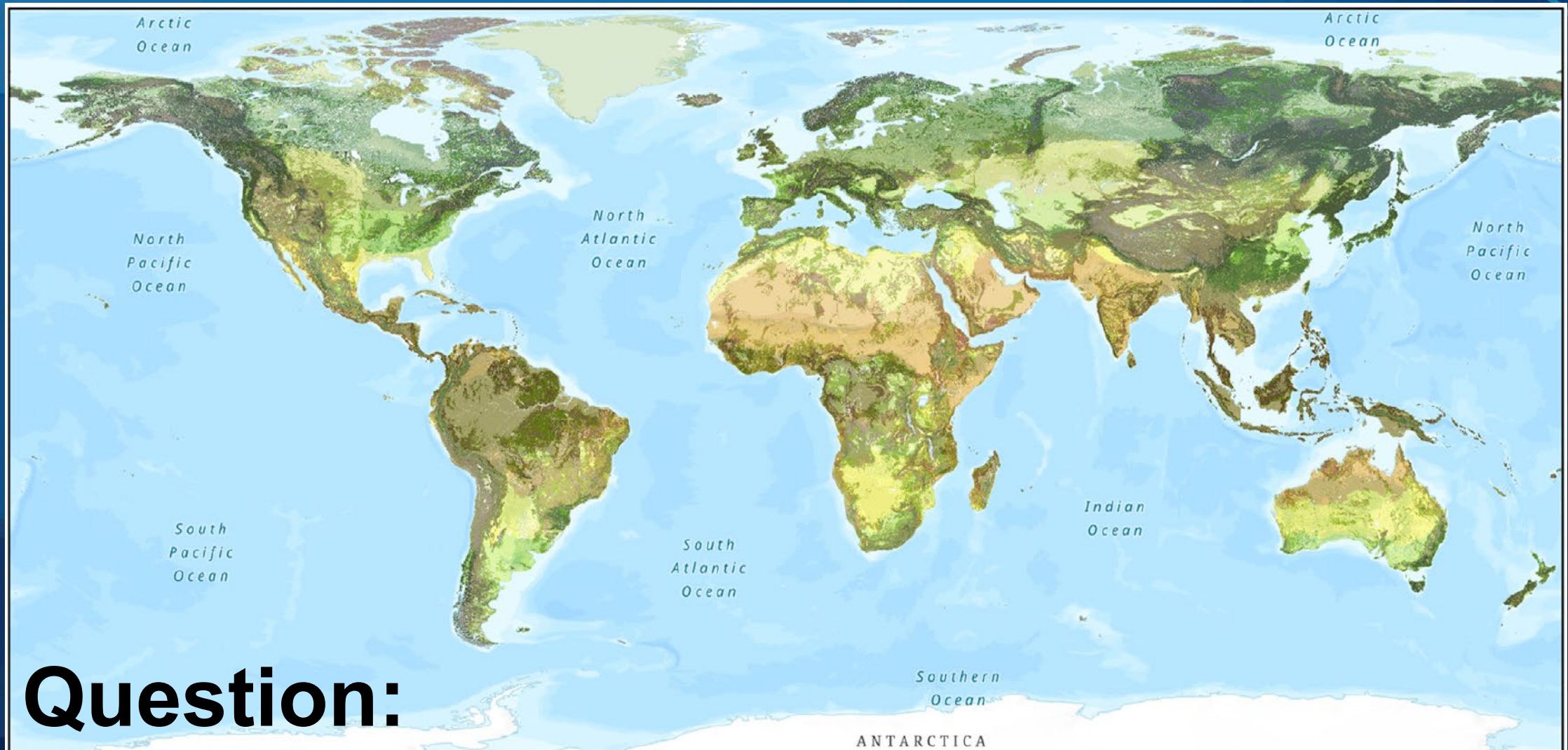
Paper: <https://doi.org/10.1016/j.gecco.2019.e00860>

