Ecosystem Extent and related indicators: An overview

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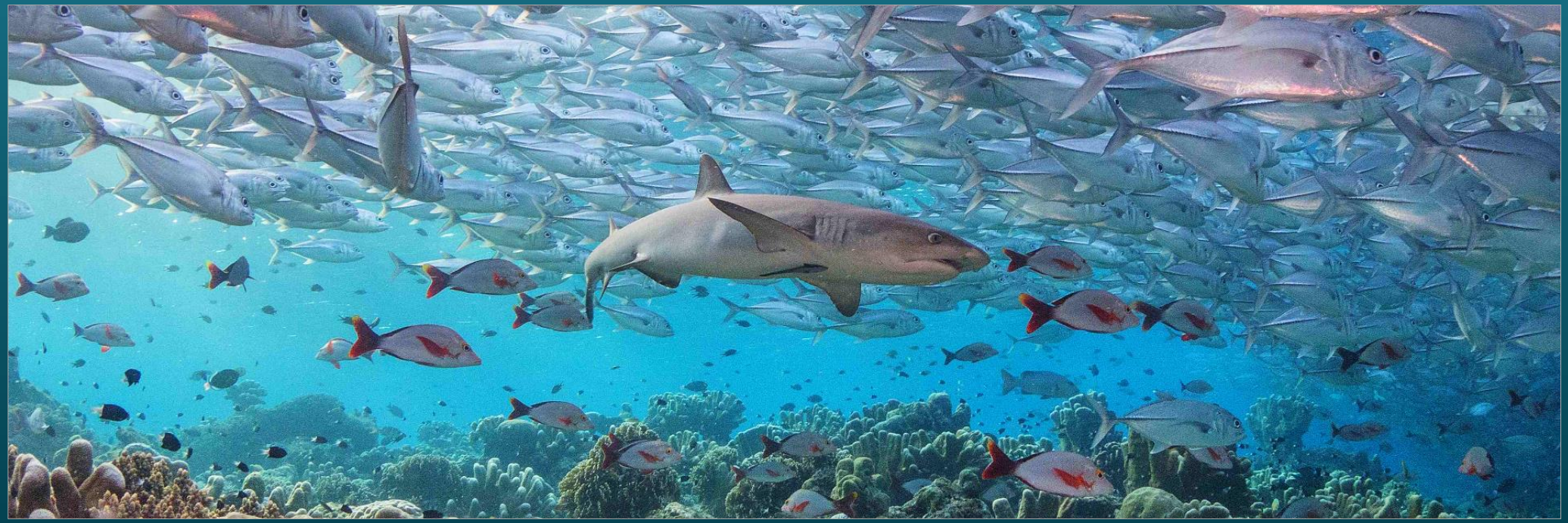
27 September 2021
Ecosystem Extent and Integrity webinar
Hosted by GEO BON & UN SEEA



Joe Parks from Wikimedia

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GEO BON



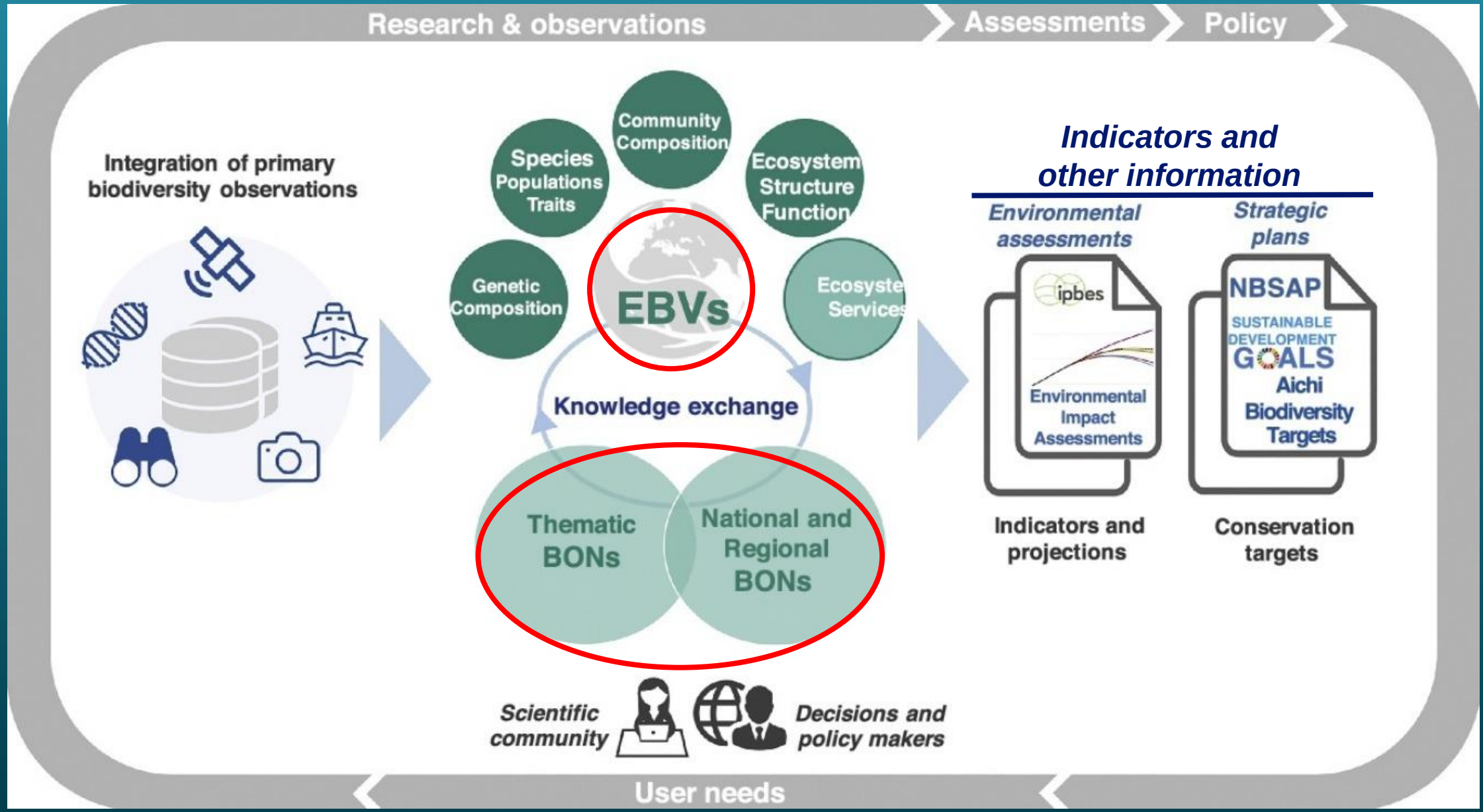
Wikimedia Avoini

GEO BON's Mission

Improve the acquisition, coordination and delivery
of biodiversity observations and related services
to users including decision makers and the scientific community.

- In the GBF context…
  - GEO BON supports Parties to track and guide progress to national targets

GEO BON Overview



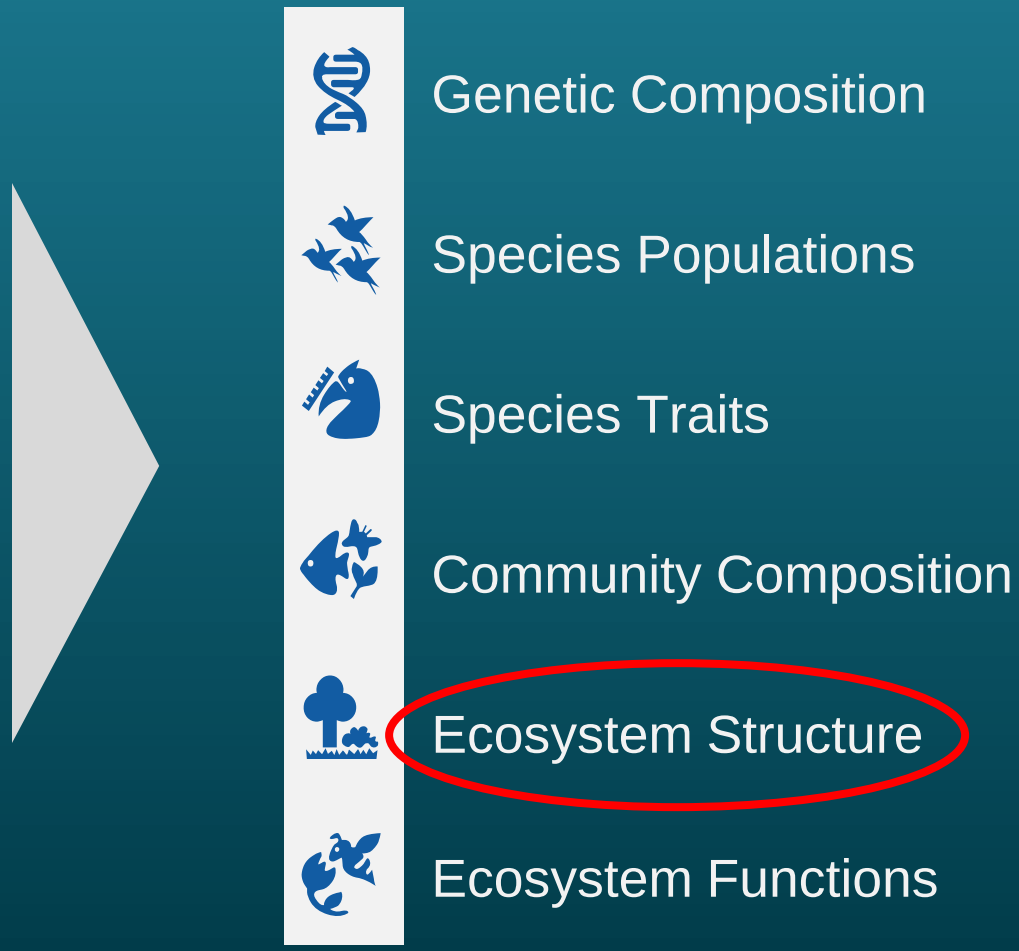
Navarro et al. 2017

What Are Essential Biodiversity Variables?

Set of measurements to capture the major dimensions of biodiversity and how it is changing

Criteria:

- ❖ Biological
- ❖ State variables
- ❖ Sensitive to change
- ❖ Scalable
- ❖ Feasible
- ❖ Ecosystem agnostic



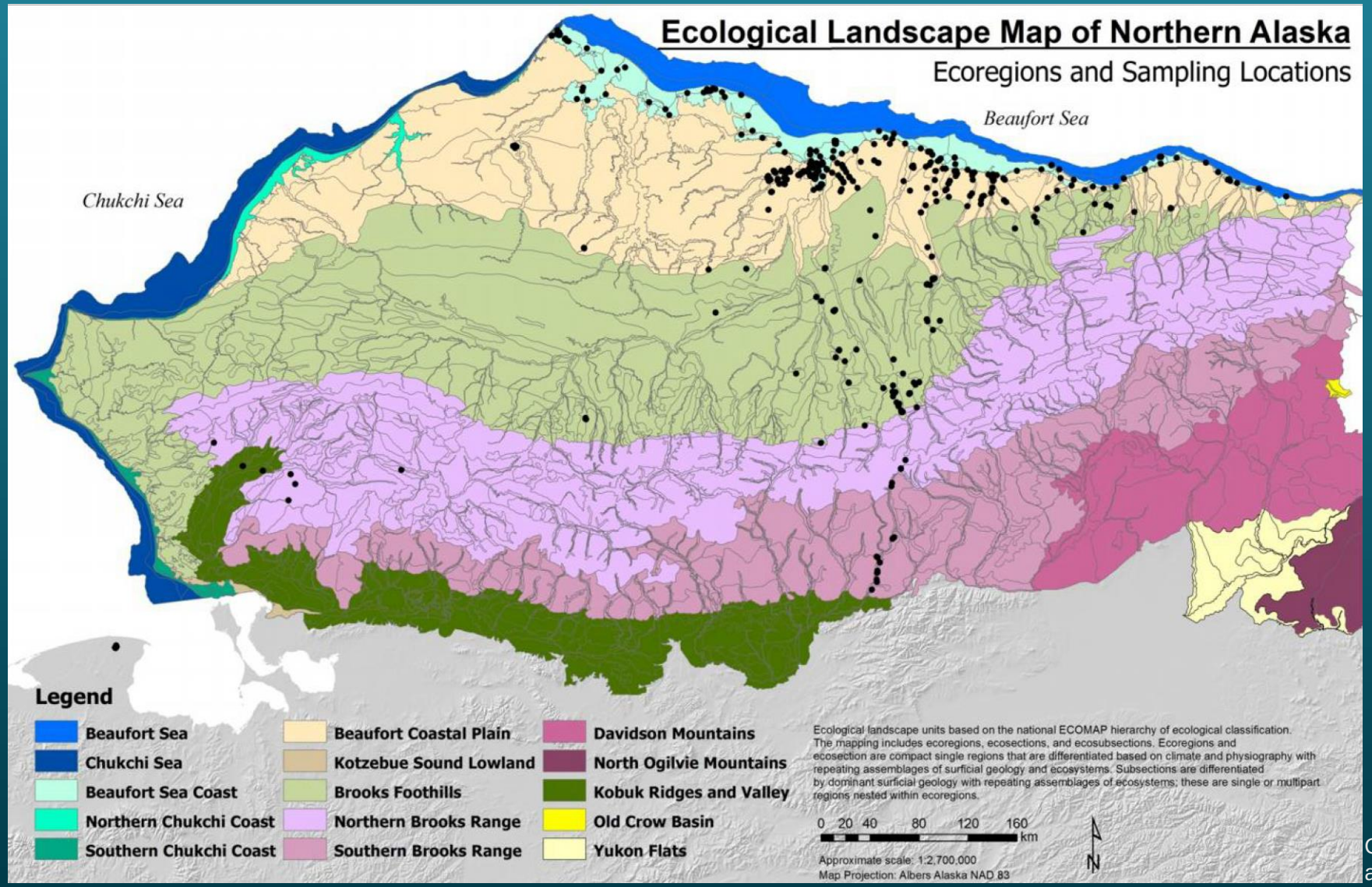
Ecosystem Extent



Wikimedia Apalsola

What is Ecosystem Extent?

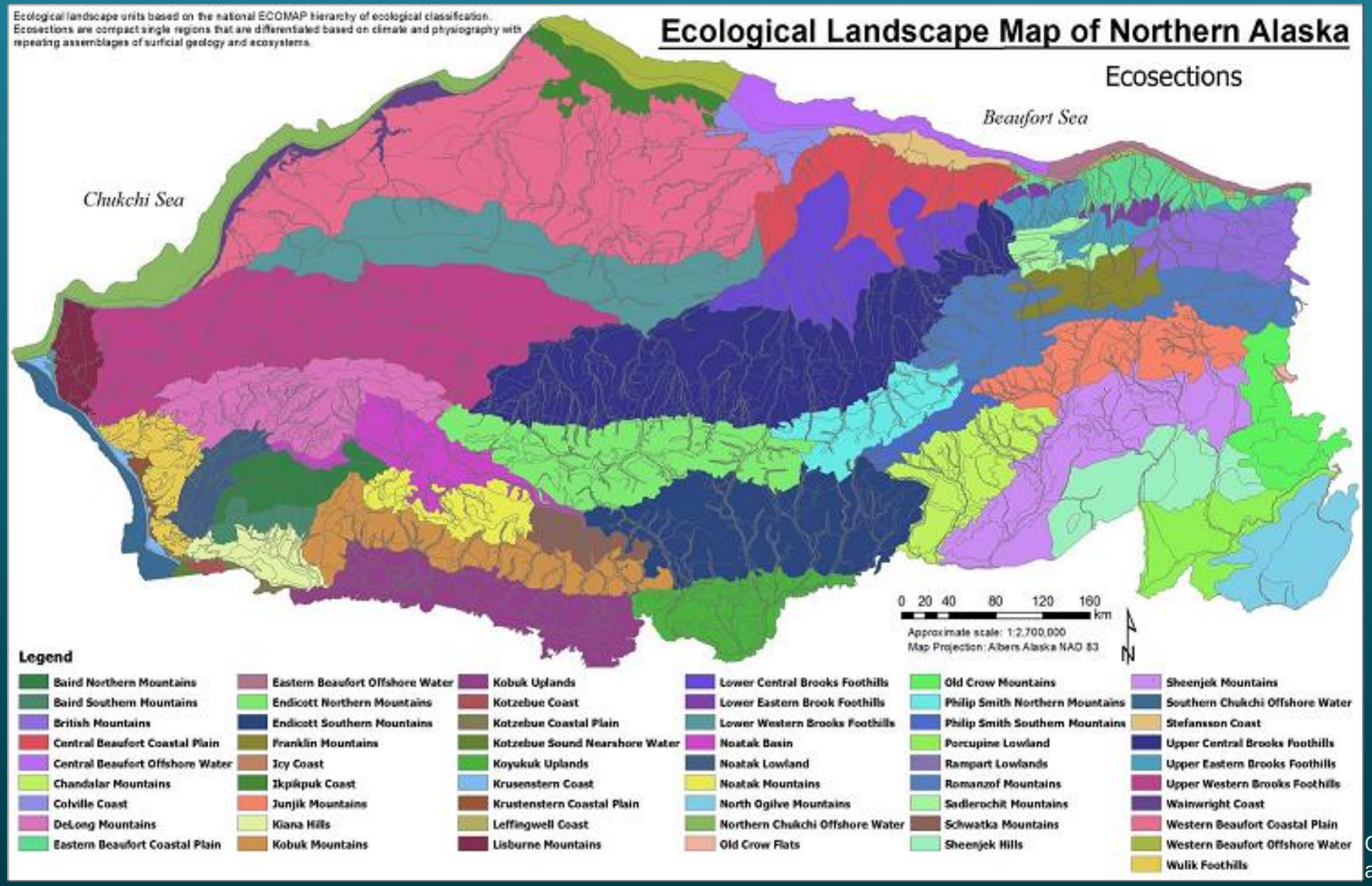
- A dataset that outlines one or more ecosystems of interest



ORNL DAAC from Jorgenson and Grunblatt, 2013

What is Ecosystem Extent?

- Hierarchical



ORNL DAAC from Jorgenson and Grunblatt, 2013

Approaches to Define an Ecosystem

- By physical structure
  - Tree height; scrub; grassland…
  - Ex: FAO Land Cover Classification System
- By physical environment
  - Climate, soils, slope….
  - Ex: USGS Global Ecosystem Land Units
- By structure, composition, function & processes
  - IUCN Ecosystem Typology V2.0



US National Park Service

Extent Is Just the Beginning

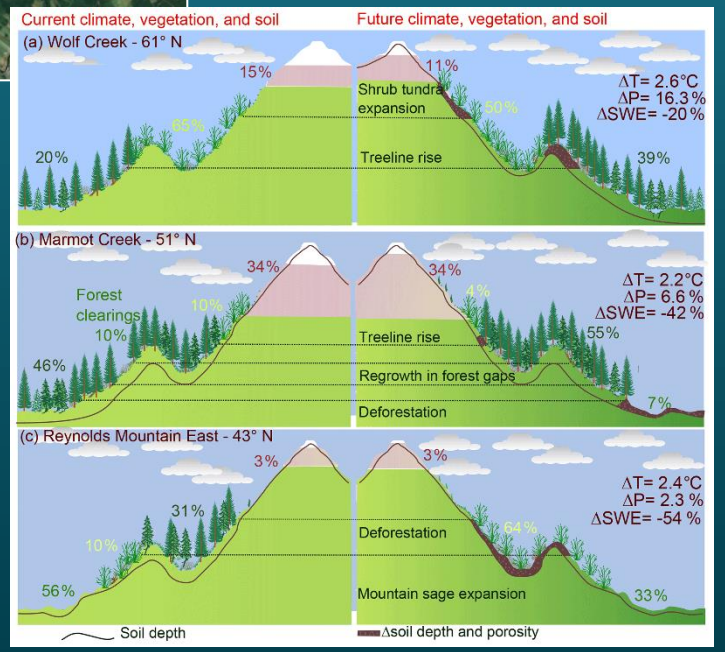
- Pixel-based classification
  - Enables derived products…
- Total area
- Fragmentation (affects condition)
- Corridors/connectivity
- Location
- Habitat
- Environmental accounting