Data: <https://rmgsc.cr.usgs.gov/outgoing/ecosystems/WorldEcosystemsGeographic.mpk>

Living Atlas (Image Service): <https://www.arcgis.com/home/item.html?id=926a206393ec40a590d8caf29ae9a93e>

Storymap: <https://storymaps.arcgis.com/stories/a4a6b1f779be4b64816d1876cfe669b9%20>

2015 World Terrestrial Ecosystems (WTEs; n=431)



Question:

Can these ecosystems be used by nations for Ecosystem Conservation Status Reporting (CBD GBF) and Ecosystem Accounting (UN SEEA)?

Considerations

Classification – IUCN GET?

Sanctioned Mapping Approach?

Spatial Resolution?

Accuracy?

Currency?

Uncertainty?

Availability?

Considerations

Classification – IUCN GET?

Sanctioned Mapping Approach

Spatial Resolution?

Accuracy?

Currency?

Uncertainty?

Availability?

*Open File Report – U.S. Geological Survey
National Land Imaging Program*

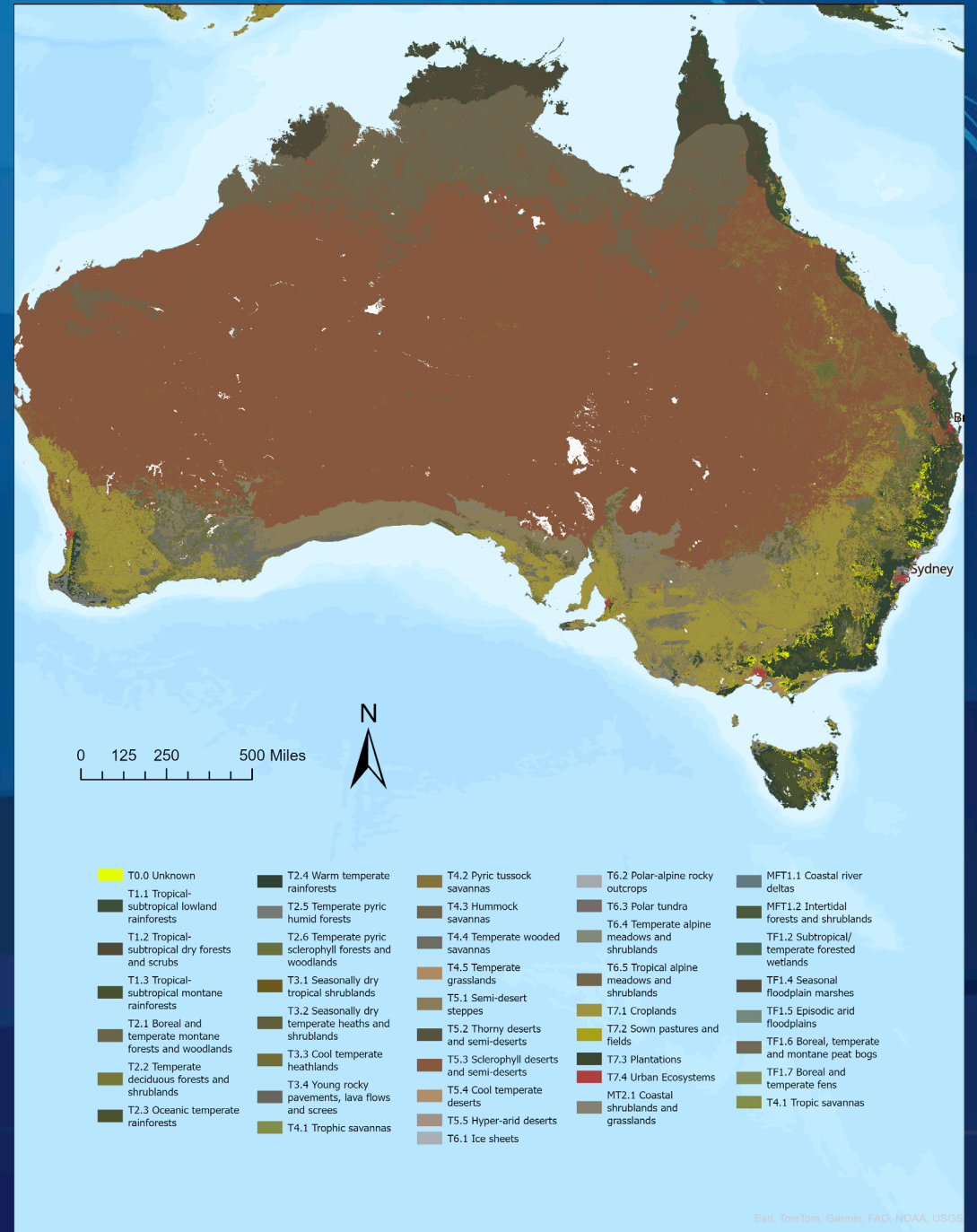
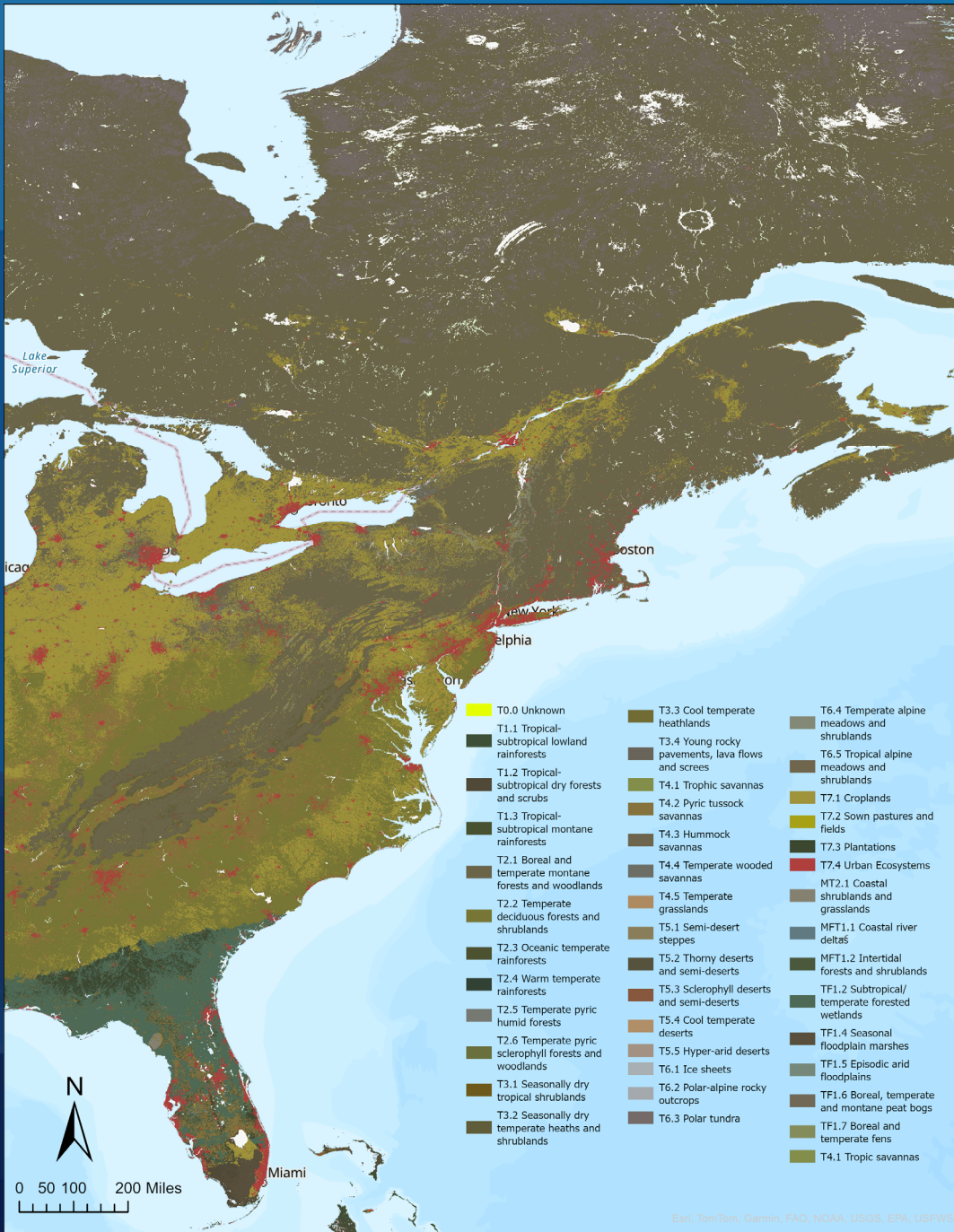
A Crosswalk of the 2015 World Terrestrial Ecosystems to the IUCN Global Ecosystem Typology Framework