googlemaps



Ipe-institutodepesquisasecologicas

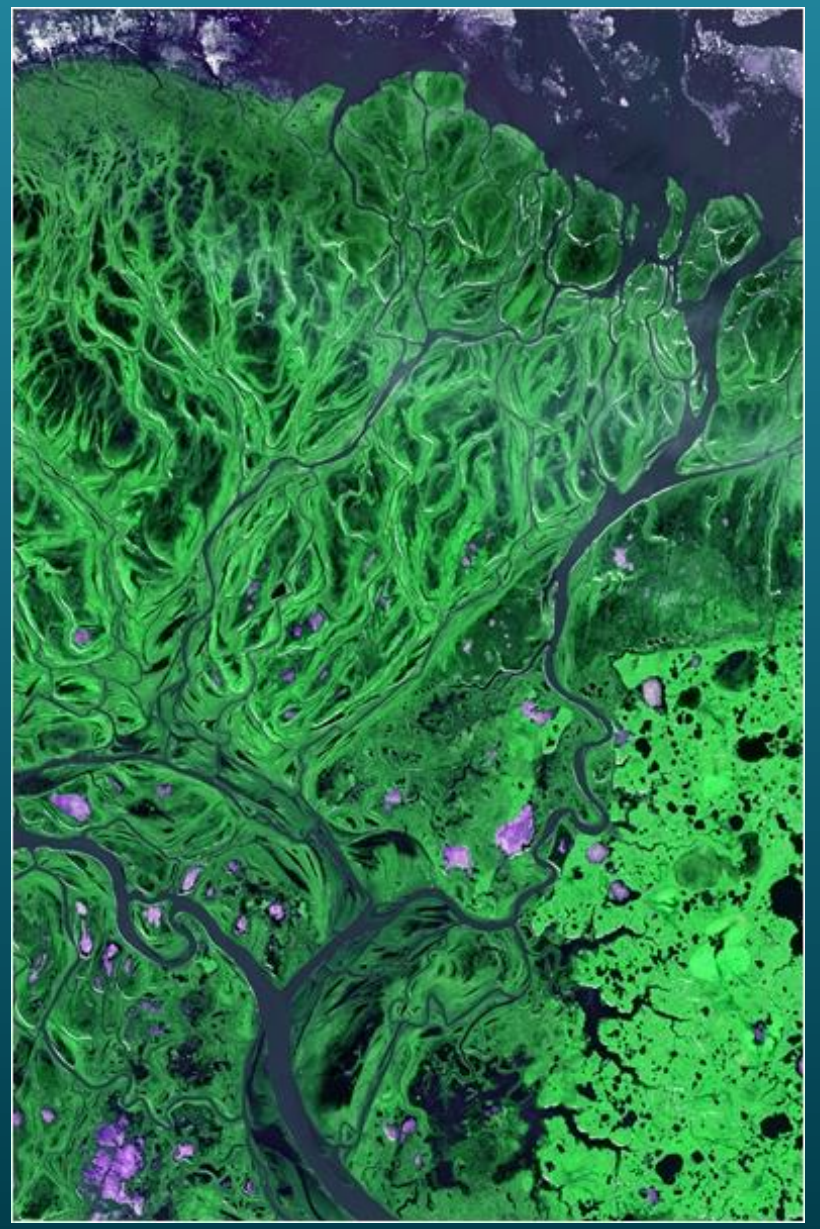


Kabir Rasouli et al 2019

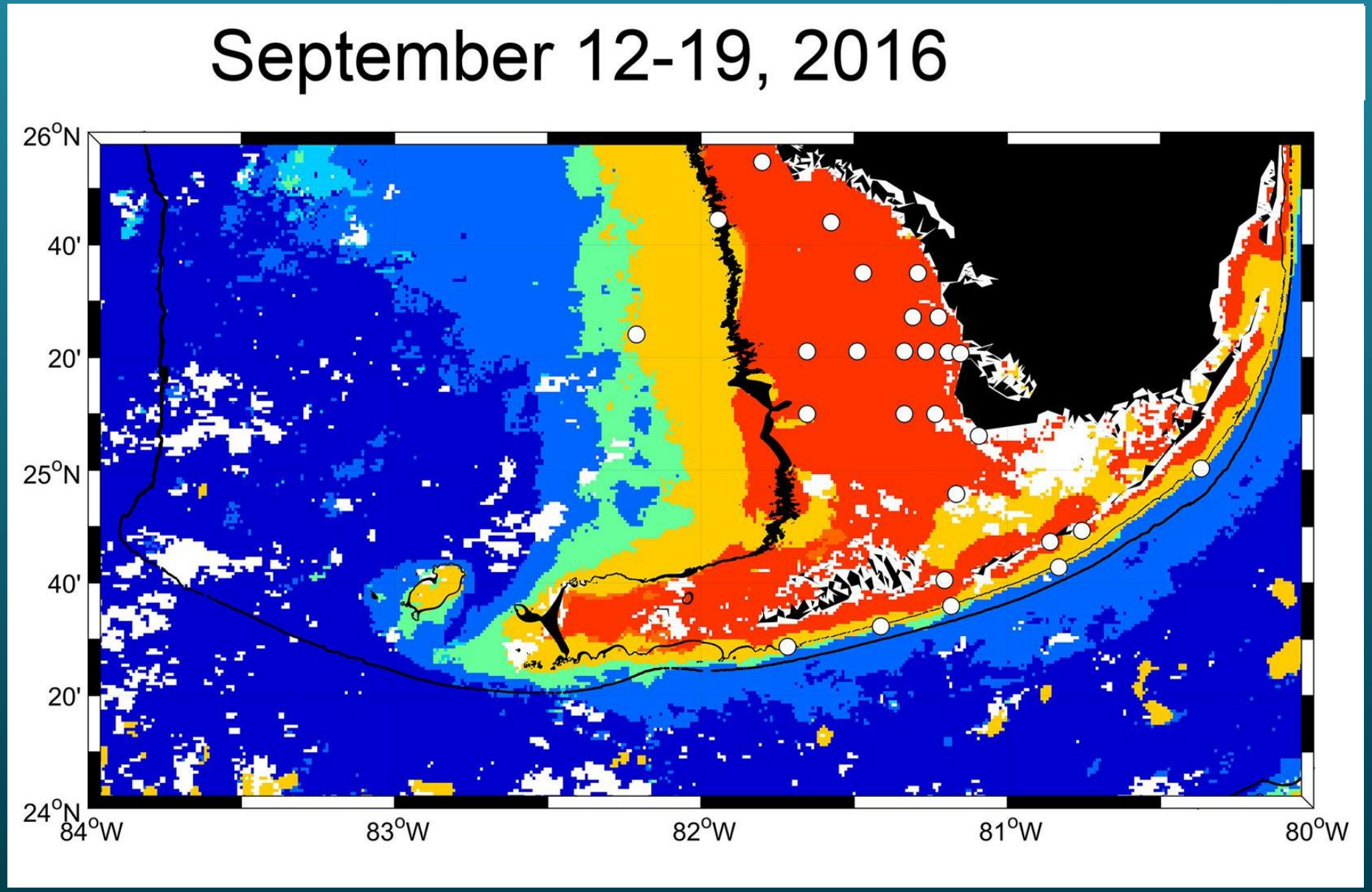
Relationship to Land Cover

- Land Cover includes non-ecosystem classes
- Often…the only maps available

- Challenges
  - Classes
  - Update frequency
  - Spatial resolution
  - Accuracy varies



Marine Ecosystems: “Seascapes”



Montes et al 2020, Front Mar Sci

Ecosystem Extent in the Context of GBF

2050 Goal	Components	Headline Indicators	Component Indicator
Goal A: The integrity of all ecosystems is enhanced, with an increase of at least 15% in the area, connectivity and integrity of natural ecosystems…	A.1. Area of natural ecosystems	A.0.1. Extent of selected natural and modified ecosystems…e.g.,: • Forest, savannahs & grasslands • Wetlands • Mangroves • Saltmarshes • Coral reef • Seagrass • Macroalgae • Intertidal habitats	[⟵]
	A.2. Connectivity of natural ecosystems	A.0.2. Species Habitat Index *(presented in the species population webinar)*	A.2.1. CMS Connectivity Indicator (CMS)
	A.3. Integrity of natural ecosystems		A.3.1. Ecosystem Integrity Index

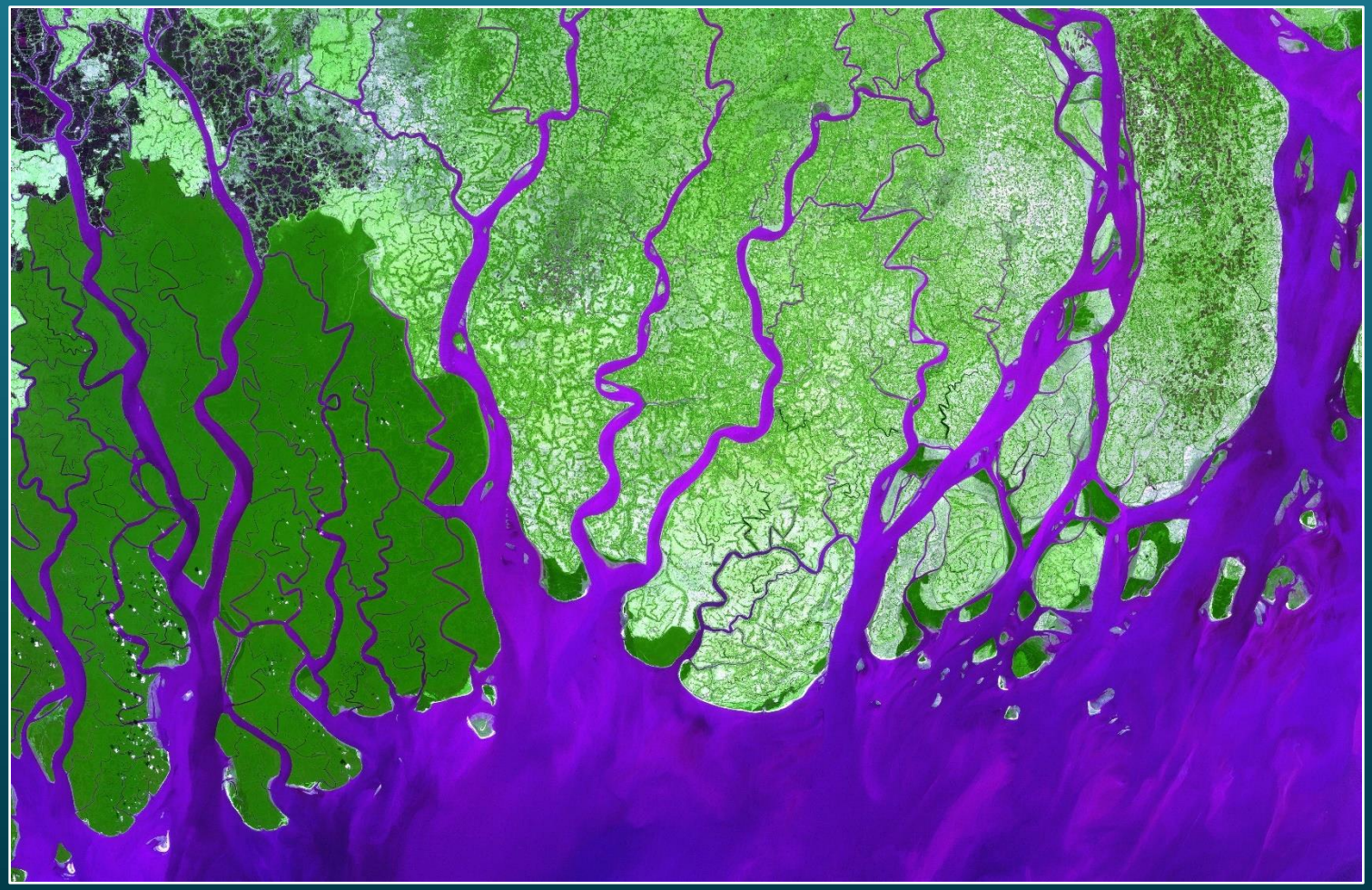
Proposed monitoring approach and headline, component and complementary indicators for the post-2020 global biodiversity framework CBD/WG2020/3/INF/2 (5 August 2021)… Annex I

Main Challenges

- Most common source: Land Cover maps
- Geographic and temporal availability varies
- Accuracy varies
- Classes

- Many datasets available on GEO BON EBV Data Portal
  - https://portal.geobon.org/datasets

Thank you



Improving capacity for monitoring ecosystem extent through the integration of global and national spatial data products

Victor H Gutierrez-Velez, Maria Cecilia Londoño, Jeronimo Rodriguez, Angela Mejia, Victoria Sarmiento, Wilson Lara, Ivan Gonzalez, Jaime Burbano



High-Resolution Global Maps of 21st-Century Forest Cover Change

Science

High-resolution mapping of global surface water and its long-term changes

nature

Annual maps of global artificial impervious area (GAIA) between 1985 and 2018

Remote Sensing of Environment

High-spatiotemporal-resolution mapping of global urban change from 1985 to 2015

nature sustainability

Mapping and sampling to characterize global inland water dynamics from 1999 to 2018 with full Landsat time-series

Remote Sensing of Environment

Global Food Security-Support Analysis Data at 30 m (GFSAD)

USGS science for a changing world

MAPPING TREE PLANTATIONS WITH MULTISPECTRAL IMAGERY: PRELIMINARY RESULTS FOR SEVEN TROPICAL COUNTRIES

WORLD RESOURCES INSTITUTE

Análisis de tendencias y patrones espaciales de deforestación en Colombia

IDEAM

ECOSISTEMAS CONTINENTALES, COSTEROS Y MARINOS DE COLOMBIA

IDEAM

Identificación espacial de los sistemas de humedales continentales de Colombia

INSTITUTO HUMBOLDT COLOMBIA

BioModelos

INSTITUTO HUMBOLDT COLOMBIA

MEJORES MODELOS CON EL APOYO DE EXPERTOS

Evaluación de tierras: zonificación

upra
Unidad de Planificación Rural Agropecuaria

METODOLOGÍA CORINE LAND COVER

IDEAM

Mapa Indicativo de Factores de Compensación

MINAMBIENTE

Regiones bióticas delimitadas para los grupos taxonómicos de aves, mamíferos y herpetos.

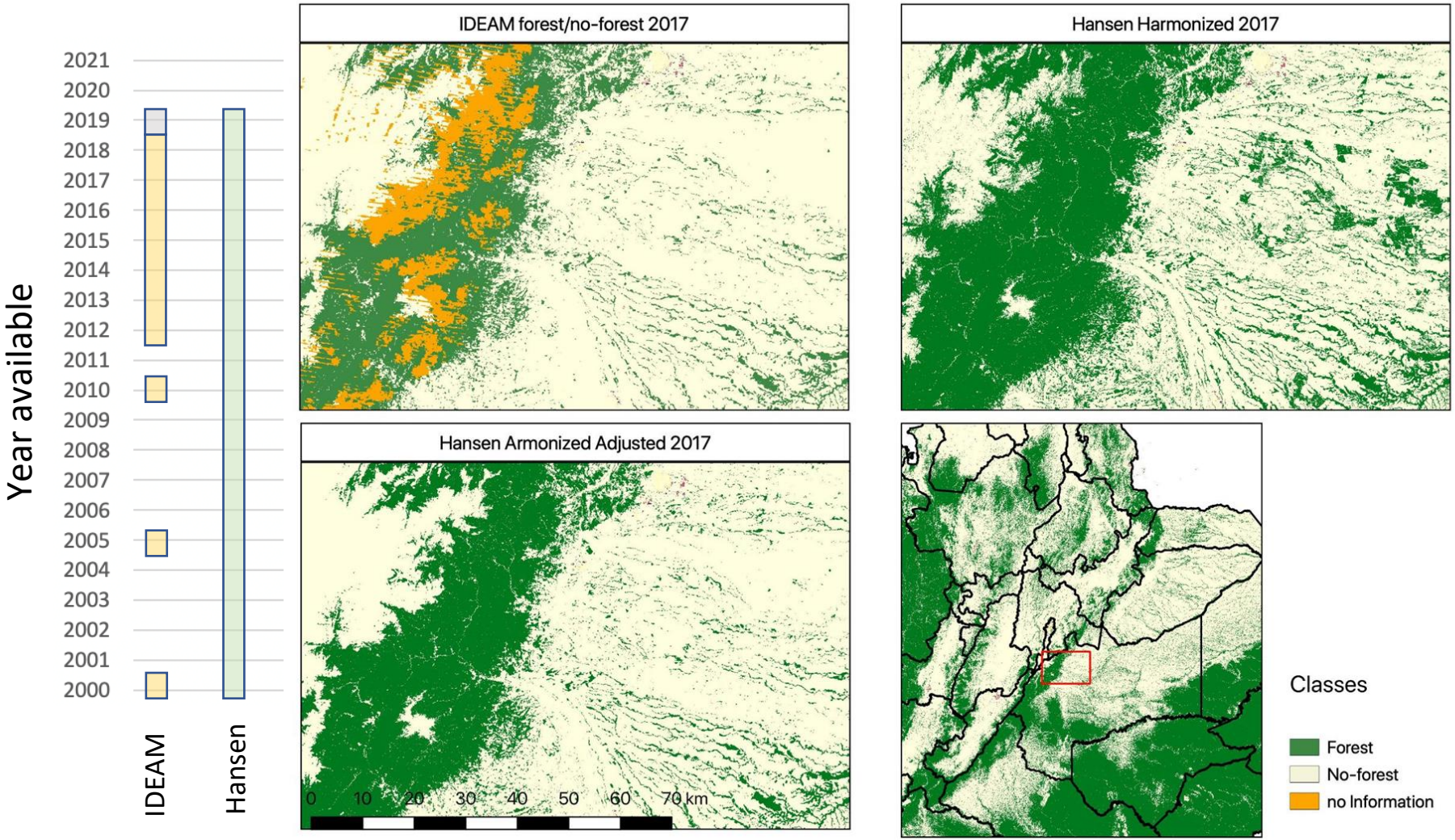
INSTITUTO HUMBOLDT COLOMBIA

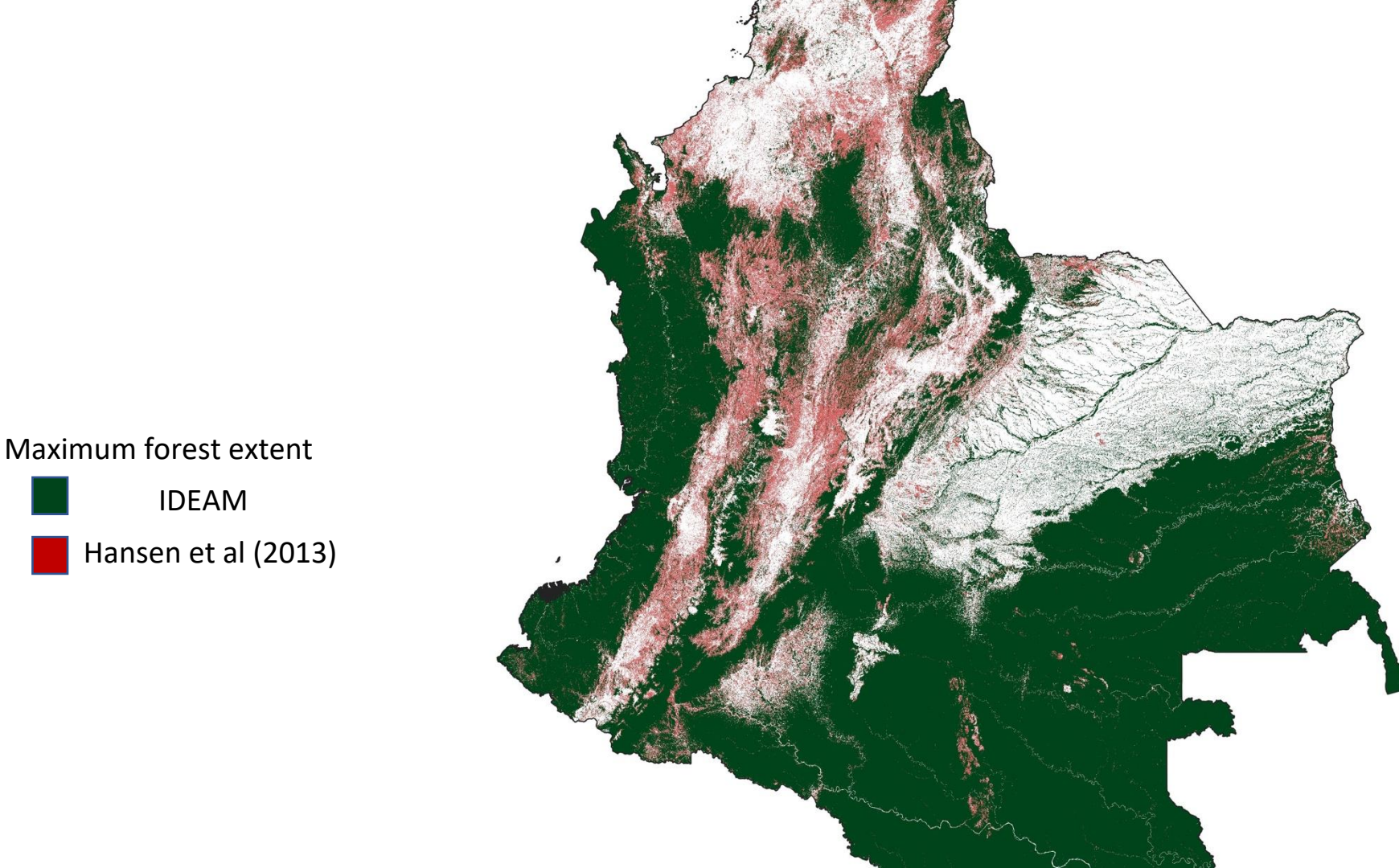
Priorities for improving the monitoring of ecosystem extent through data integration

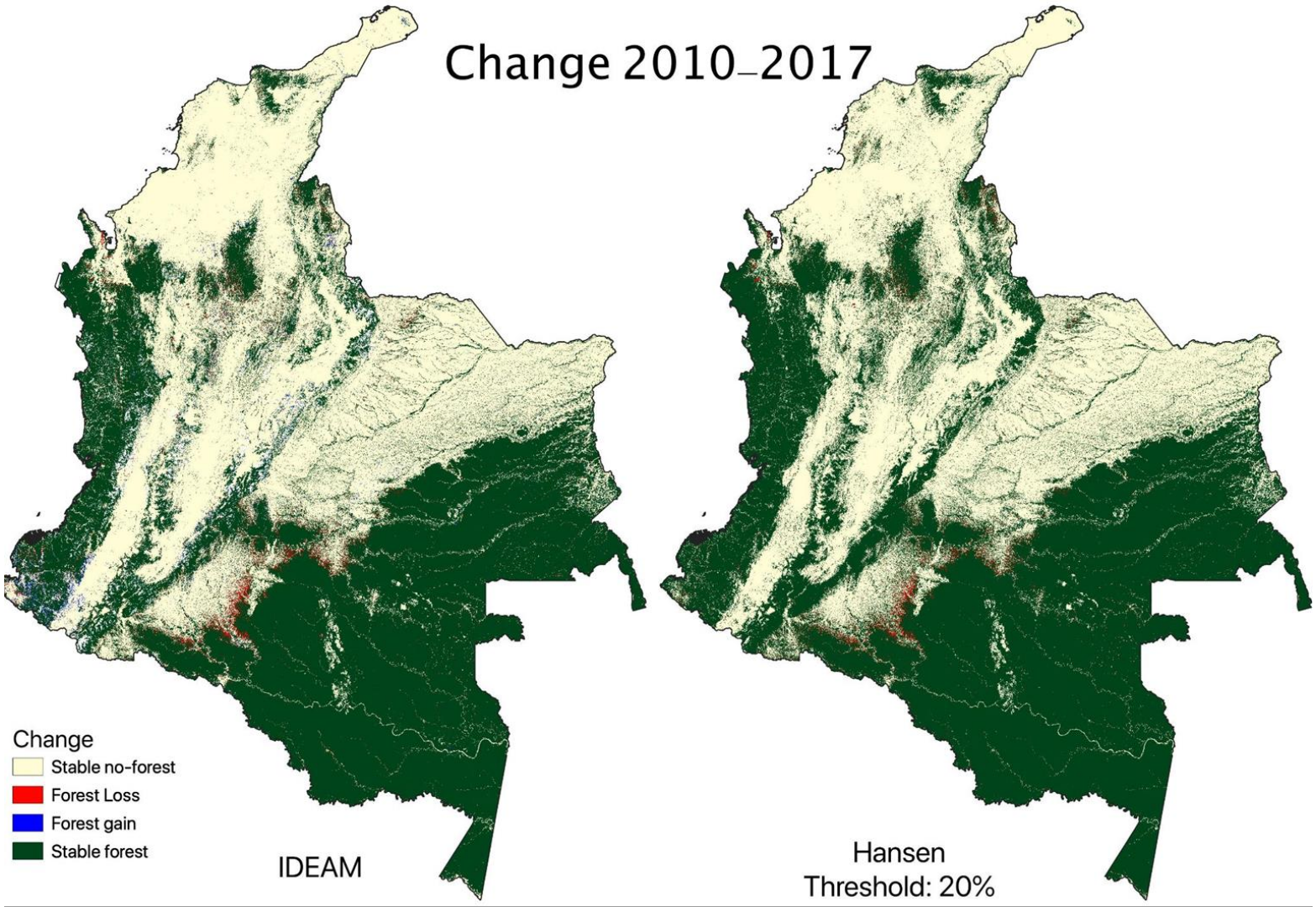
- To produce methods for data integration, QA/QC, gap identification and gap filling
- To produce software that facilitates data integration and analysis
- To enable access to data and methods to inform reporting and decision-making.