By Kelly B. Sides¹, Nadia Najj¹, Amber Kremer², Devon Burton¹, and Roger Sayre¹

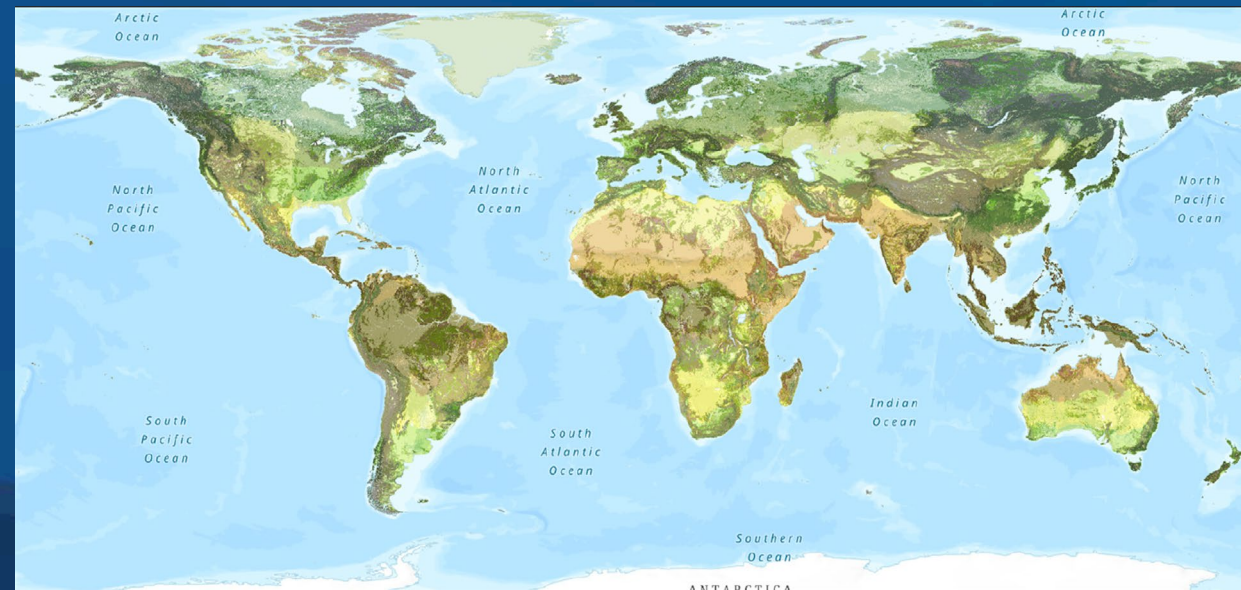
¹U.S. Geological Survey.

²Group on Earth Observations

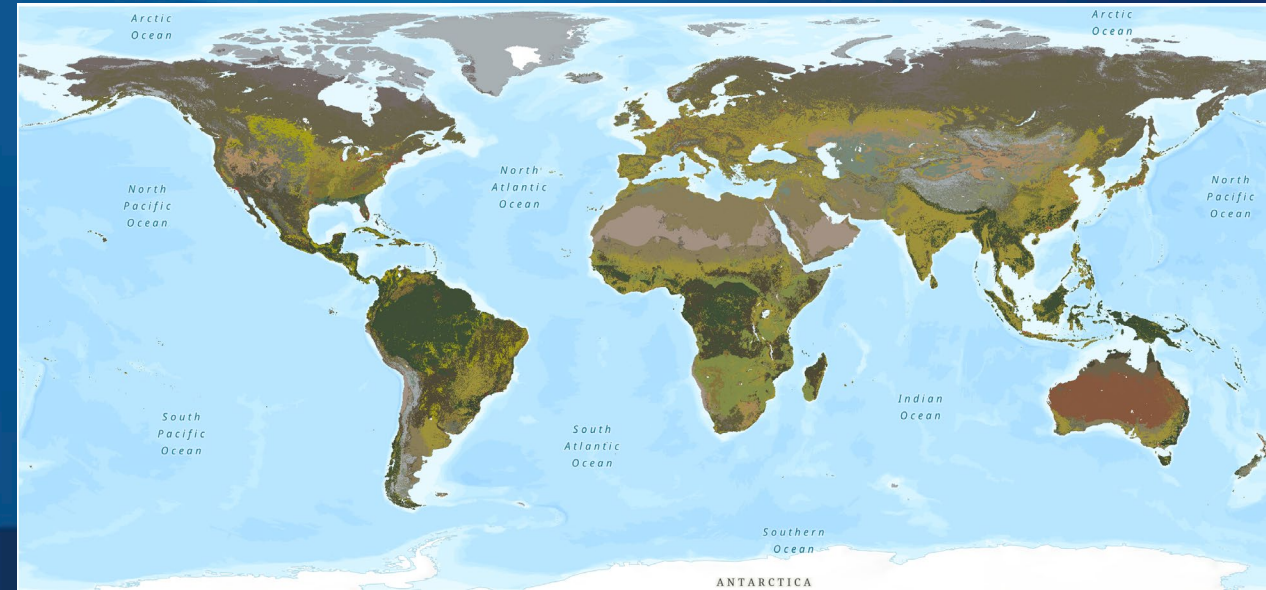




Crosswalk of the WTE 2015 with IUCN GET Level 3 (Ecosystem Functional Groups)



World Terrestrial Ecosystems (WTE)



Global Ecosystems Typology (GET)

Considerations

Classification – IUCN GET? ✓

Sanctioned Mapping Approach?

Spatial Resolution?

Accuracy?

Currency?

Uncertainty?

Availability?

Considerations

Classification – IUCN GET? ✓

Sanctioned Mapping Approach? ✓

Spatial Resolution?

Accuracy?

Currency?

Uncertainty?

Availability?

Considerations

Classification – IUCN GET? ✓

Sanctioned Mapping Approach ✓

Spatial Resolution? Small Countries ✗ Big Countries ✓ (Maybe)

Accuracy?

Currency?

Uncertainty?

Availability?

WTEs – Source of Linework for:

USNVC Hierarchy

Class

Subclass

Divisions

Formations

Macrogroups

Groups

Community Alliances

Community Associations

→ IUCN GET Level 3 EFGs (80% Compatibility)