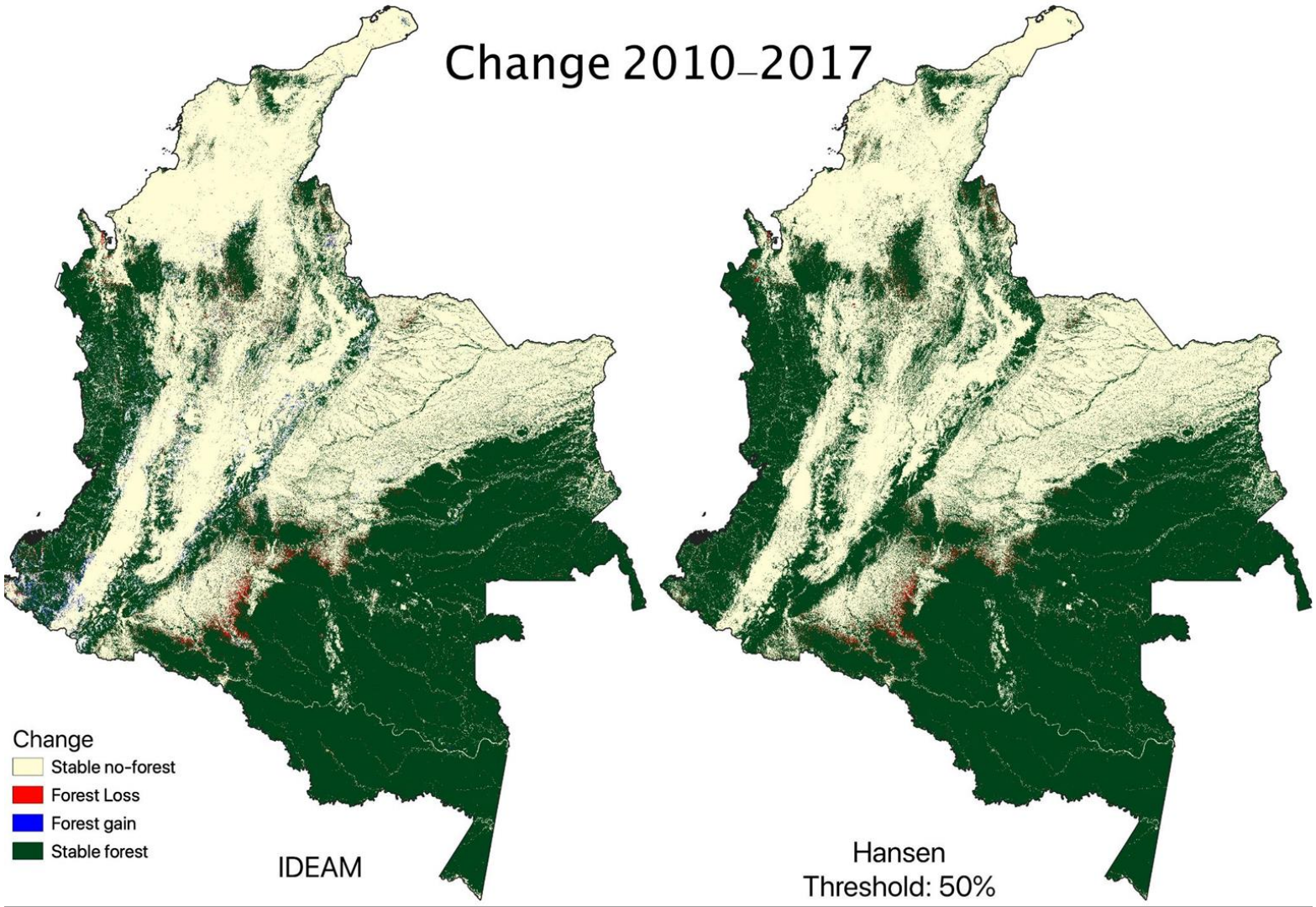
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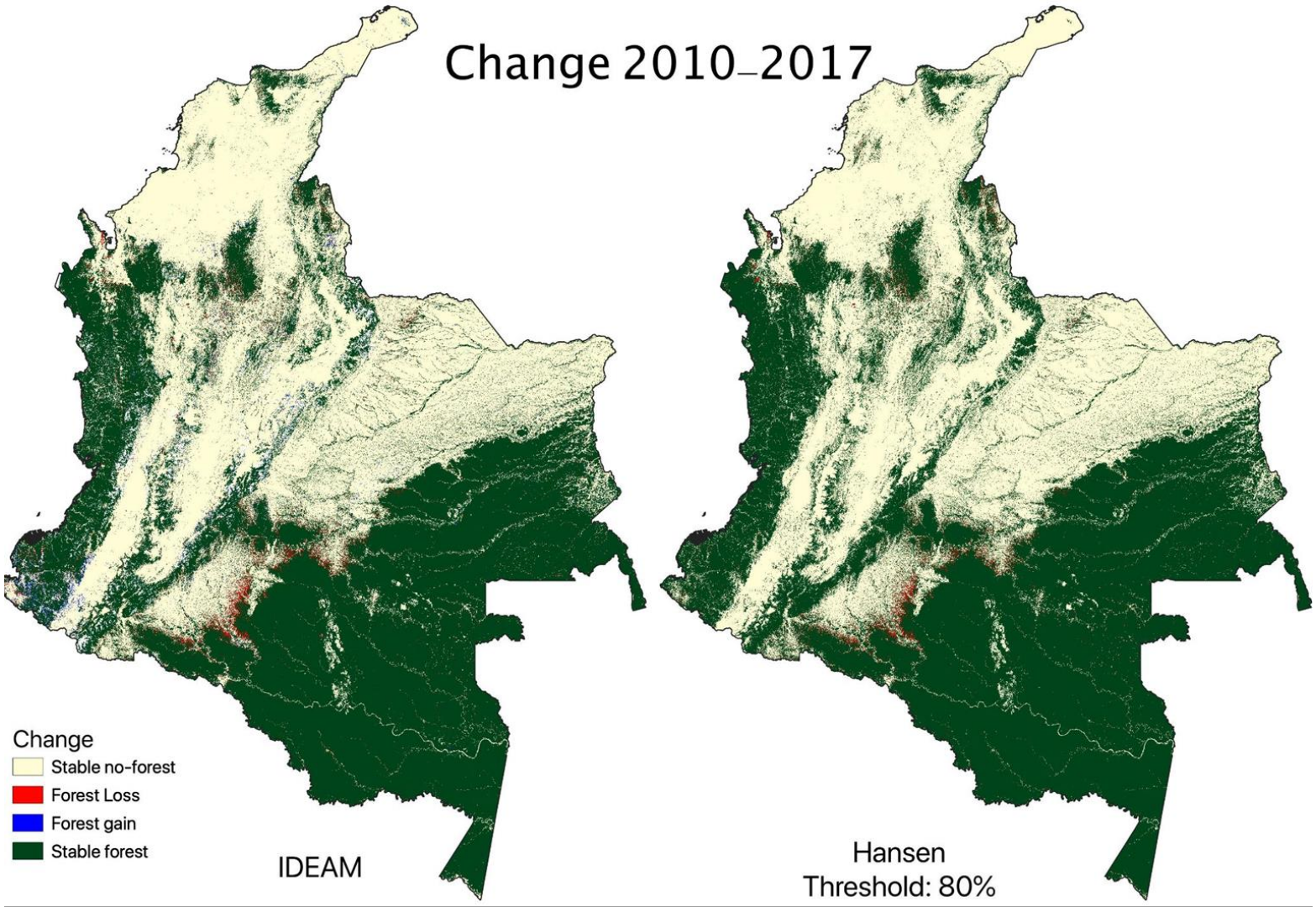
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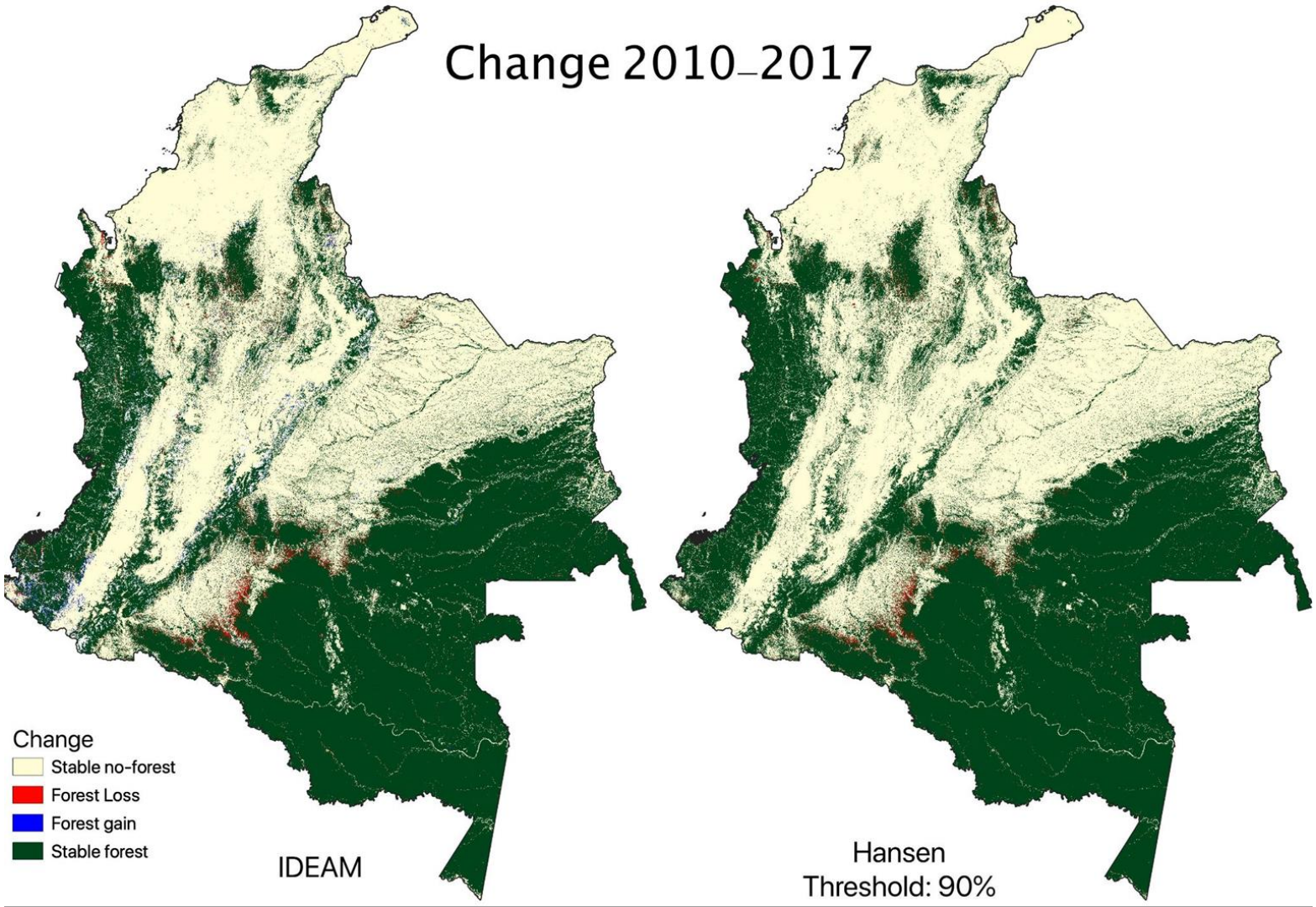

Year available
2021
2020
2019
2018
2017
2016
2015
2014
2013
2012
2011
2010
2009
2008
2007
2006
2005
2004
2003
2002
2001
2000
IDEAM
Hansen
IDEAM forest/no-forest 2017
Hansen Harmonized 2017
Hansen Armonized Adjusted 2017
0 10 20 30 40 50 60 70 km
Classes
Forest
No-forest
no Information

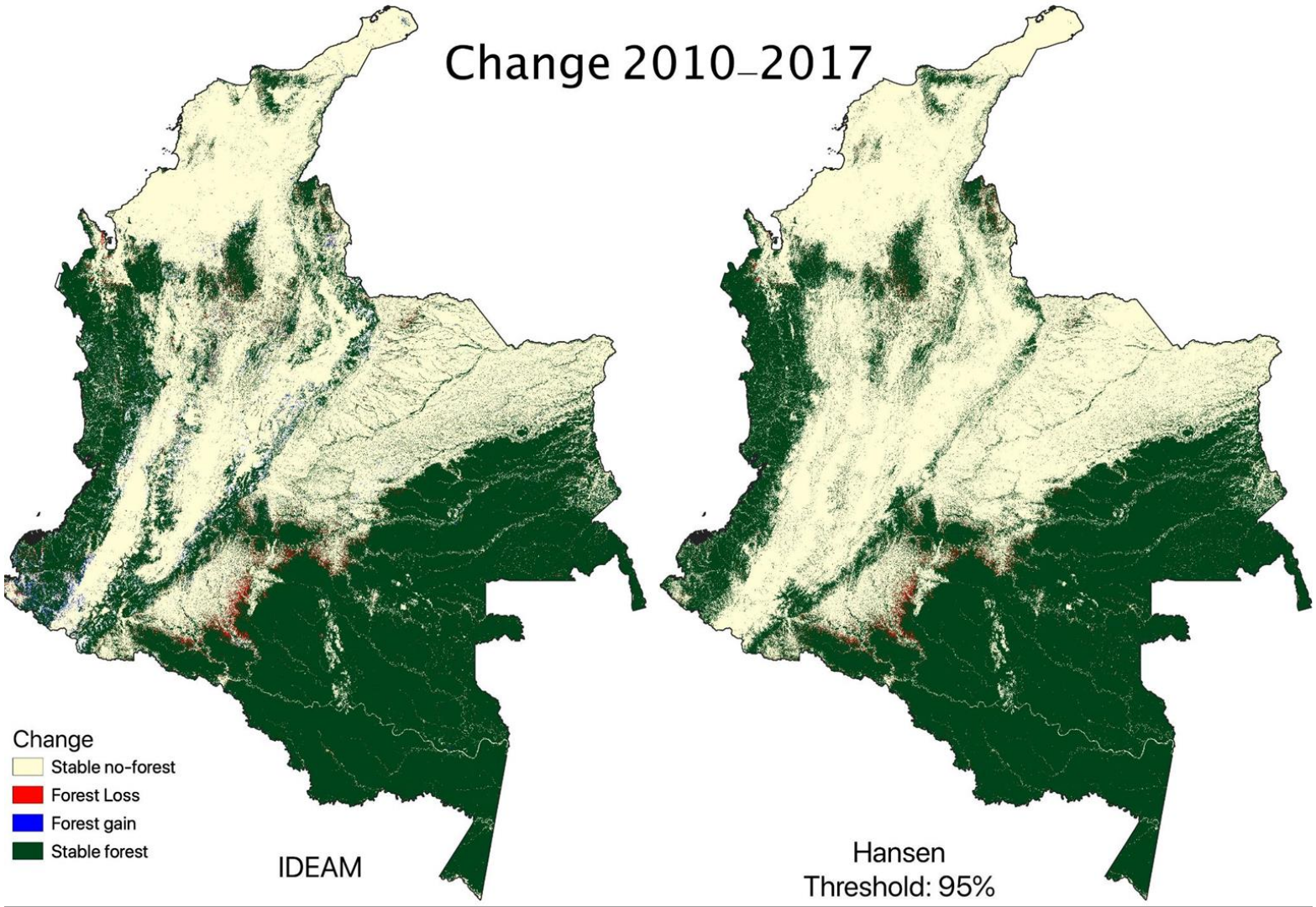

Maximum forest extent
IDEAM
Hansen et al (2013)

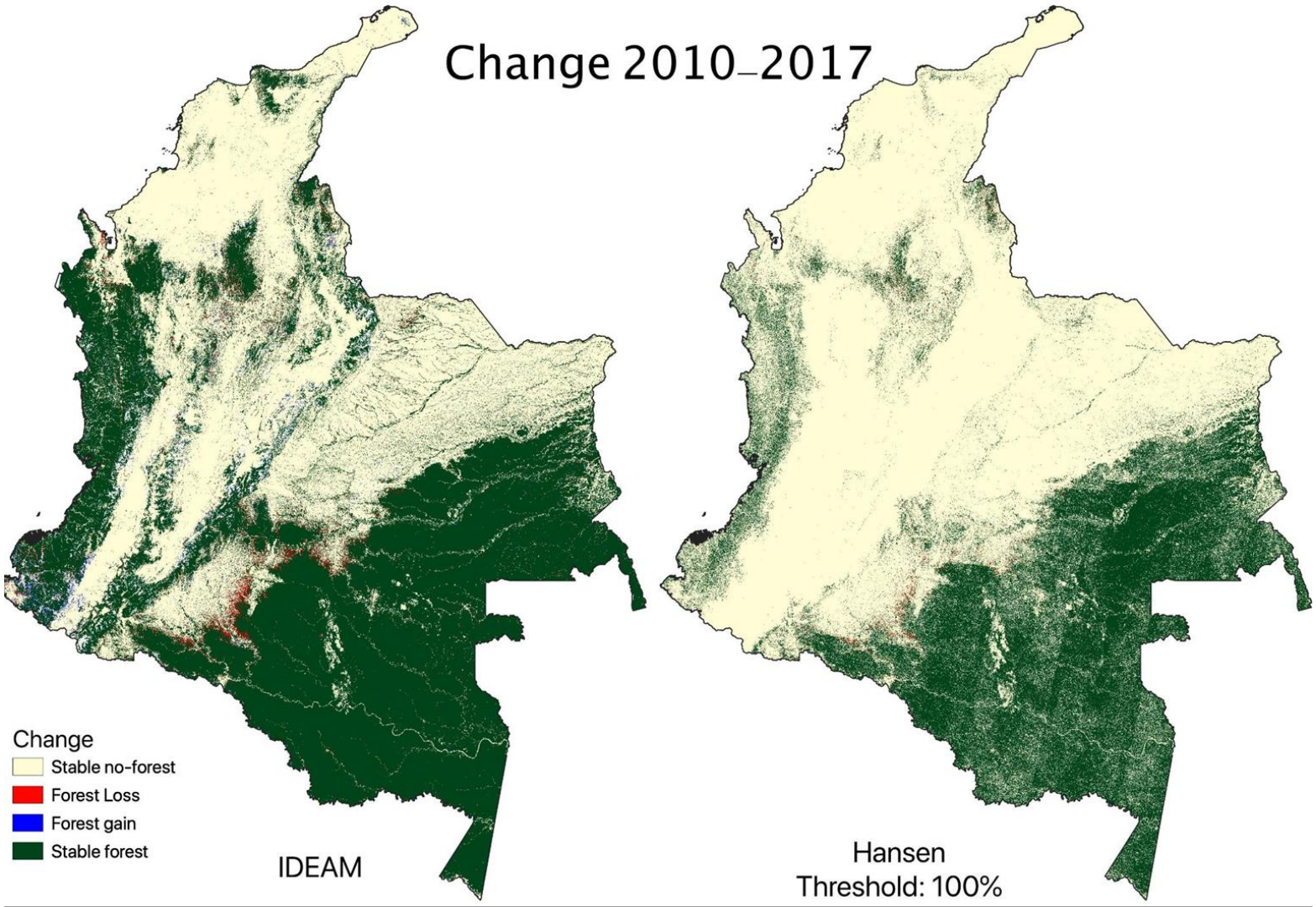

Change 2010_2017
Change
Stable no-forest
Forest Loss
Forest gain
Stable forest
IDEAM
Hansen
Threshold: 20%


Change 2010_2017
Change
Stable no-forest
Forest Loss
Forest gain
Stable forest
IDEAM
Hansen
Threshold: 50%


Change 2010_2017
Change
Stable no-forest
Forest Loss
Forest gain
Stable forest
IDEAM
Hansen
Threshold: 80%


Change 2010_2017
Change
Stable no-forest
Forest Loss
Forest gain
Stable forest
IDEAM
Hansen
Threshold: 90%


Change 2010_2017
Change
Stable no-forest
Forest Loss
Forest gain
Stable forest
IDEAM
Hansen
Threshold: 95%

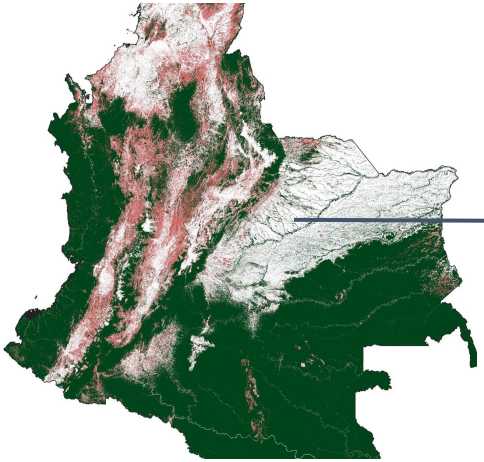

Change 2010_2017
Change
Stable no-forest
Forest Loss
Forest gain
Stable forest
IDEAM
Hansen
Threshold: 100%