Considerations

Classification – IUCN GET? ✓

Sanctioned Mapping Approach? ✓

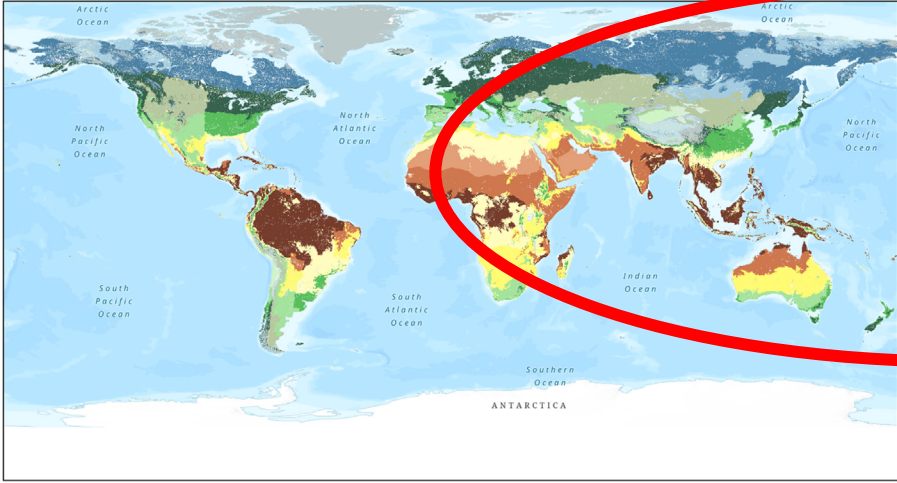
Spatial Resolution? ✓

Accuracy? ✓

Currency? ✓

Uncertainty? ✓

Availability? ✓



**World Climate
Regions (18)**

**Project to 2050
5 CMIP6 Models, 3 SSPs**

+



**World
Landforms (4)**

Do not project

+



**World Biomes
(8)**

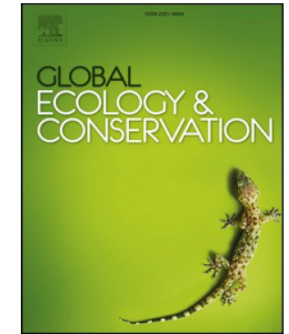
**Project to 2050
3 SSPs**



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Global Ecology and Conservation

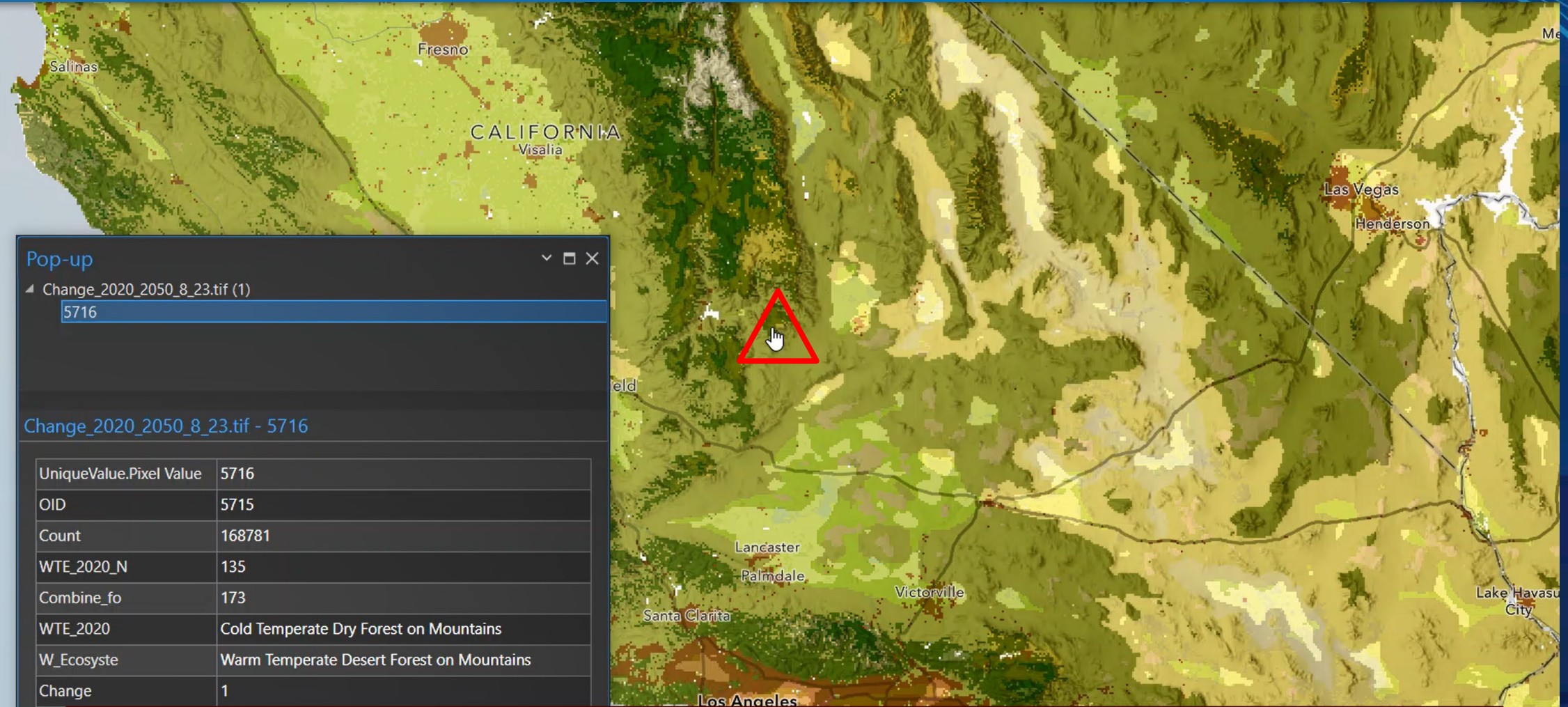
journal homepage: www.elsevier.com/locate/gecco



Potential 2050 distributions of World Terrestrial Ecosystems from projections of changes in World Climate Regions and Global Land Cover

Roger Sayre^{a,*}, Charlie Frye^b, Sean Breyer^b, Patrick R. Roehrdanz^c, Paul R. Elsen^d, Kevin Butler^b, Clint Brown^b, Jill Cress^e, Deniz Karagulle^b, Madeline Martin^f, Florencia Sangermano^g, Regan L. Smyth^h, Terry L. Sohlⁱ, Nicholas H. Wolff^j, Dawn J. Wright^b, Zhouting Wu^k

WTE 2015 and WTE 2050



2015 – Cold Temperate Dry Forests on Mountains

2050 – Warm Temperate Desert Forests on Mountains

System of Environmental-Economic Accounting

Ecosystem Accounting

3.67 The use of IUCN GET as the reference classification of ecosystem types reflects the need for a globally applicable classification of ecosystem types covering all realms. There is a range of existing global classifications of ecosystem types, habitats, land cover and land use, as well as regional or realm-specific classifications of ecosystem types that may be used in other contexts. Examples include World Terrestrial Ecosystems (Sayre and others, 2020); the European Nature Information System and Mapping and Assessment of Ecosystems and their Services (MAES); the Food and Agriculture Organization of the United Nations (FAO) Global Agro-Ecological Zones; the SEEA Central Framework Classification of Land Use and Land Cover Basic Rules and Classifications (annex I, sects. B and C); the Moderate Resolution Imaging Spectroradiometer (MODIS); and classifications used under global conventions such as the United Nations Framework Convention on Climate Change and the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention).⁴⁴ To support the integration of data and the com-

Conclusion

USGS/Esri/TNC and others are continuing to map World Ecosystems in all three domains to produce reference-level, globally comprehensive, globally systematic characterizations to support ecosystem conservation status reporting and ecosystem accounting applications.

Recommendation

The GEO Global Ecosystem Atlas Initiative should consider using these World Ecosystems, crosswalked to the GET, for top-down display and use. Similar to the 'cached zoom levels' of Google Earth.