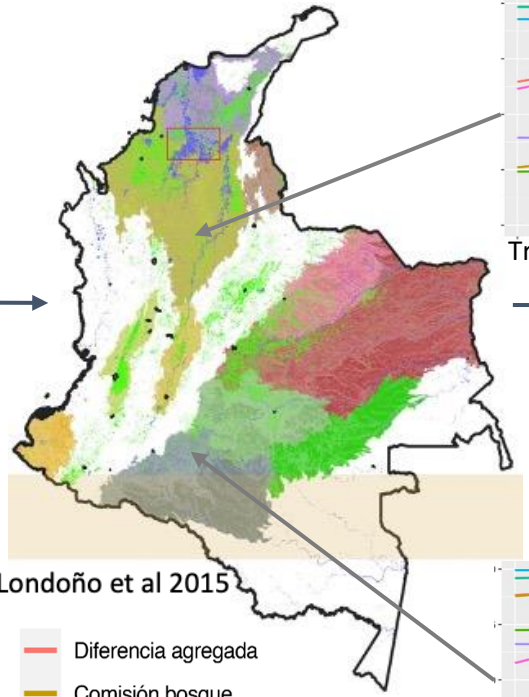
Maximum common extent
IDEAM-HANSEN

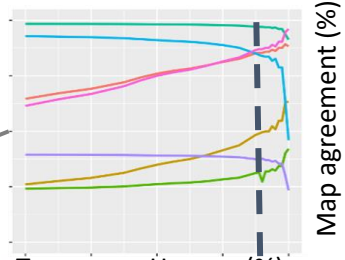
National biotic units

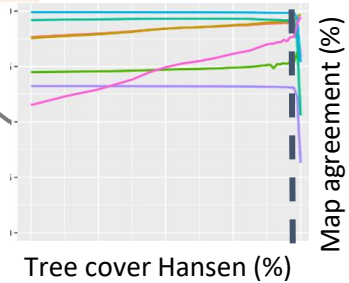
Optimal agreement per unit

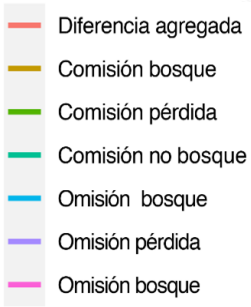
Harmonized map

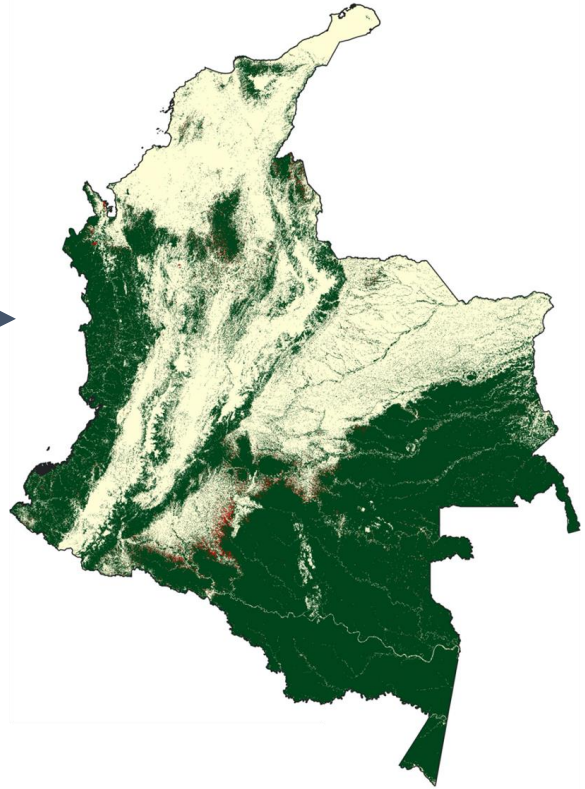




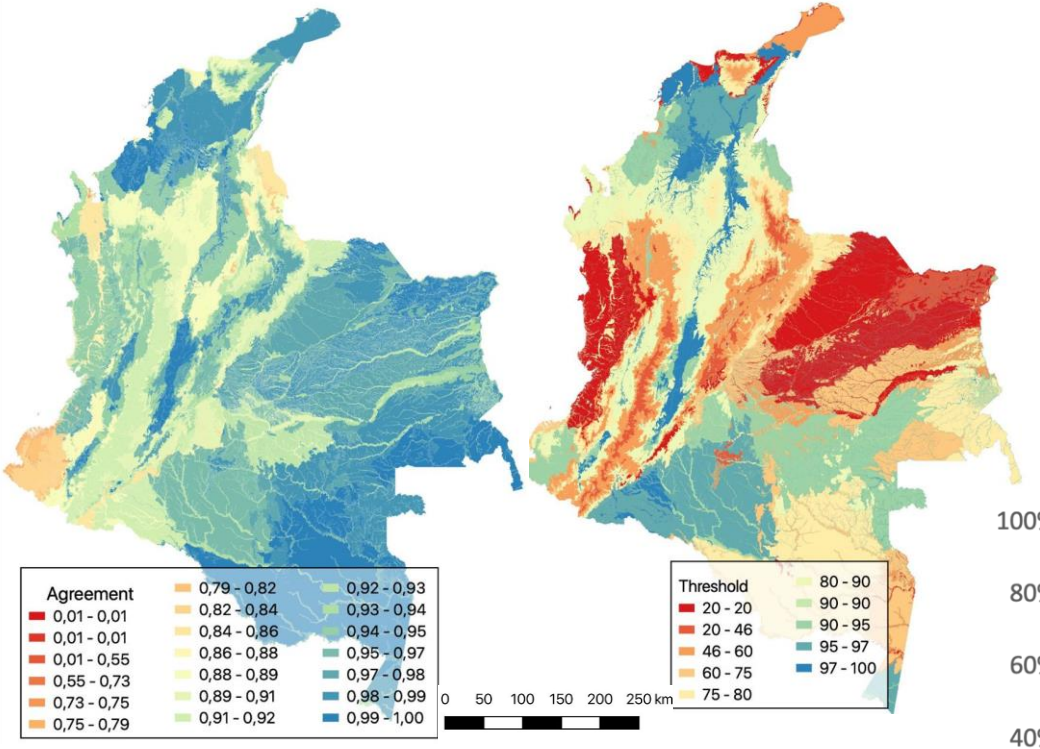






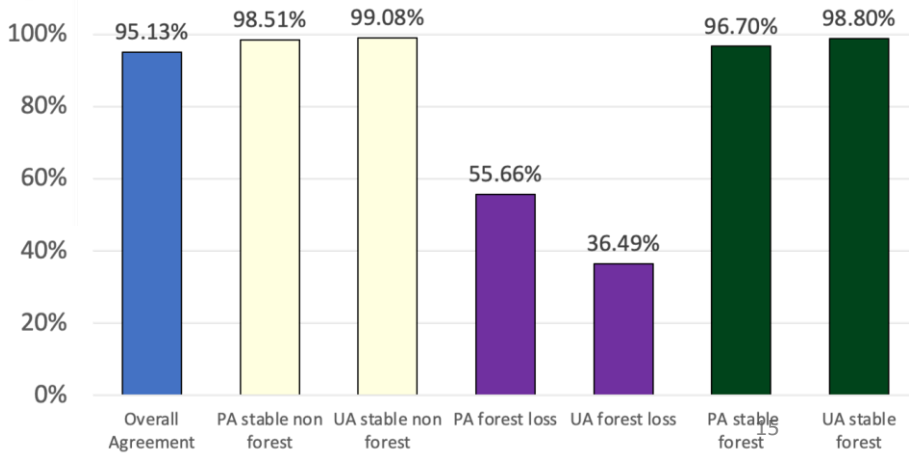


Overall agreement

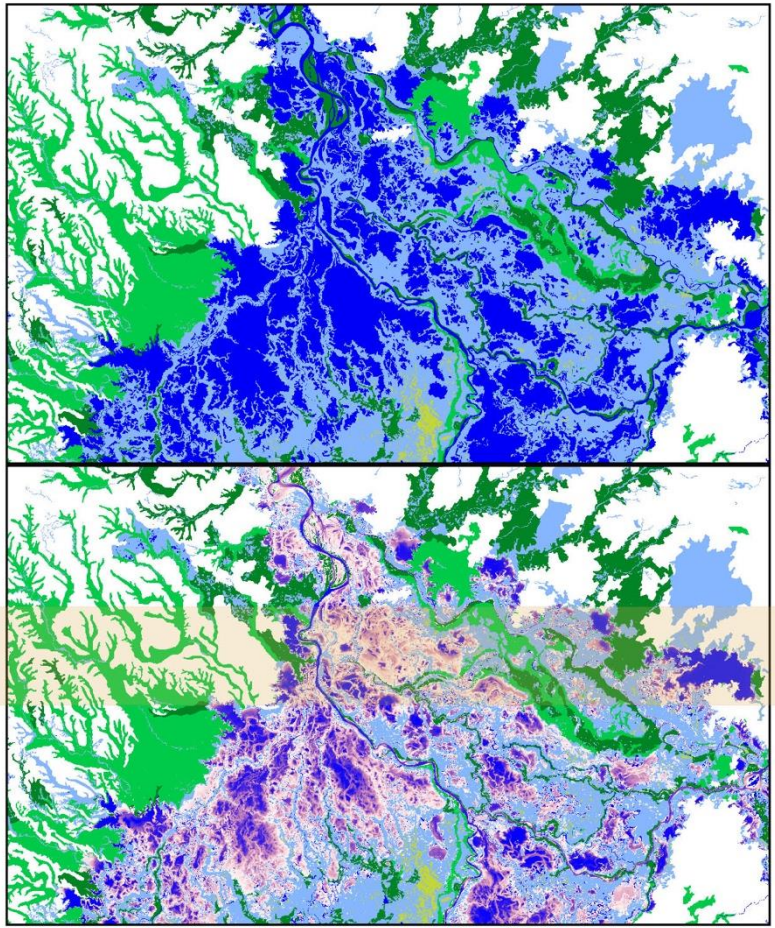


Optimum threshold

Country wide weighted agreement



Wetlands



0 10 20 30 40 50 60 km

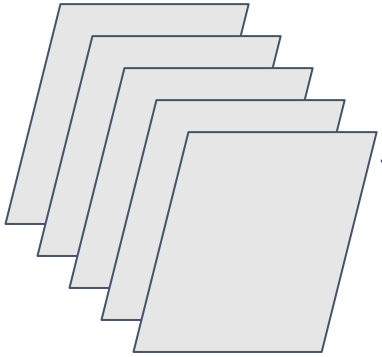
Wetlands IAVH
- Permanent
- Permanent under Canopy
- Seasonal
- Mid Potential
- Low Potential

Florez et al 2016

Ocurrence (1984_2018)
- Not water
- 1%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

Pekel et al 2016

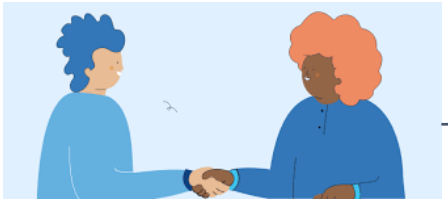
Ecosystem and Land cover products



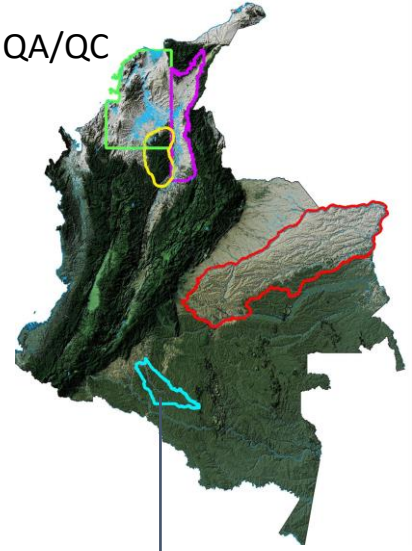
Land cover legend



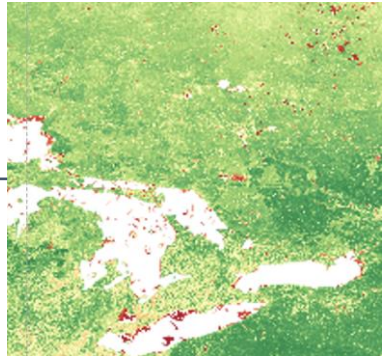
Resolve classification conflicts (decision rules)



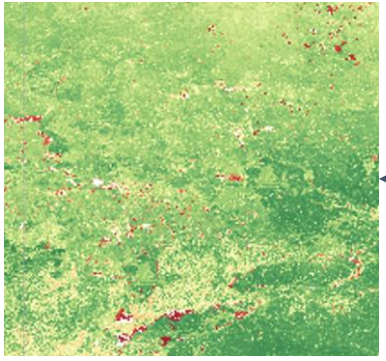
QA/QC



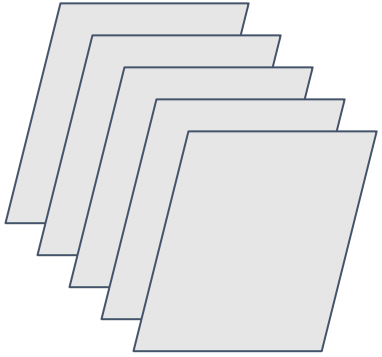
Identification of data gaps



Gap filling



Multi-temporal spectral metrics



Priorities for improving the monitoring of ecosystem extent through data integration

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Integrating Ecological Remote Sensing Data to Derive EBV Metrics





Documentation for package ‘ecochange’ version 1.3

Layer	Dataset	Author
occurrence	Global Surface Water	Pekel et.al., 2016
change		
seasonality		
recurrence		
transition		
extent		
treecover2000	Global Forest Change	Hansen et.al., 2013
lossyear		
gain		
datamask		
first		
last		
TC_2000	Global Continuous Tree Cover data	Sexton et.al., 2013
TC_2005		
TC_2010		
TC_2015		

https://cran.r-project.org/web/packages/ecochange/ecochange.pdf

INTERNATIONAL JOURNAL OF REMOTE SENSING
2021, VOL. 42, NO. 19, 7428–7453
https://doi.org/10.1080/01431161.2021.1958391

Taylor & Francis
Taylor & Francis Group

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Probabilistic approximation to change and no change in multispectral remote sensing

Victor Hugo Gutierrez-Velez, Jeronimo Rodriguez-Escobar, Wilson Lara and Victoria Sarmiento-Giraldo

Department of Geography and Urban Studies, Temple University, Philadelphia, PA, USA

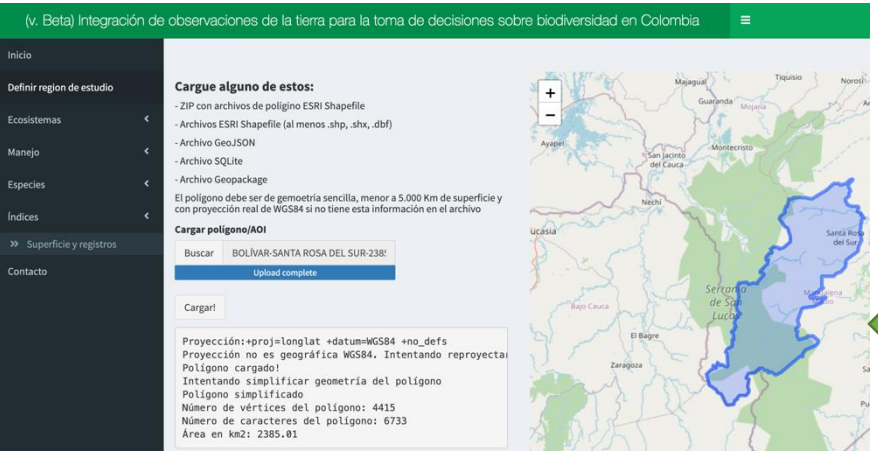
Gutierrez-Velez et al

rastermapr package

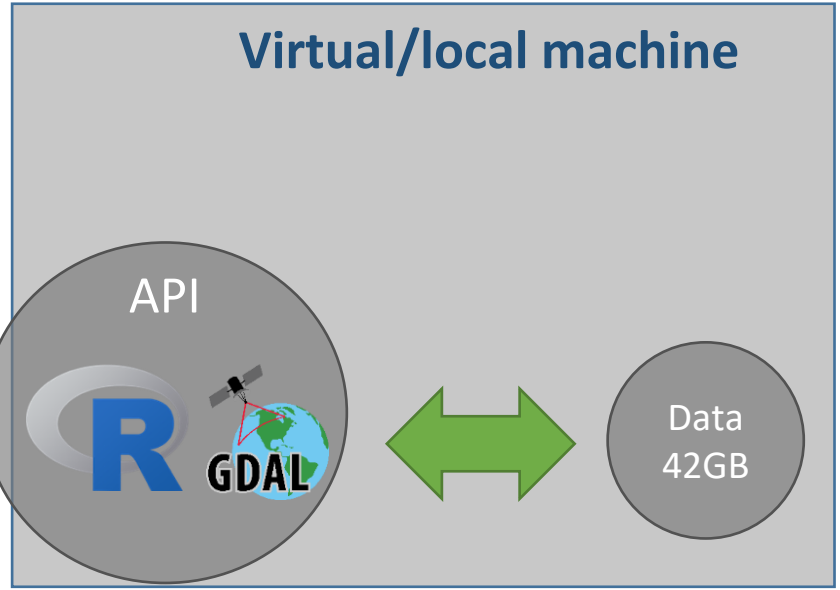
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1. Front-end



2. Back-end



Queries

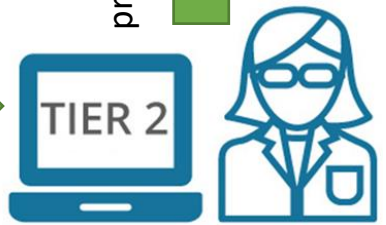


3. Software

ecoChange R

rastermapr R

New products



Take home messages

- The harmonization of global and national data sets aims to inform biodiversity monitoring and decision making nationally while ensuring consistency with global assessments.

- The development of a cloud infrastructure facilitates the use of harmonized data for characterizing, monitoring and reporting biodiversity conservation efforts.

- The integration of data, software and infrastructure can enable dynamic data improvements and timely data use for decision-making.

Improving capacity for monitoring ecosystem extent and integrity through the integration of global and national spatial data products

Victor H Gutierrez-Velez, Maria Cecilia Londoño, Jeronimo Rodriguez, Angela Mejia, Victoria Sarmiento, Wilson Lara, Ivan Gonzalez, Jaime Burbano

victorhugo@temple.edu



BOSProject
Biodiversity Observation Support

www.bosproject.org

DEAKIN UNIVERSITY

RED LIST OF ECOSYSTEMS



Ecosystems in the post-2020 global biodiversity framework

Professor Emily Nicholson (Deakin University, Australia)

nature ecology & evolution

PERSPECTIVE

https://doi.org/10.1038/s41559-021-01538-5

Check for updates

Scientific foundations for an ecosystem goal, milestones and indicators for the post-2020 global biodiversity framework

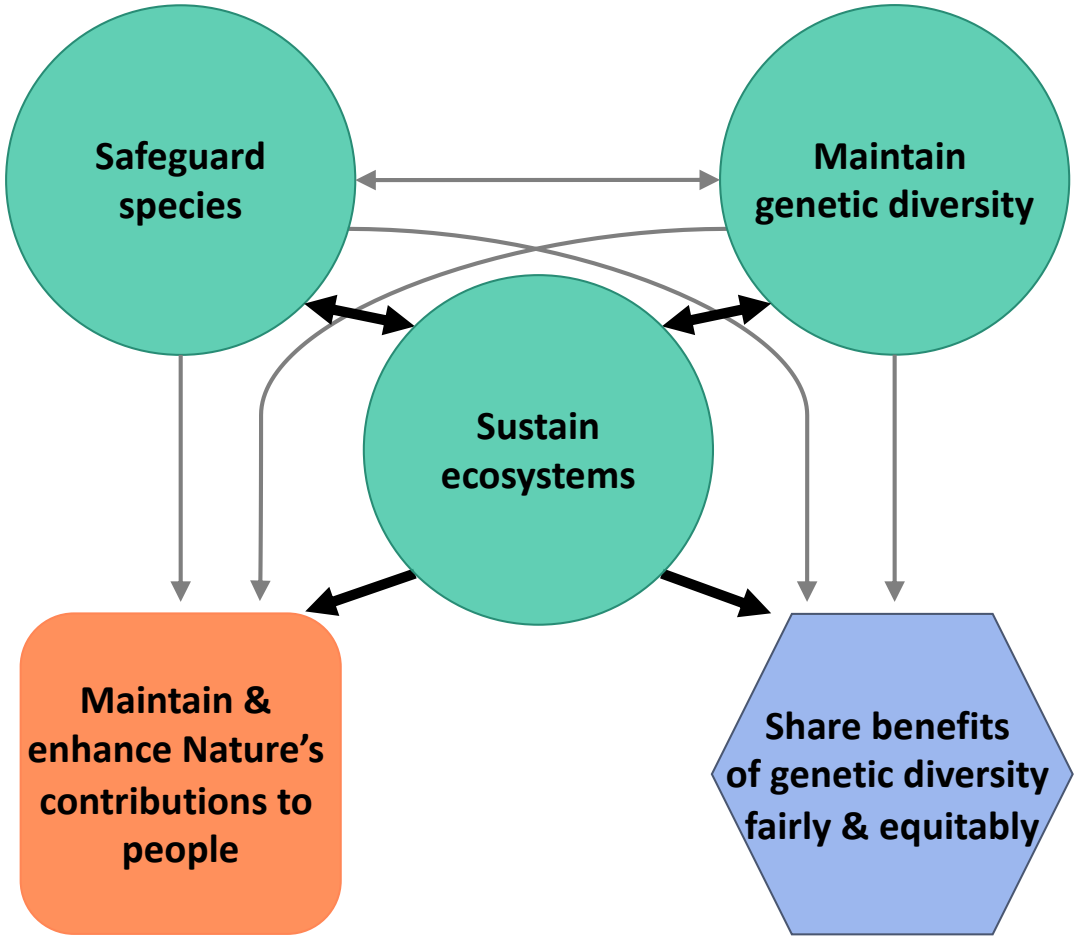
Emily Nicholson[1,2]✉, Kate E. Watermeyer[1], Jessica A. Rowland[1], Chloe F. Sato[1], Simone L. Stevenson[1], Angela Andrade[2,3], Thomas M. Brooks[4,5,6], Neil D. Burgess[7,8], Su-Ting Cheng[9], Hedley S. Grantham[10], Samantha L. Hill[7], David A. Keith[2,11,12], Martine Maron[13], Daniel Metzke[14], Nicholas J. Murray[15], Cara R. Nelson[2,16], David Obura[17], Andy Plumptre[18], Andrew L. Skowno[19,20] and James E. M. Watson[13]



Ecosystems in the Post-2020 Global Biodiversity Framework

- Strategic Plan for Biodiversity 2011-2020, created in 2010, include the **Aichi Biodiversity Targets**
  - 20 targets under 5 goals, none met (some partially met)
  - Species targets (no extinctions) but no specific ecosystem target
- Goals of the first draft of the post-2020 global biodiversity framework

Convention on Biological Diversity



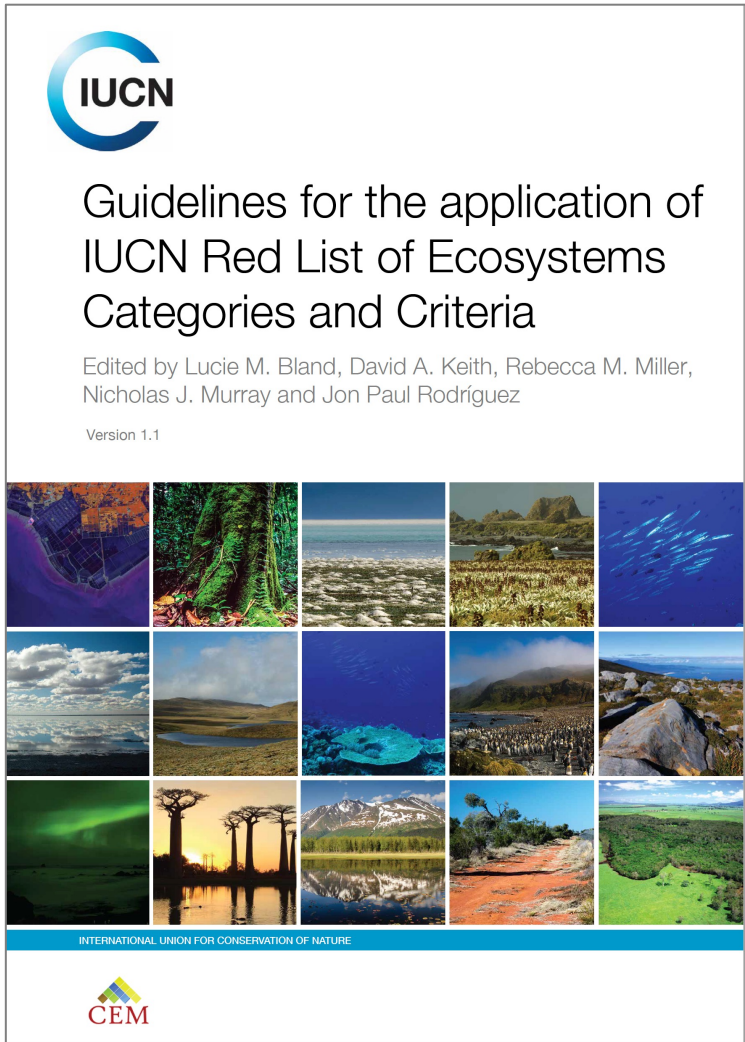
Watson, J.E.M., Keith, D.A., Strassburg, B.B.N., Venter, O., Williams, B., Nicholson, E. (2020) Set a global target for ecosystems. *Nature* 578, 360-362.

Nicholson et al. (2021) Scientific foundations for an ecosystem goal & indicators for the post-2020 global biodiversity framework. *Nature Ecol & Evol*

Why an ecosystem goal?

Big developments in ecosystem conservation science over last decades:

- Accepted definitions of ecosystems and collapse
  - Ecosystem: biotic and abiotic components, processes and interactions within and between them, in a place
  - Collapse: endpoint of decline, defining features are lost, replacement by another ecosystem type



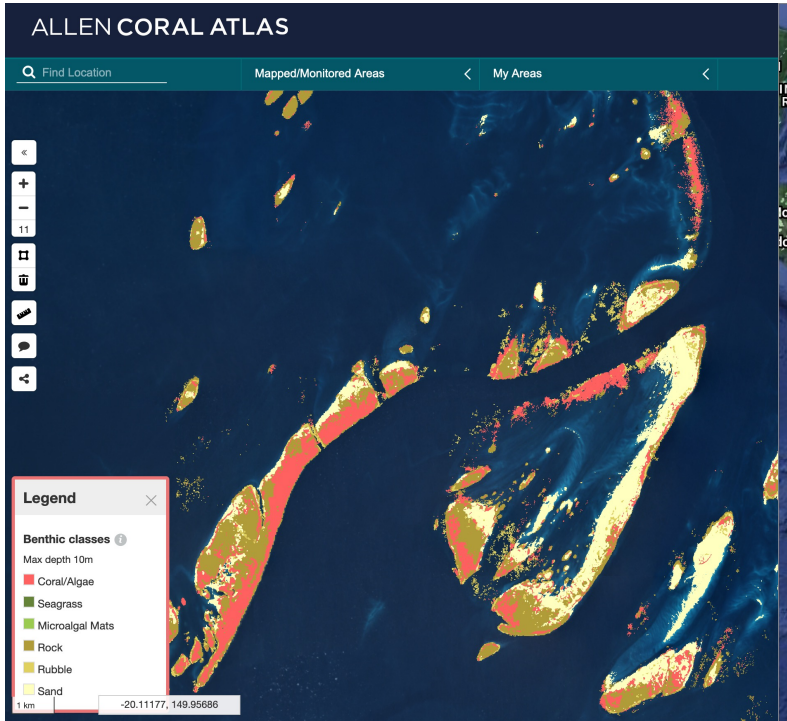
Why an ecosystem goal?

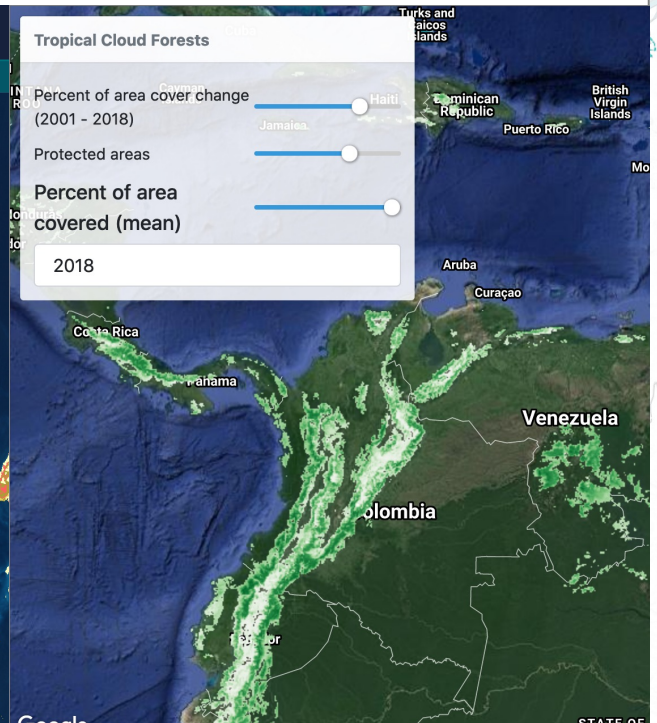
Big developments in ecosystem conservation science over last decades:

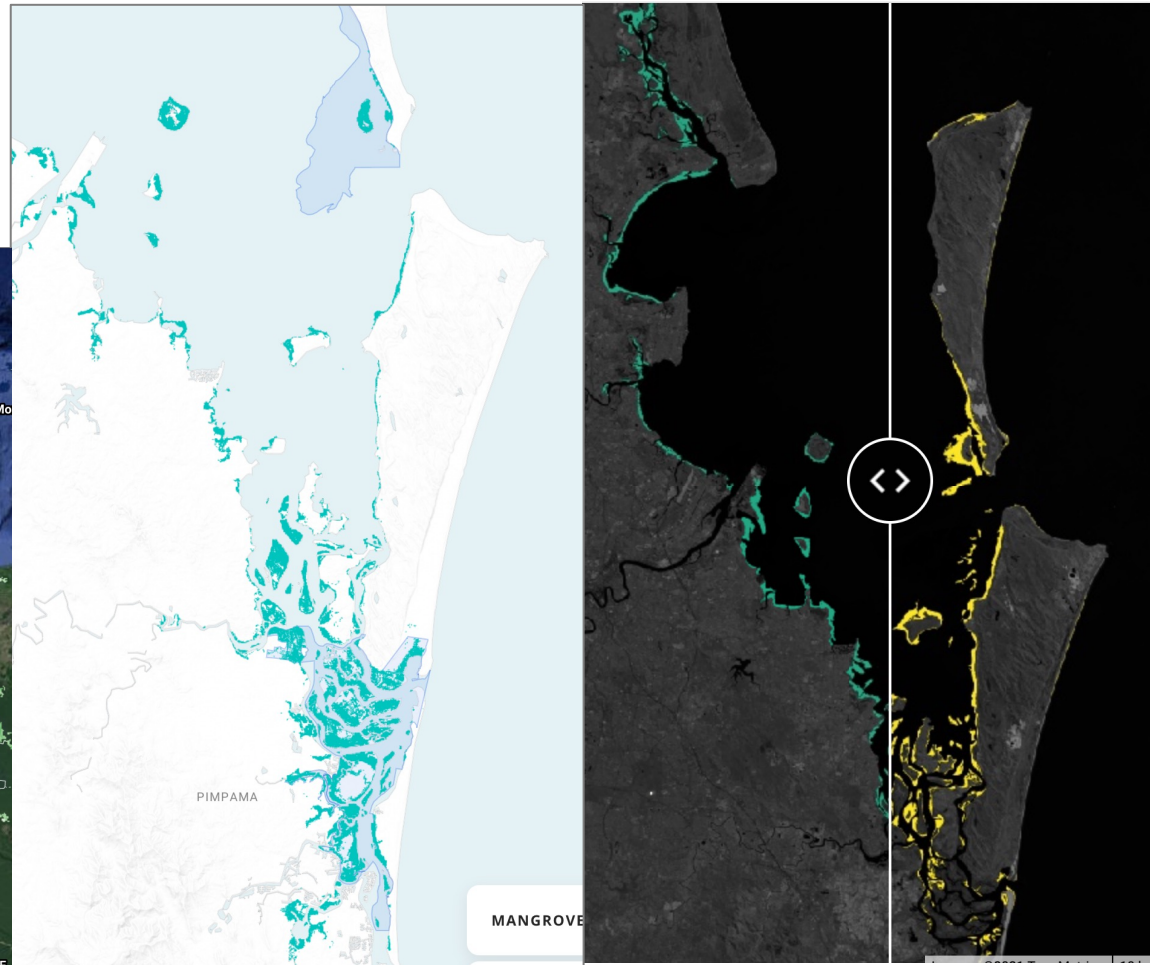
- Accepted definitions of ecosystems and collapse
- Ecosystem mapping

https://www.globalmangrovewatch.org https://www.intertidal.app/

http://www.earthenv.org/cloudforest





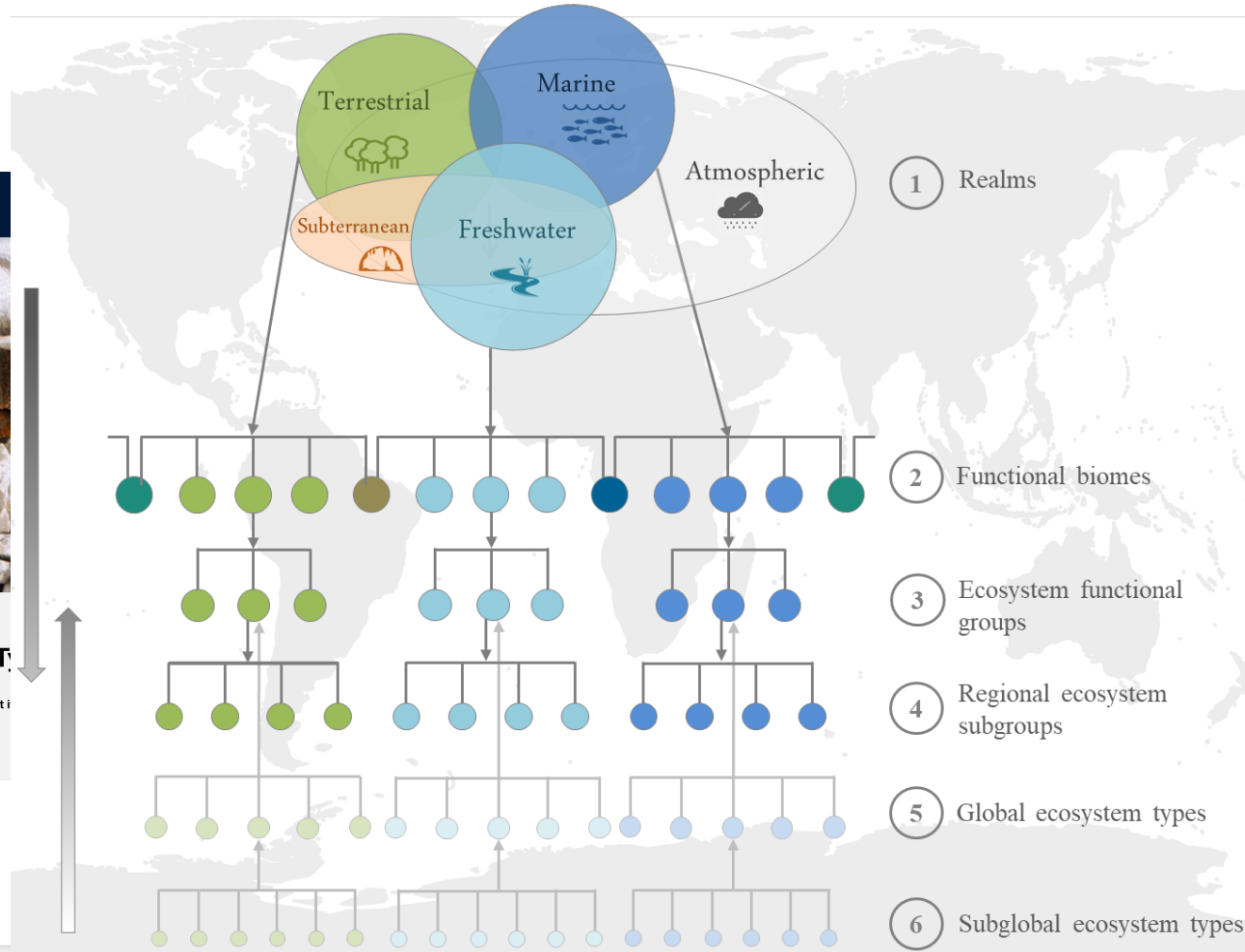


Why an ecosystem goal?

Big developments in ecosystem conservation science over last decades:

- Accepted definitions of ecosystems and collapse
- Ecosystem mapping
- Ecosystem classification: https://global-ecosystems.org/





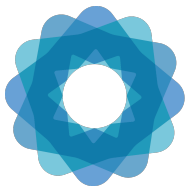
Why an ecosystem goal?

Big developments in ecosystem conservation science over last decades:

- Accepted definitions of ecosystems and collapse
- Ecosystem mapping
- Ecosystem classification: https://global-ecosystems.org/
- Ecosystem risk assessment: Red List of Ecosystems

>3000 ecosystem assessed http://iucnrle.org

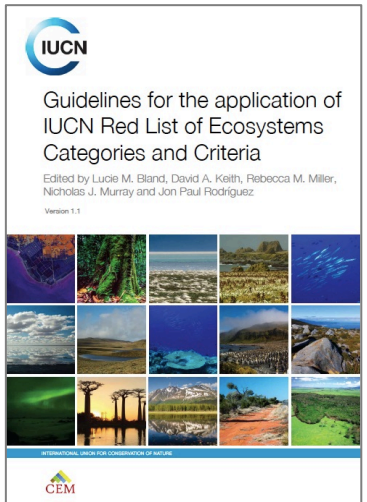
- Ecosystem accounting: https://seea.un.org/

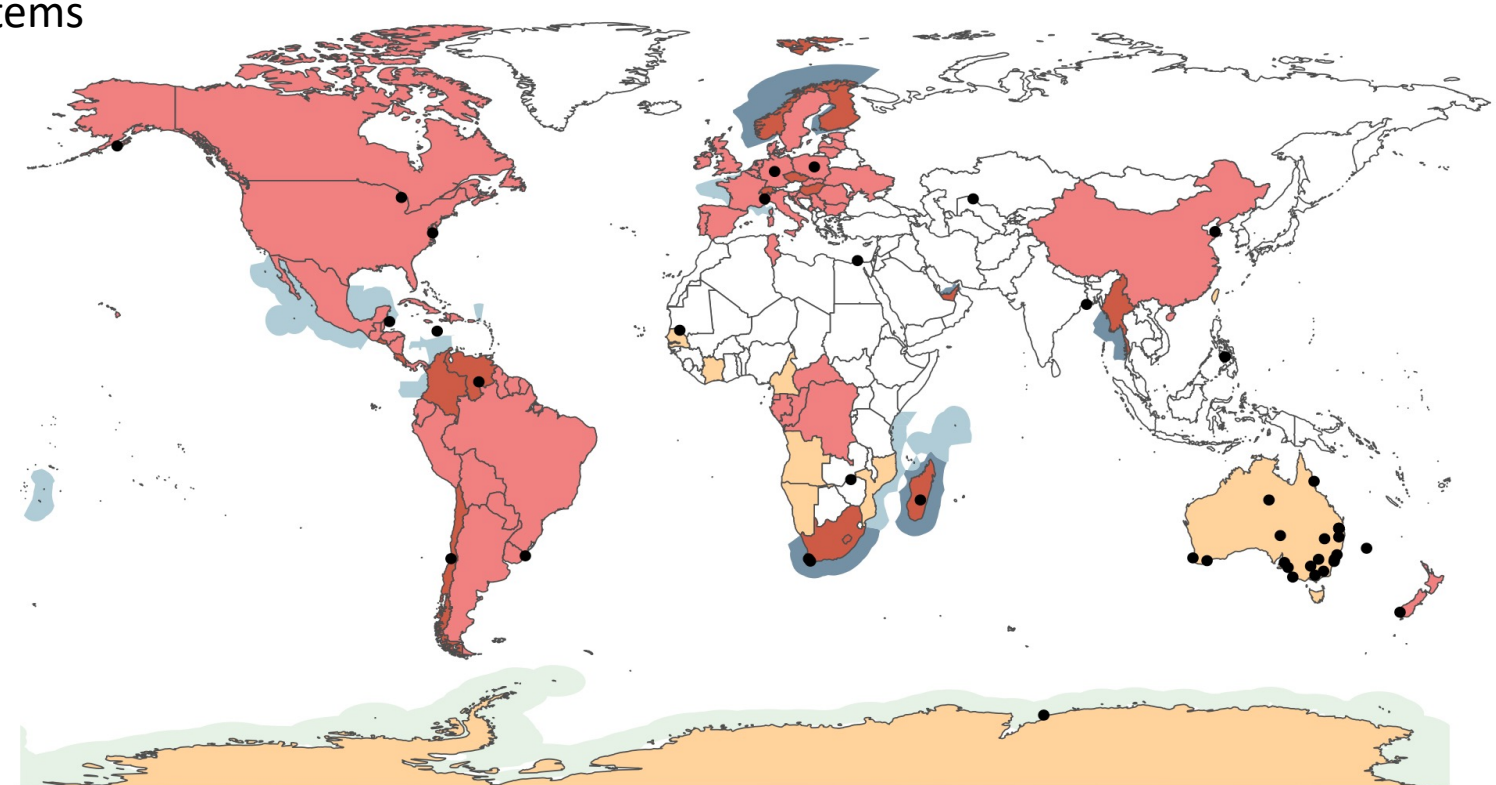


System of Environmental Economic Accounting



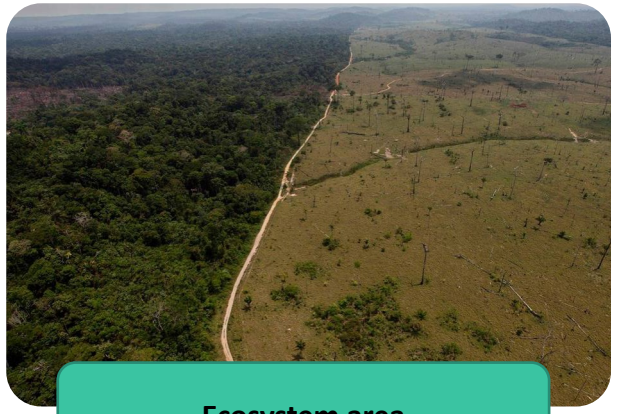






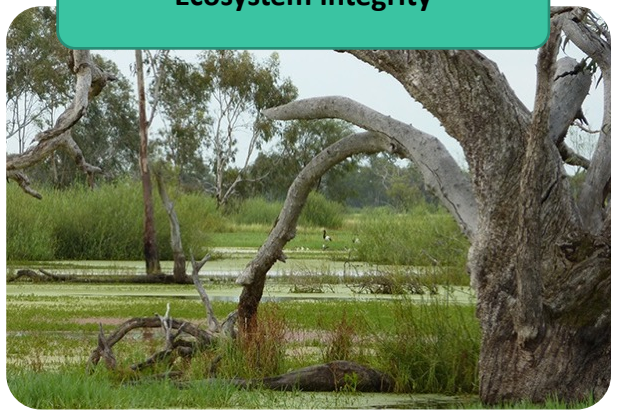
Core components for an ecosystem goal

1. Ecosystem area or extent
2. Ecosystem integrity
3. Risk of ecosystem collapse



Ecosystem area

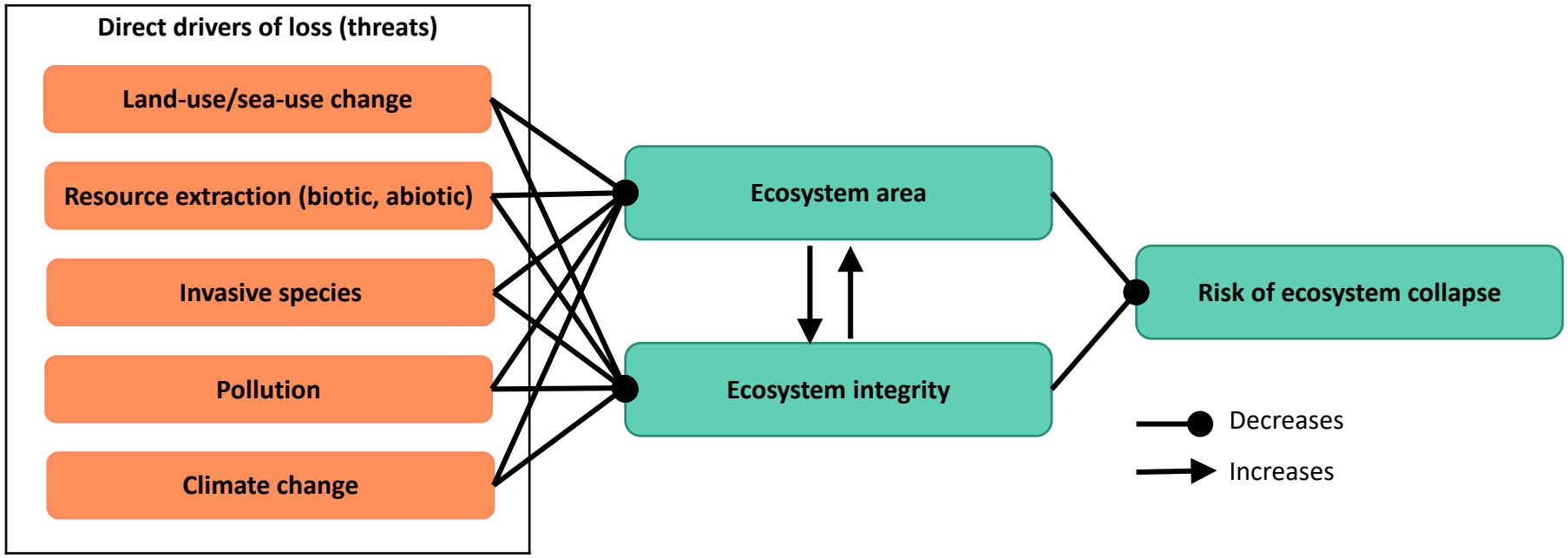
Ecosystem integrity



Risk of ecosystem collapse

CO	Collapsed
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
NT	Near Threatened
LC	Least Concern
DD	Data Deficient
NE	Not Evaluated

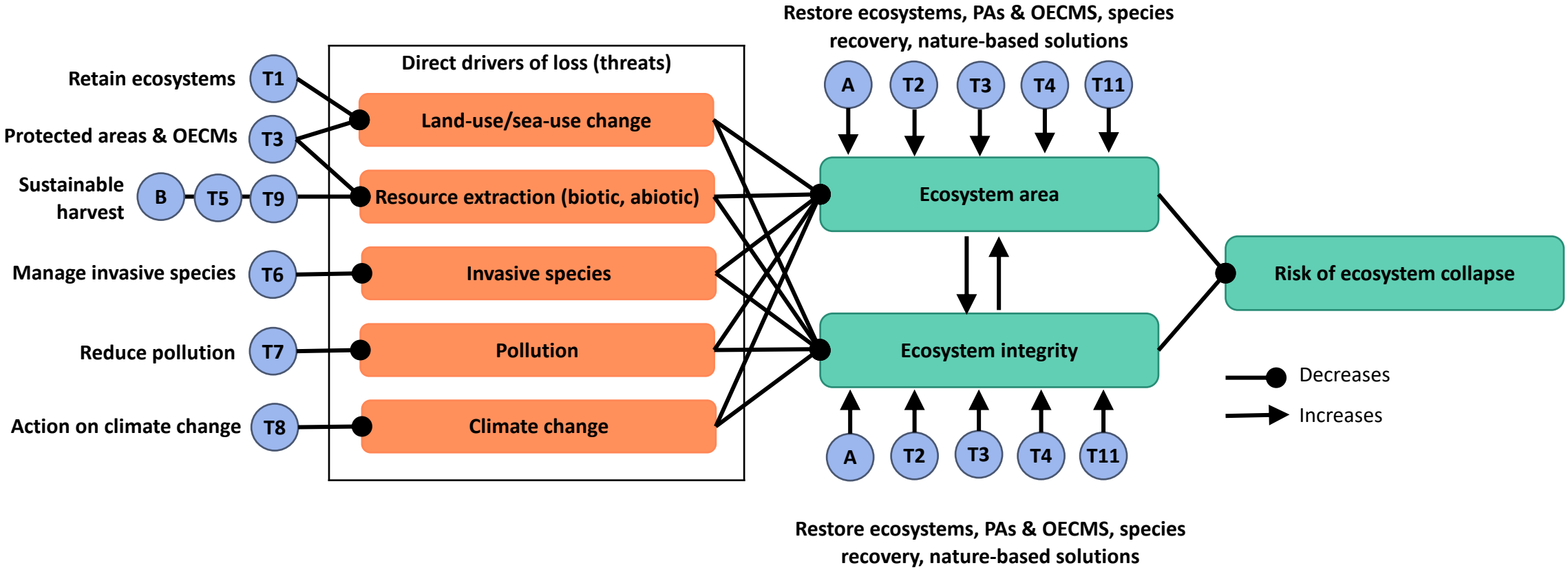
Core components for an ecosystem goal



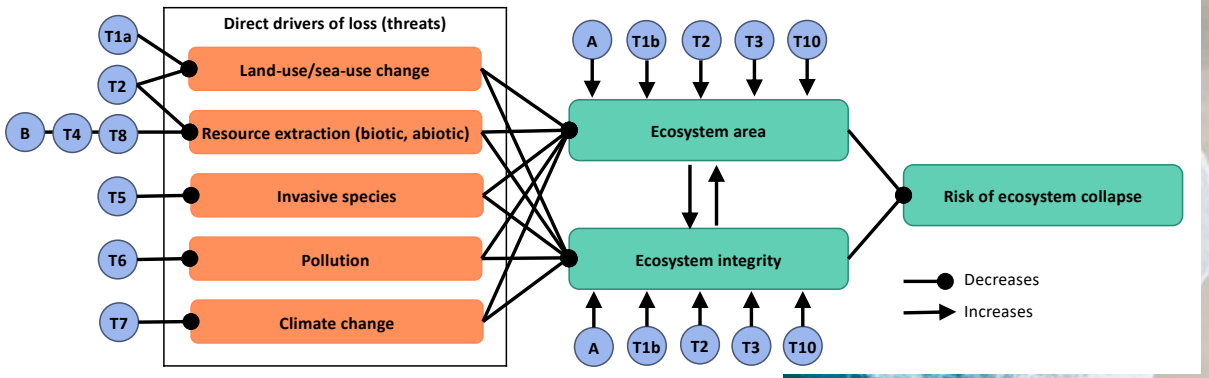
Targets to achieve an ecosystem goal

Actions targets to halt loss of ecosystem area & integrity

Actions targets to reverse loss of ecosystem area & integrity: restoration



Indicators: what do they need to do?



A good indicator set for an ecosystem goal is:

1. **Aligned with and cover all goal components**
2. **Relevant to ecosystems:** specific ecosystems, features, collapse
3. **Tested & behaves predictably:** responses & biases are understood
4. Calculated using **available, accessible data:** spatial & temporal coverage; open access

Watermeyer et al. (2021), Using decision science to evaluate global biodiversity indices. *Conserv Biol,* 35: 492-501. https://doi.org/10.1111/cobi.13574

Nicholson et al. (2021) Scientific foundations for an ecosystem goal & indicators for the post-2020 global biodiversity framework. *Nature Ecology & Evolution (in review)*

Indicator	*Collapse risk*	*Area*	*Integrity Composition*	*Integrity Structure*	*Integrity Function*	*Drivers*	*Marine*	*Freshwater*	*Terrestrial*	*Ecosystem relevance*	*Performance tested*	*Global trend coverage*
Red List Index of Ecosystems	+						+	+	+	+	+	x
Change in the extent of water-related ecosystems over time		+						+		+	-	+
Continuous Global Mangrove Forest Cover		+		+			+			+	-	+
Ecosystem Area Index									+	+	+	-
Forest Area as a Proportion of Total Land Area									+	x	-	+
Global Mangrove Watch										+	-	+
Trends in Primary Forest Extent									+	+	-	+
Tree Cover Loss (Global Forest Watch)									+	x	-	+
Wetland Extent Trends Index										+	-	+
Bioclimatic Ecosystem Resilience Index									+	x	x	+
Biodiversity Habitat Index									+	x	x	+
Biodiversity Intactness Index									+	x	-	+
Living Planet Index									+	x	+	+
Mean Species Abundance									+	x	x	+
Red List Index for species									+	-	+	+
Species Habitat Index			+			+			+	x	x	+
Ecosystem Intactness Index				+		+			+	x	-	+
Forest Landscape Integrity Index				+		+			+	x	x	-
Live Cover via Vegetation Continuous Fields				+					+	x	-	+
Ecosystem Health Index			+	+	+		+	+	+	+	+	-
Live Coral Cove					+		+			+	+	+
Proportion of land degraded over total land area					+				+	x	-	+
Vegetation Health Index					+				+	x	-	+
Water Turbidity & an estimate of Trophic State Index					+			+		+	-	+
Coral Reef Watch						+	+			+	+	+
Human Footprint						+			+	x	-	+
Marine Cumulative Human Impacts						+	+			-	-	+
Ocean Health Index						+	+			x	-	+

1. Only one indicator of collapse risk
2. Bias towards terrestrial & forest ecosystems
3. Bias towards composition (vs function)
4. Low relevance to specific ecosystems
5. Trade-off between data coverage & ecosystem relevance
6. Low levels of performance testing

Where to next?

- Post-2020 goals need strong scientific basis: area, integrity & collapse risk
- Theory of change can identify pathways for impact & gaps
- Indicator set needs work! Need an ongoing process so we are not constrained by current data & indicators
- Post-2020 goals will flow through SDGs, national & local policy, influence monitoring frameworks: we need to get them right

Prof Emily Nicholson
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https://conservationscience.org.au/
https://iucnrle.org/
@n_ylime @redlisteco



Thank you

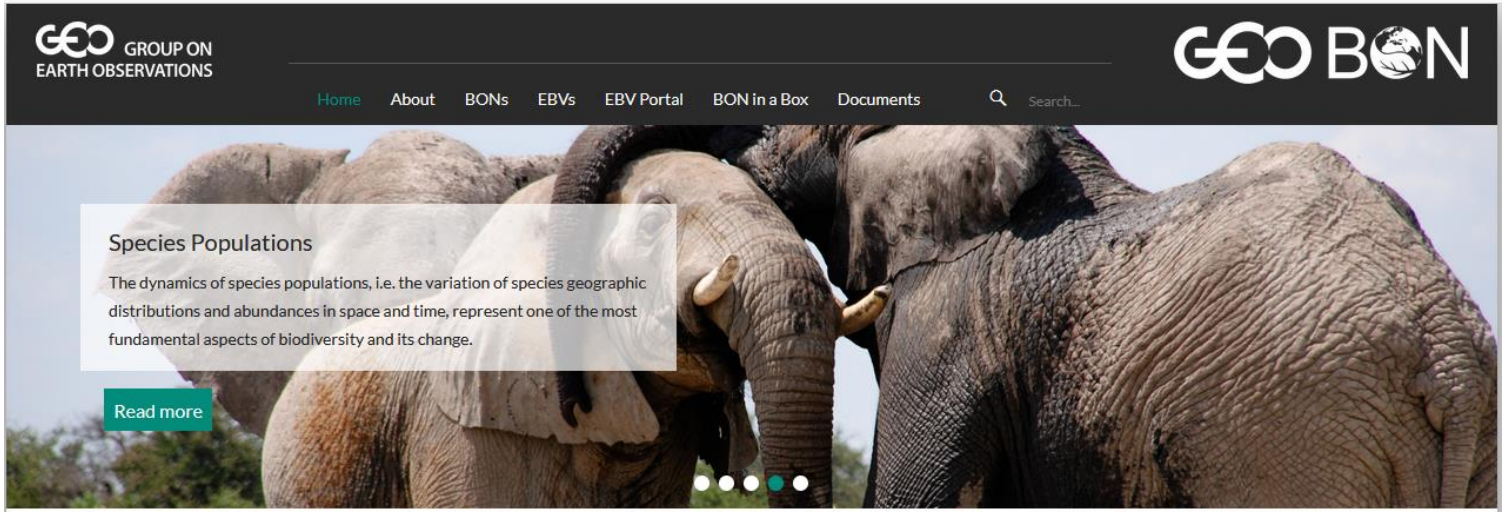
The Concept and Monitoring of Ecosystem Integrity

Andrew Hansen
Montana State University
hansen@montana.edu

Ecosystem Extent and Integrity Webinar

Webinars on Supporting Implementation of the Post-2020 Global Biodiversity Framework: Indicators

Monday September 27th



Introduction



OPEN ENDED WORKING GROUP
ON THE POST-2020 GLOBAL
BIODIVERSITY FRAMEWORK

CBD/WG2020/3/3
5 July 2021

A. 2050 Goals and 2030 Milestones

Goal A

The integrity of all ecosystems is enhanced, with an increase of at least 15 per cent in the area, connectivity and integrity of natural ecosystems, …

Finalizing a post-2020 GBF requires:

- **A working definition of ecosystem integrity (EI);**
- **Indicators of ecosystem structure, function, and composition;**
- **The means by which countries globally can measure, monitor, and evaluate trends in condition of these indicators;**
- **A system to report improvements or degradation in EI.**

We offer a schema for using Earth observations to monitor and evaluate global forest EI.

Introduction

Topics

- **Define EI**
- **Define the schema**
- **Draw conclusions**

Presentation is based on:

DOI: 10.1111/conl.12822

REVIEW

Conservation Letters
A journal of the Society for Conservation Biology
Open Access
WILEY

Toward monitoring forest ecosystem integrity within the post-2020 Global Biodiversity Framework

Andrew J. Hansen[1] | Benjamin P. Noble[1] | Jaris Veneros[1] | Alyson East[1] | Scott J. Goetz[2] | Christina Supples[3] | James E. M. Watson[4,5] | Patrick A. Jantz[2] | Rajeev Pillay[6] | Walter Jetz[7] | Simon Ferrier[8] | Hedley S. Grantham[9] | Thomas D. Evans[9] | Jamison Ervin[3] | Oscar Venter[6] | Anne L. S. Virnig[3]

What is Ecosystem Integrity?

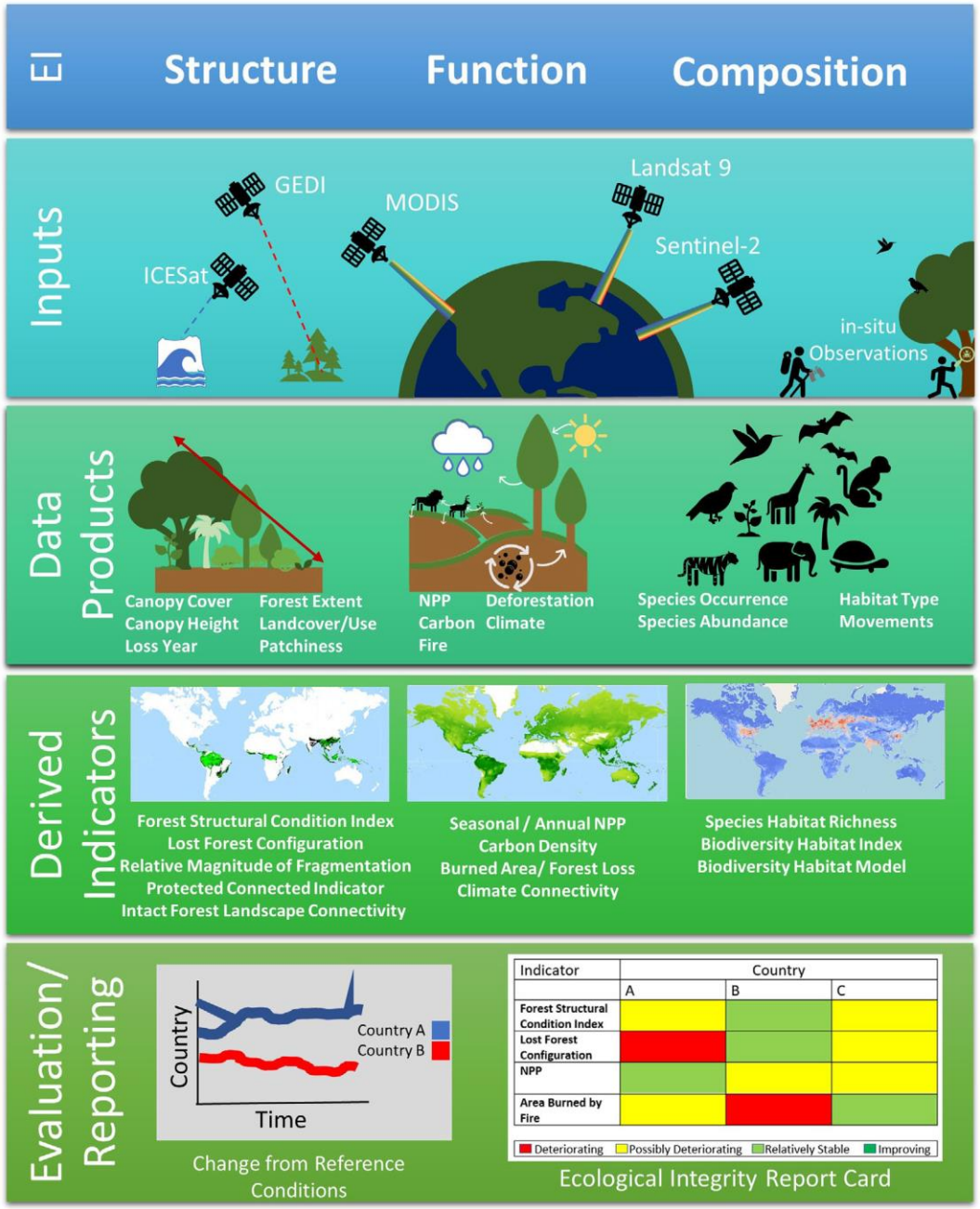
Oxford Dictionary - The condition of having no part or element taken away or wanting; undivided or unbroken state; material wholeness, completeness, entirety.

Andreasen et al., 2001; Dale & Beyeler, 2001; Parrish et al., 2003; Wurtzebach & Schultz, 2016 - The ecosystem structure, function, and composition relative to "the natural or historic range of variation of these characteristics" or are "characteristic of a region.

TABLE 1 Previous applications of subsets and comprehensive indices of ecosystem integrity

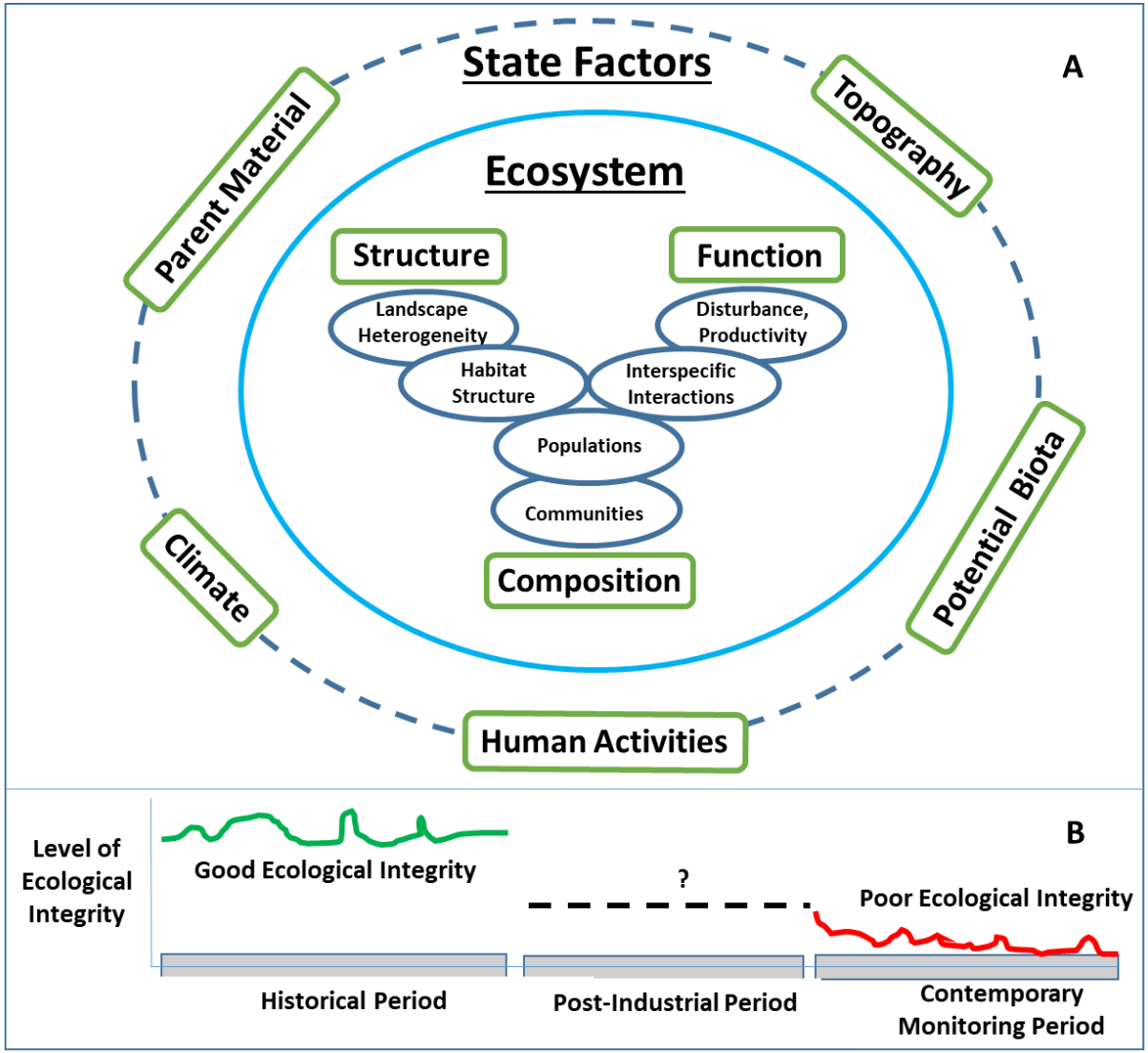
Component of ecosystem integrity	Response variable	Spatial scale	References
Structure	Forest Structural Condition Index	Pantropical	Hansen et al. (2019)
	Stand structure	Acadia National Park	Tierney et al. (2009)
	Habitat fragmentation	Canadian national parks	Fraser et al. (2009), Parks Canada Agency (2011)
	Aquatic emergent plant cover	Two wetlands	Díaz-Delgado et al. (2018)
Function	Soil nitrogen saturation	Acadia National Park	Tierney et al. (2009)
	Fire Intensity and Pattern	South African national parks	Timko and Innes (2009)
	Succession	Canadian national parks	Fraser et al. (2009), Parks Canada Agency (2011)
	Primary productivity	Mid-Atlantic US.	Pan et al. (2006)
Composition	Aquatic Index of Biotic Integrity	Individual streams or rivers	Karr and Dudley (1981)
	Biodiversity Intactness Index	Populations of plants and animals in South Africa	Scholes and Biggs (2005)
	Invasive plants	Acadia National Park	Tierney et al. (2009)
	Species richness	Canadian national parks	Fraser et al. (2009), Parks Canada Agency (2011)
	Allelic diversity	Global	Miraldo et al. (2016)
Structure, function, and composition	Stand structure, invasive plants, soil nitrogen saturation	Acadia National Park	Tierney et al. (2009)
	Habitat fragmentation, succession, species richness	Regional: all Canadian National Parks	Fraser et al. (2009), Parks Canada Agency (2011)

Schema for Monitoring EI in the Post-2020 GBF



Schema for Monitoring EI in the Post-2020 GBF

EI - a measure of ecosystem structure, function and composition relative to the reference state of these components being predominantly determined by the extant climatic–geophysical environment (while acknowledging a backdrop of climate change.



Representation of the concept of ecosystem integrity in the context of the ecosystem and controlling state factors.

Selection of Metrics

Ecosystem Component (Level I / Level II) Potential Indicator (source)	1. Ecosystem structure, function, or composition	2. Extent and Spatial Resolution	3. Temporal Resolution	4. Aggrega-tion	5. Credibility \ Availability	6. Refer-ence State
Ecosystem Structure						
Stand Structure						
Forest Structural Condition Index (Hansen et al. 2019)	Yes	Yes	Yes	Yes	Yes	No
Landscape Structure						
Lost Forest Configuration (Grantham et al. 2020)	Yes	Yes	Yes	Yes	Yes	Yes
Relative Magnitude of Fragmentation[1]	Yes	Yes	Yes	Yes	No	No
Ecosystem Function						
Productivity						
MODIS Net Primary Productivity (Running et al. 2004)	Yes	Yes	Yes	Yes	Yes	No
Carbon Storage						
Carbon Density (Spawn et al. 2020)	Yes	Yes	No	Yes	Yes	No
Natural Disturbance Regime						
MODIS Area Burned (Chuvieco et al. 2018)	Yes	Yes	Yes	Yes	Yes	No
Ecosystem Composition						
Populations						
Living Planet Index (Collen et al. 2009)	Yes	No	No	No	Yes	No
Red List Index[2] (Rodrigues et al. 2014)	Yes	No	No	Yes	Yes	No
Communities						
Species Habitat Index by group (Jetz et al. 2019)	Yes	Yes	Yes	Yes	Yes	Yes
Biodiversity Intactness Index (BII) (Tim Newbold et al. 2016)	Yes	Yes	Yes	Yes	Yes	Yes
Biodiversity Habitat Index (BHI) (Hoskins et al. 2020)	Yes	Yes	Yes	Yes	Yes	Yes
Bioclimatic Ecosystem Resilience Index (BERI) (Ferrier et al. 2020)(This is a combination of ecosystem structure and composition elements)	Yes	Yes	Yes	Yes	Yes	Yes

meets all criteria meets all except reference state does not meet criteria

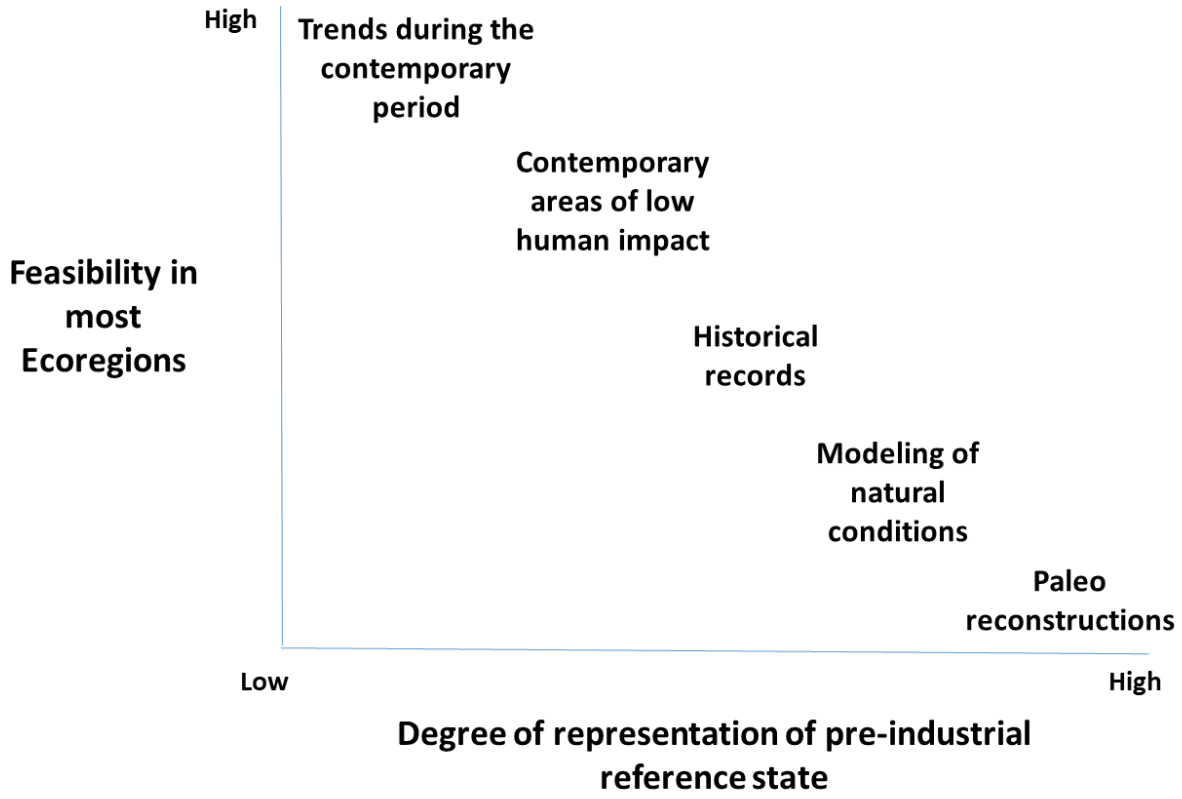
Recommended Metrics

Ecosystem Component / Indicator	Description	Data Inputs	Spatial / Temporal Resolution	Citation and Data Source
Ecosystem Structure				
Forest Structural Condition Index (FSCI)	Vegetation structure within forest stands. Inputs include canopy cover, canopy height, and time since disturbance. ….	Landsat Sentinel-2 ICESAT-2	30 m 2012-2019 Tropical forests	Hansen et al. 2019[1]
Lost Forest Configuration (LFC)	Index of the current patchiness of forest areas relative to the natural potential in forests without extensive human modification. ….	Laestadius et al. 2011	300m 2019. Plans for annual updates.	Grantham et al. 2020[2]
Ecosystem Function				
MODIS Net Primary Productivity (NPP)	Functional measure of new biomass fixed by green plants through photosynthesis. ….	MODIS	1 km 2000-2020	Running et al. 2004[5] Scurlock and Olson 2013
MODIS Burned Area	Fire history relates directly to the function of a given ecosystems disturbance regime. ….	MODIS	250 m 2000-2020	Chuvieco et al. 2018[6]
Ecosystem Composition				
Species Habitat Index by group	Average decrease in suitable habitat and populations of amphibian, bird and mammal species and the resulting change in the ecological integrity of ecosystems. ….	Landsat, MODIS	1km 2000-2018	Powers & Jetz 2019, Jetz et al. 2019[8]

Ready for use

Potential to be readied for use

Reference Conditions



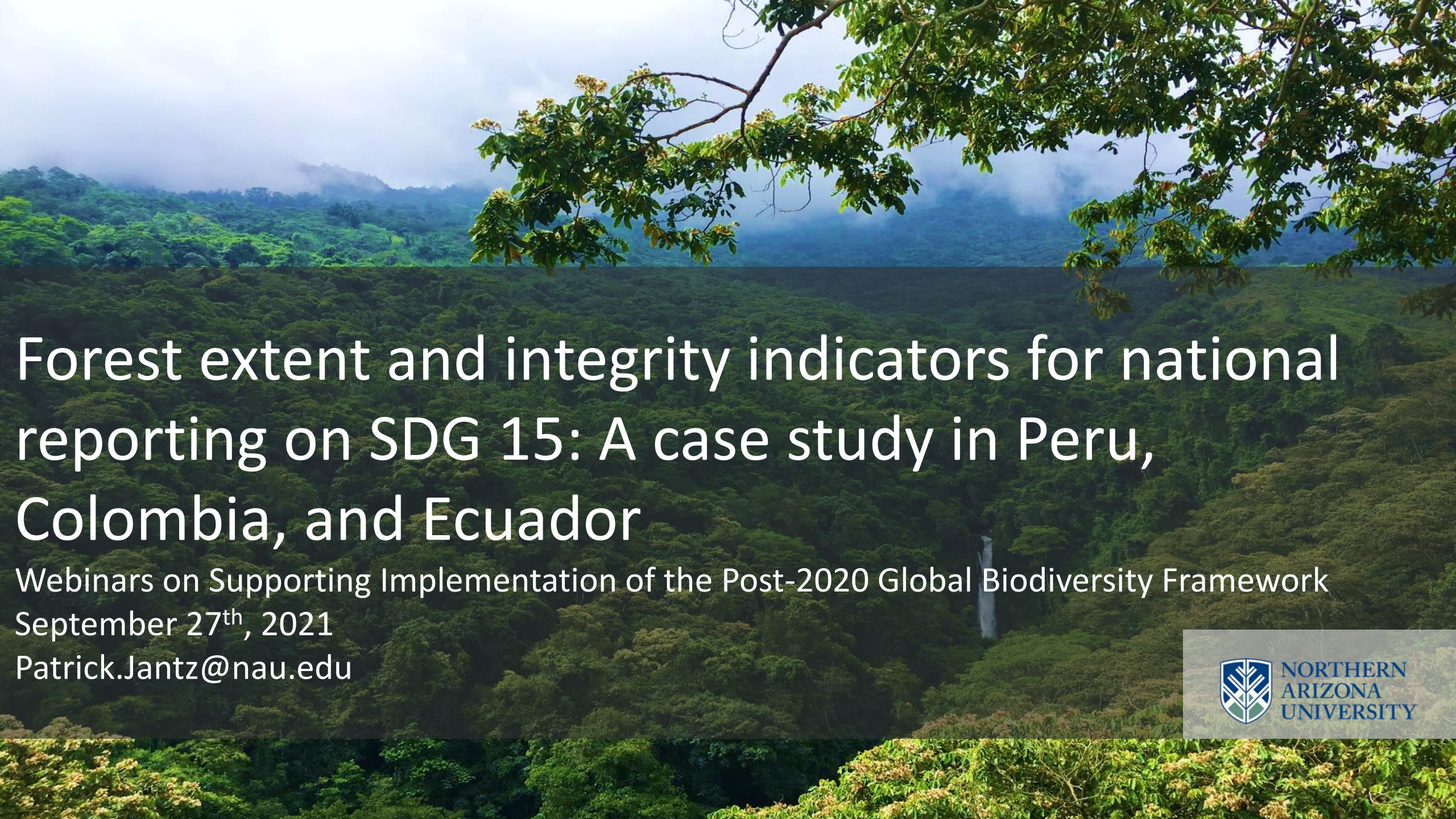
Gradient of methods for establishing reference state

Conclusions

Our schema could allow for consistent, fine-scale, nationally relevant, global monitoring of the components of EI that would help facilitate measurable success in reaching the post 2020 biodiversity targets.

We advocate that Parties to the CBD build upon this schema and operationalize a comprehensive approach for using EO to monitor indicators of EI.

Catalyzing this opportunity will help nations to better identify, address, monitor, and ultimately overcome critical underlying causes of ecosystem and biodiversity loss.



Forest extent and integrity indicators for national reporting on SDG 15: A case study in Peru, Colombia, and Ecuador

Webinars on Supporting Implementation of the Post-2020 Global Biodiversity Framework

September 27th, 2021

Patrick.Jantz@nau.edu

NORTHERN ARIZONA UNIVERSITY

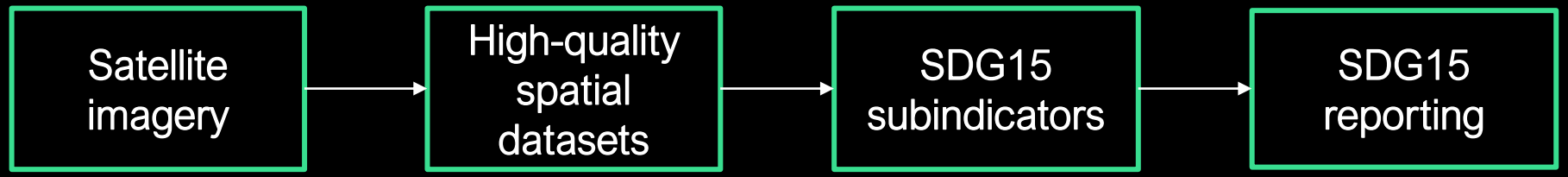


NASA Life on Land Project

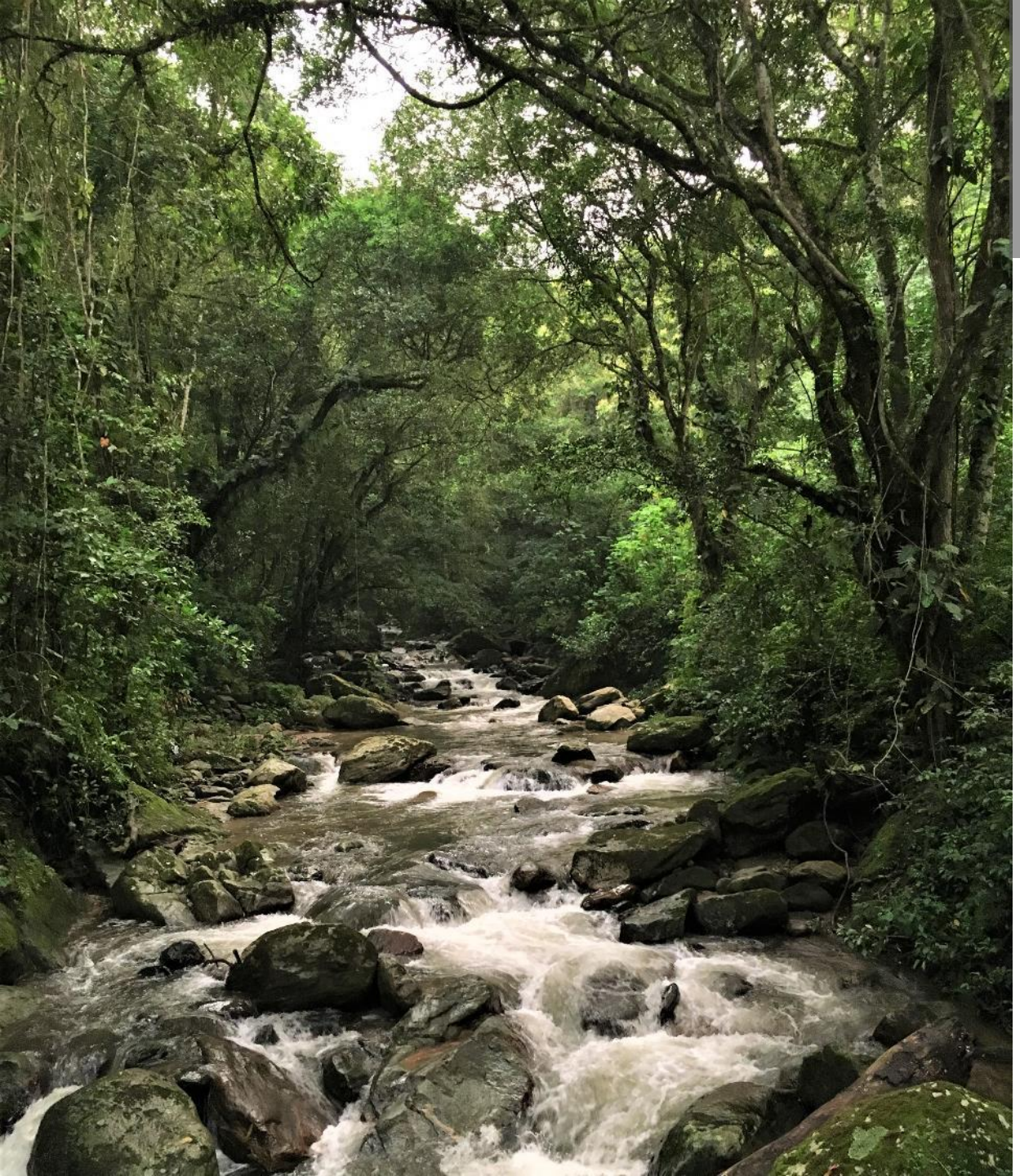
Science Team: Andy Hansen, Scott Goetz, Patrick Jantz, James Watson, Oscar Venter, Ivan Gonzalez, Jaris Veneros, Jose Aragon
UNDP Team: Jamison Ervin, Anne Virnig, Christina Supples
National Teams: Colombia -Susana Rodríguez-Buritica, Maria Cecilia Londoño, Dolors Armenteras
Ecuador –Nestor Alberto Acosta Buenaño, Monica Andrade, Carlos Montenegro
Peru -Erasmo Otarola, Michael Valqui, James Leslie
NASA HQ:Cindy Schmidt
Grant number. 80NSSC19K0186

NASA
NORTHERN ARIZONA UNIVERSITY
MONTANA STATE UNIVERSITY
UNBC UNIVERSITY OF NORTHERN BRITISH COLUMBIA
THE UNIVERSITY OF QUEENSLAND AUSTRALIA
WCS
gef
UNDP Empowered lives. Resilient nations.

The goal of the project is to move from…



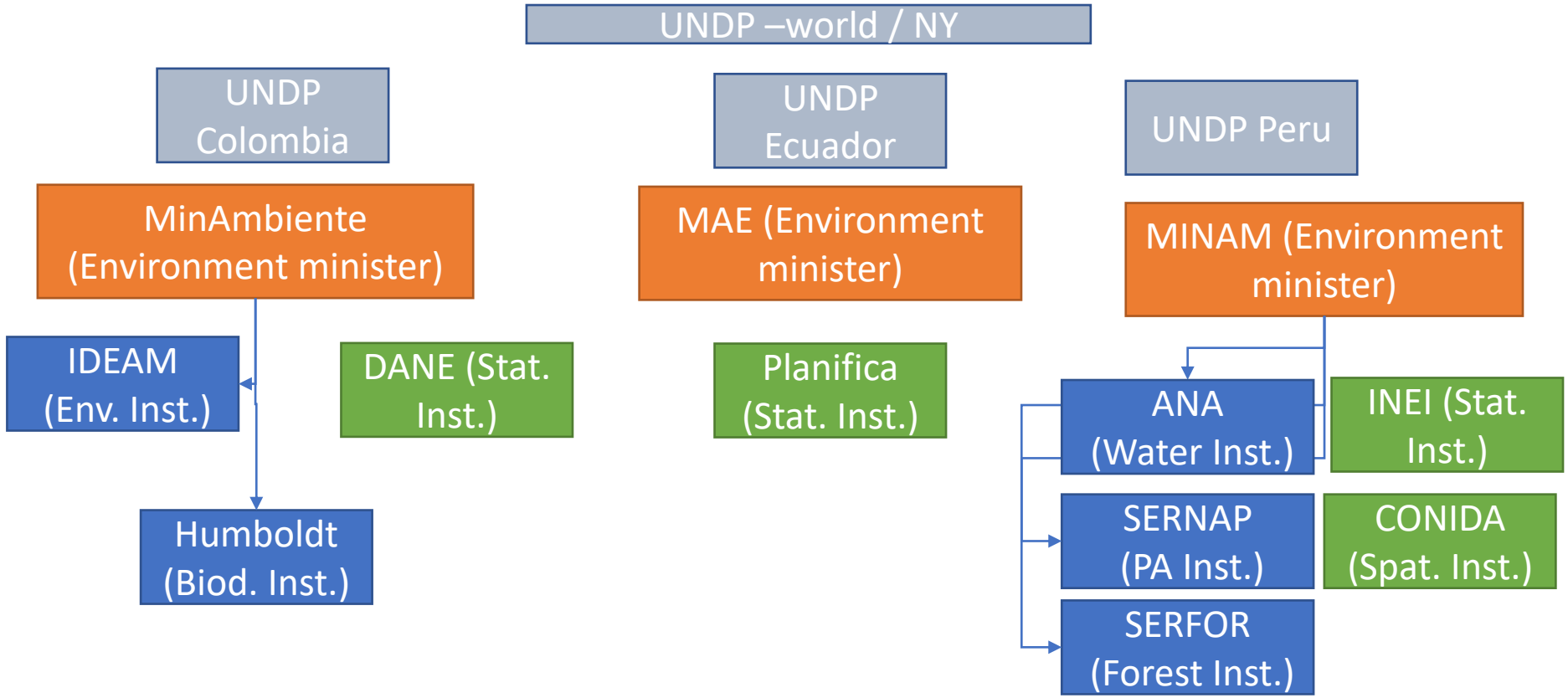
...to set and achieve ambitious nature-based goals and targets



Engagement of Key Partners

- Monthly Project Calls
  - ~30 participants up to the Director level
- Virtual Annual Workshop
  - ~50 participants up to the Director level
- Regional Partnerships
  - SERVIR Amazonia, ProAmazonia (Ecuador), National Adaptation Plan and Amazonia Resiliente (Perú), Paramos de Vida (Colombia), and Amazonia Sostenible para la paz (Colombia)

	Colombia	Ecuador	Perú
Environmental secretariat	Environmental Ministry (MinAmbiente)	Ministry of Environment (MAE)	Ministry of the Environment (MINAM)
Statistic offices	Statistic national department (DANE)	Census and statistics national institute (INEC)	Statistic and informatics national institute (INEI)
Environmental agencies	Environmental studies institute (IDEAM), Humboldt's biodiversity institute (IAVH)	-	National service of protected areas (SERNANP) National aerospatial research and development commission (CONIDA)
International agencies	UNDP Colombia	UNDP Ecuador	UNDP Perú



Metas	Indicador	Métricas	Apoyo desde proyecto	Nuevas desde proyecto*	Reportadas en Perú	Reportadas en Ecuador	Reportadas en Colombia
15.1 Para 2020, velar por la conservación, el restablecimiento y el uso sostenible de los ecosistemas terrestres	15.1.1 Superficie forestal como proporción de la superficie total	3	- NA -	2*			
	15.1.2 Prop. lugares importantes para diversidad biológica terr. y del agua dulce en zonas protegidas, desglosada por tipo de ecosistema	2	1	2*			
15.2 Para 2020, promover la gestión sostenible de todos los tipos de bosques	15.2.1 Progresos en la gestión forestal sostenible	5	2	3*			
15.3 Para 2030, luchar contra la desertificación	15.3.1 Proporción de tierras degradadas en comparación con la superficie total	1	- NA -	- NA -			
15.4 Para 2030, velar por la conservación de los ecosistemas montañosos	15.4.1 Cobertura por zonas protegidas de lugares importantes para la diversidad biológica de las montañas	1	1	- NA -			
	15.4.2 Índice de cobertura verde de las montañas	3	2	- NA -			
15.5 Adoptar medidas urgentes y significativas para reducir la degradación de los hábitats	15.5.1 Índice de la Lista Roja	1	- NA -	2			



TIER I

Reportando



TIER II

Se tiene información y falta consolidar algunos detalles

TIER III

En corto mediado plazo no se tendrá la información. Los más difíciles

INDICATOR 15.1.1

- Forest area as a proportion of total land area (by natural forest and ecosystem type)
  - Forest area
  - Forest area as a proportion of total land area by ecosystem type
  - Natural forest area by ecosystem type
  - Natural habitat area as a proportion of ecosystem type
  - Land area

INDICATOR 15.1.2

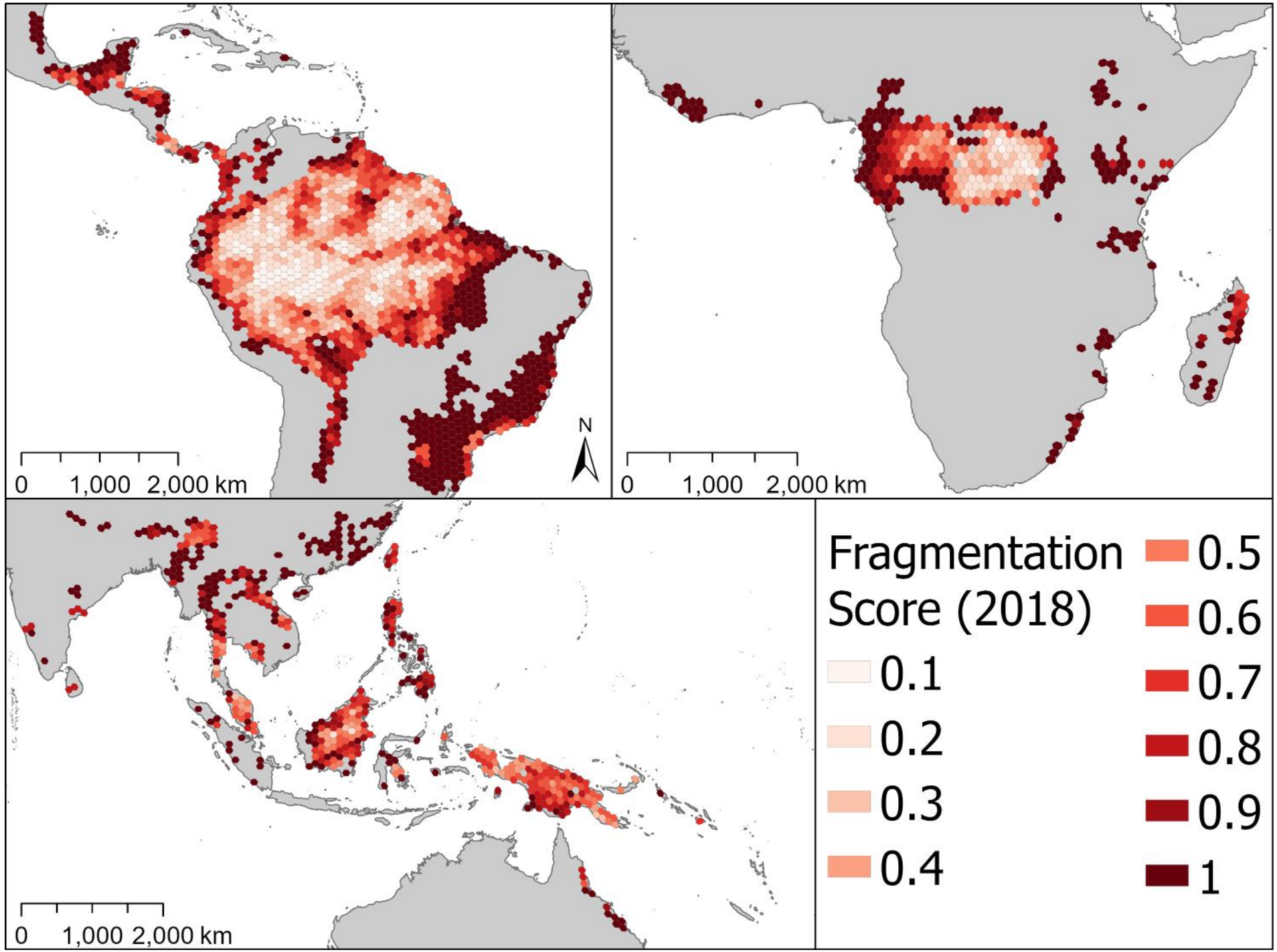
- Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type
  - Average proportion of Freshwater Key Biodiversity Areas (KBAs) covered by protected areas
  - Average proportion of ecosystem types covered by protected areas
  - Average proportion of high forest structural integrity areas covered by protected areas
  - Human Footprint change in protected areas
  - Human Footprint change around protected areas
  - Average proportion of Terrestrial Key Biodiversity Areas (KBAs) covered by protected areas

INDICATOR 15.2.1

- Progress towards sustainable forest management
  - Above-ground biomass stock in forest
  - Forest area annual net change rate
  - Forest area under an independently verified forest management certification scheme
  - Proportion of forest area under a long-term management plan
  - Proportional distribution of forest structural integrity condition classes by ecosystem type
  - Forest fragmentation index by ecosystem type (all forest, high FSII forest)
  - Forest connectivity index by ecosystem type (all forest, high FSII forest)
  - Proportion of forest area within legally established protected areas

INDICATOR 15.5.1

- Red List Index
  - Red List Index
  - Area of suitable habitats for selected vertebrate species


0 1,000 2,000 km
N
0 1,000 2,000 km
0 1,000 2,000 km
Fragmentation Score (2018)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Indicador ODS 15.2.1.5 Fragmentación

Metodología:
- Vogt *et al.* 2007 para el análisis MPSA
- Vogt *et al.* 2017 para software y cálculo
- Jantz *et al. In prep* para la implementación en bosques tropicales (inlcluído Co, Ec, Pe)

Fuente de datos:
- Hansen *et al. 2019: Mapas de bosque de alta condición estructural [2012-2018]*
- Hansen *et al. 2013: Mapas bosque no bosque anuales [2000 - 2019]*
- Conjuntos de datos nacionales (IDEAM, SERFOR)

Algoritmo:
- GuidosToolbox para uso local
- GEE* para cálculo en la nube

Repositorio:
- UNBiodiversityLab
- GEE
- FigShare, Zenodo, etc *

$$Fg = \left(1 - \frac{A_n + A_p + A_b}{A_t}\right) x\ 100$$

	Índice de fragmentación
	Área en bosque bajo la categoría de núcleos
	Área en bosque bajo la categoría de perforaciones
	Área en bosque bajo la categoría de borde o interfaz
	Área total del área de estudio

TIERS



Periodicidad: Según la fuente, 2012-2018 o 2000-2019

Resolución: 30m o según la fuente
Extensión espacial: Nacional
Agregación: Sí. Cuencas, estados, etc.

Interpretación: Menores valores del índice señalan mejor condición espacial y de unidad para los pixeles identificados como bosques. Valores más altos indican más fragmentación. Valores entre 0 y 100

Limitaciones: Depende del insumo de capa de bosque. Requiere mapas binarios que se derivan de insumos continuos. No analiza las condiciones de áreas en no bosque

Medida de incertidumbre: Ninguna para reportar



Project Coordinators

- UNDP Regional and National Coordinators
  - Carlos Montenegro
  - Claudia Fonseca
  - Gabriela Albuja
  - Patricia Huerta
- Ph.D. Students
  - 1 from each country
    - Jaris Veneros
    - Jose Aragon
    - Ivan Gonzalez

Thank You!!



Contact: Patrick.Jantz@nau.edu

Links: https://unbiodiversitylab.org/
https://nbsapforum.net/nasa-forest-integrity-project/nasa-forest-integrity-project-data-access-instructions

System of Environmental Economic Accounting

Accounting for Ecosystem Extent and Integrity - Overview of SEEA Ecosystem Accounting

Alessandra Alfieri

United Nations Statistics Division

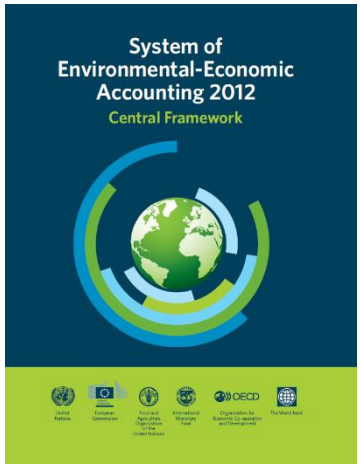
United Nations

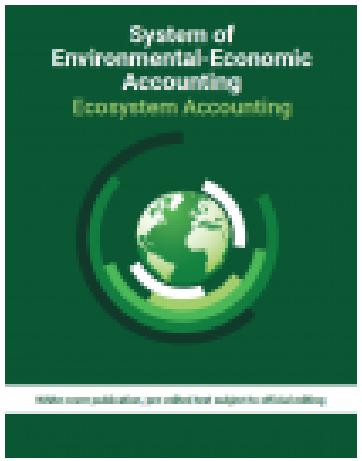
Outline

- Overview of SEEA Ecosystem Accounting (EA) and its relevance to Goal A of the GBF
- Accounting ecosystem extent in SEEA EA
- Accounting ecosystem condition in SEEA EA
- Conclusions

Standardisation of measurement of the environment

- SEEA Central Framework adopted as statistical standard through an intergovernmental process (ECOSOC / United Nations Statistical Commission) in 2013
- SEEA Ecosystem Accounting discussed in March 2021
  - > chapters 1-7 describing the accounting framework and the physical accounts adopted as an international statistical standard
  - > chapters 8-11 recognized as describing internationally recognized statistical principles and recommendations for the valuation of ecosystem services and assets in a context that is coherent with the concepts of System of National Accounts
- SEEA status of implementation 2020:
  - > 89 countries implementing the SEEA Central Framework
  - > 34 countries compiling SEEA Ecosystem Accounts
  - > 27 countries planning to start implementation of the SEEA





SBSTTA-24

- The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) at its recent meeting in May 2021 :
  - > *"Recognizes* the value of aligning national monitoring with the **United Nations System of Environmental-Economic Accounting statistical standard** in order to mainstream biodiversity in national statistical systems and to strengthen national information and monitoring systems and reporting"

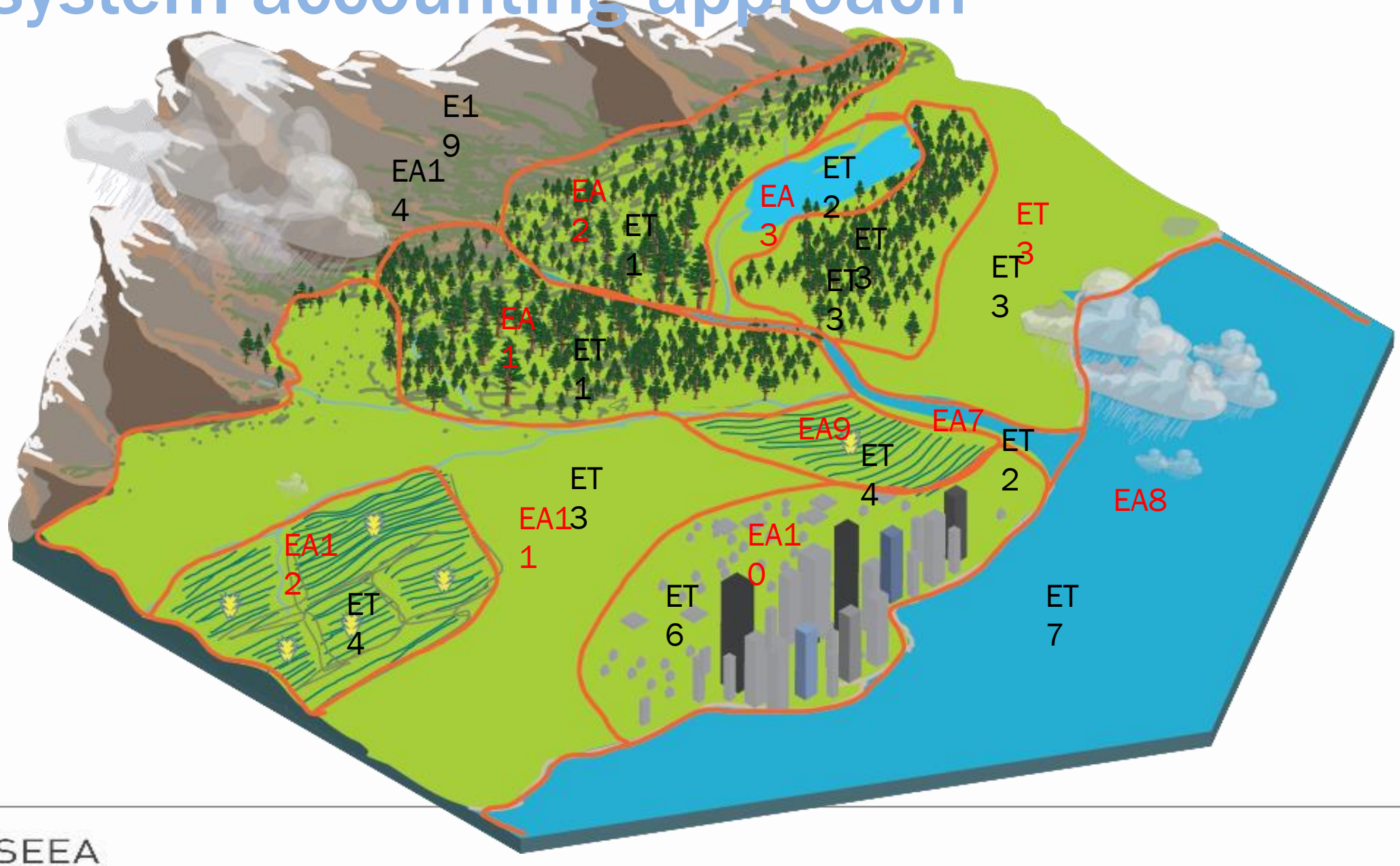
SEEA

Source: Non-Paper on SBSTTA-24 Agenda item 3
https://www.cbd.int/doc/c/13e9/73d6/0de346d7d3433024a3ef1441/sbstta-24-nonpaper-item-03-v1-en.pdf

Goal A (CBD/WG2020/3/3/Add.1 - 11 July 2021)

Proposed goal or target	Proposed indicators	Proposed disaggregation		Methodological basis	Global data set for national disaggregation
Goal A. The integrity of all ecosystems is enhanced, with an increase of at least 15% in the area, connectivity and integrity of natural ecosystems, supporting healthy and resilient populations of all species, the rate of extinctions has been reduced at least tenfold, and the risk of species extinctions across all taxonomic and functional groups, is halved, and genetic diversity of wild and domesticated species is safeguarded, with at least 90% of genetic diversity within all species maintained	A.0.1 Extent of selected natural and modified ecosystems (i.e. forest, savannahs and grasslands, wetlands, mangroves, saltmarshes, coral reef, seagrass, macroalgae and intertidal habitats)	By terrestrial and marine ecosystem types By mountains		UN System of Environmental Economic Accounting (SEEA): https://seea.un.org/ecosystemaccounting Ecosystem types based on IUCN categories.	Near ready**

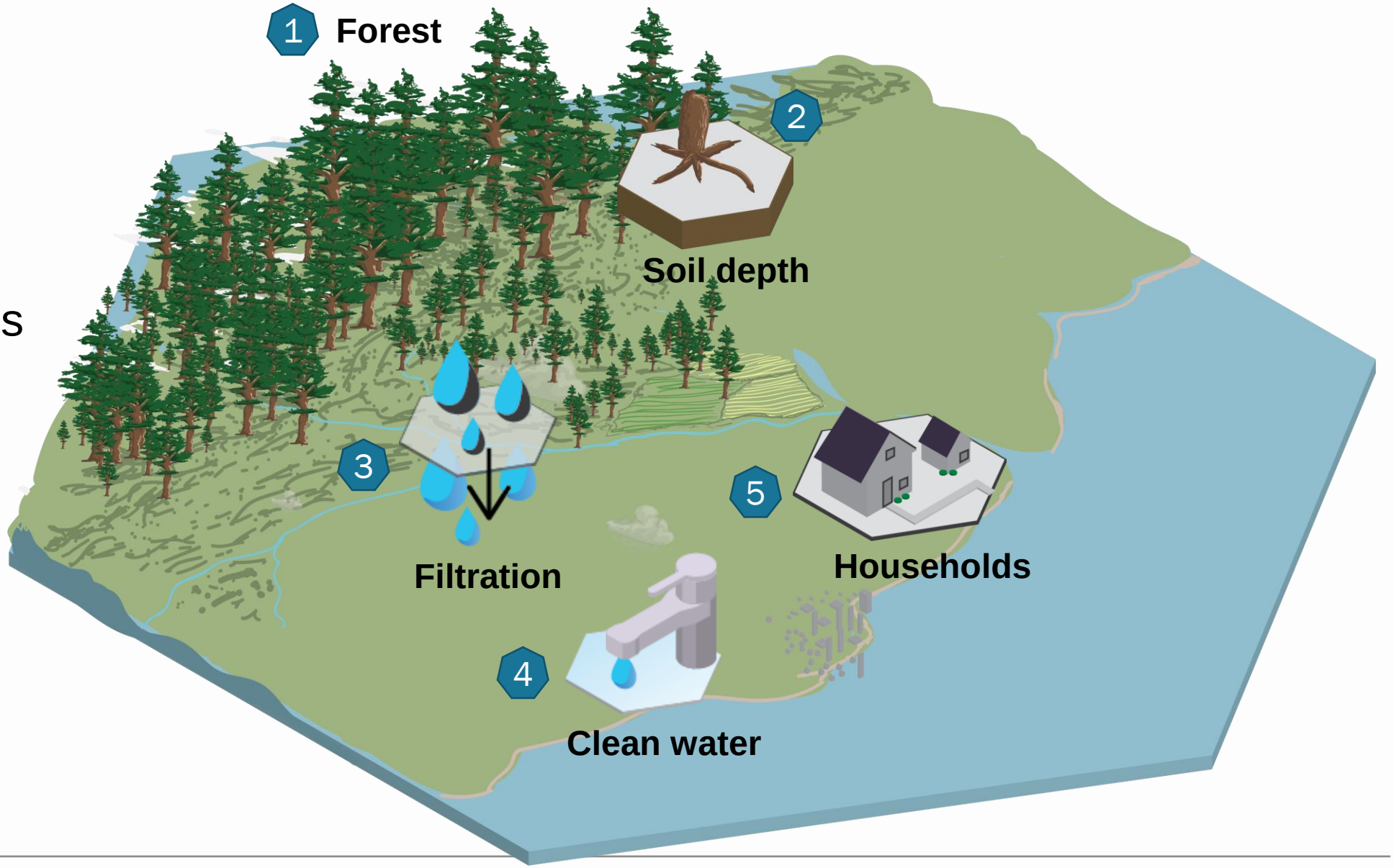
Ecosystem accounting approach



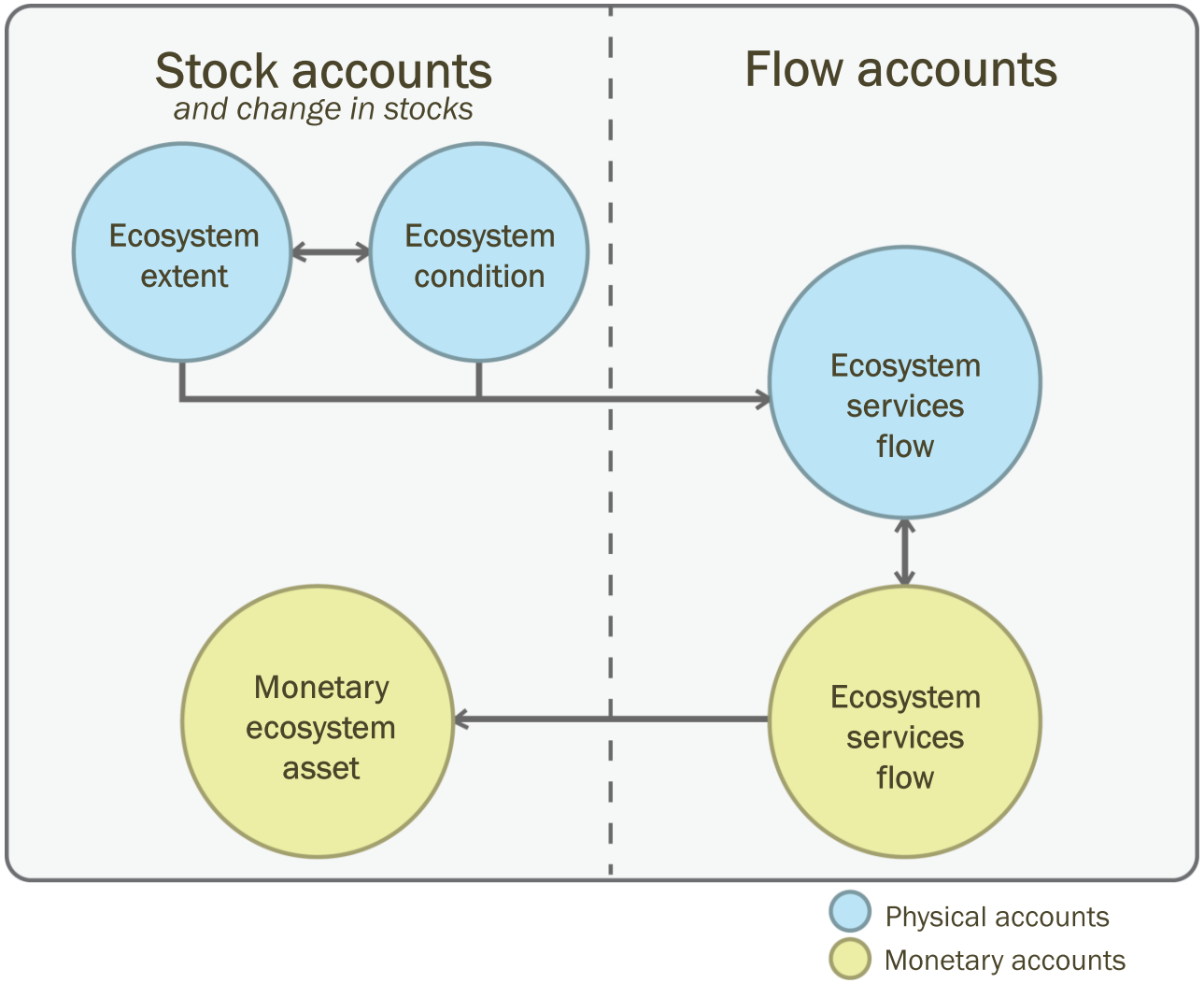
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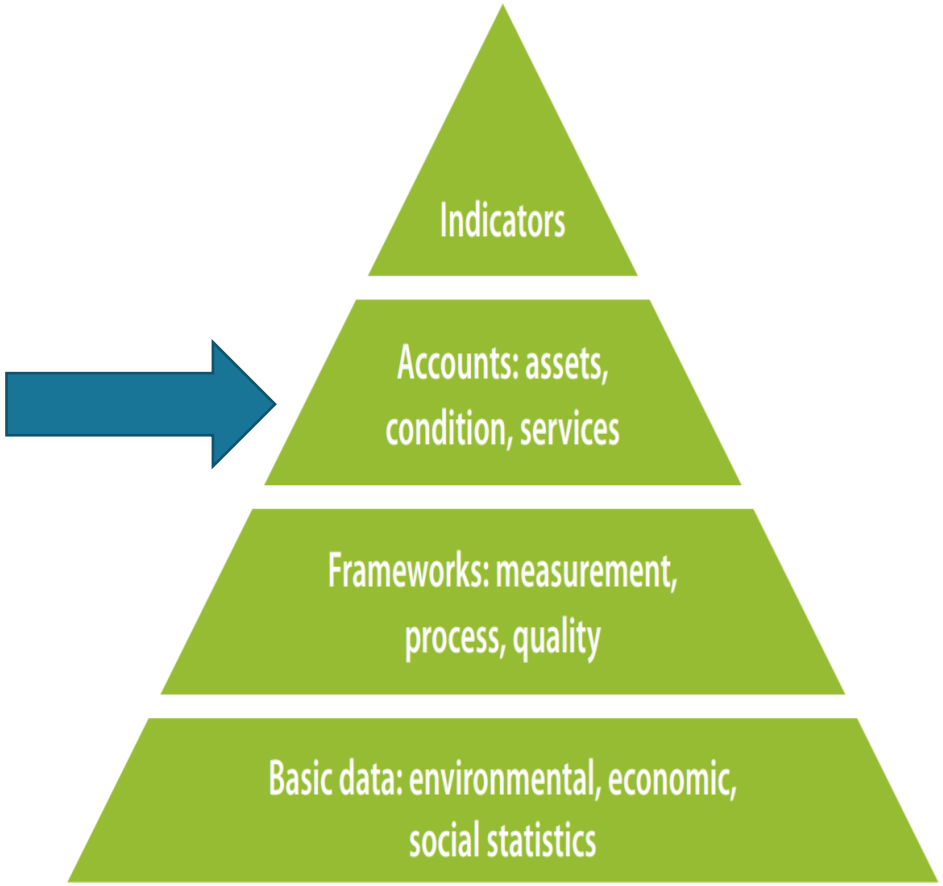
Illustration

1. Asset
2. Condition
3. Service
4. Benefit
5. Beneficiaries



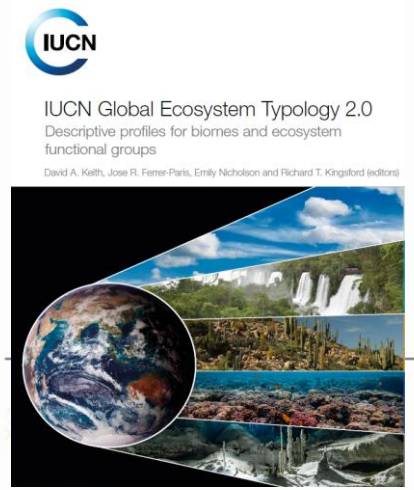
SEEA EA - Core Accounts

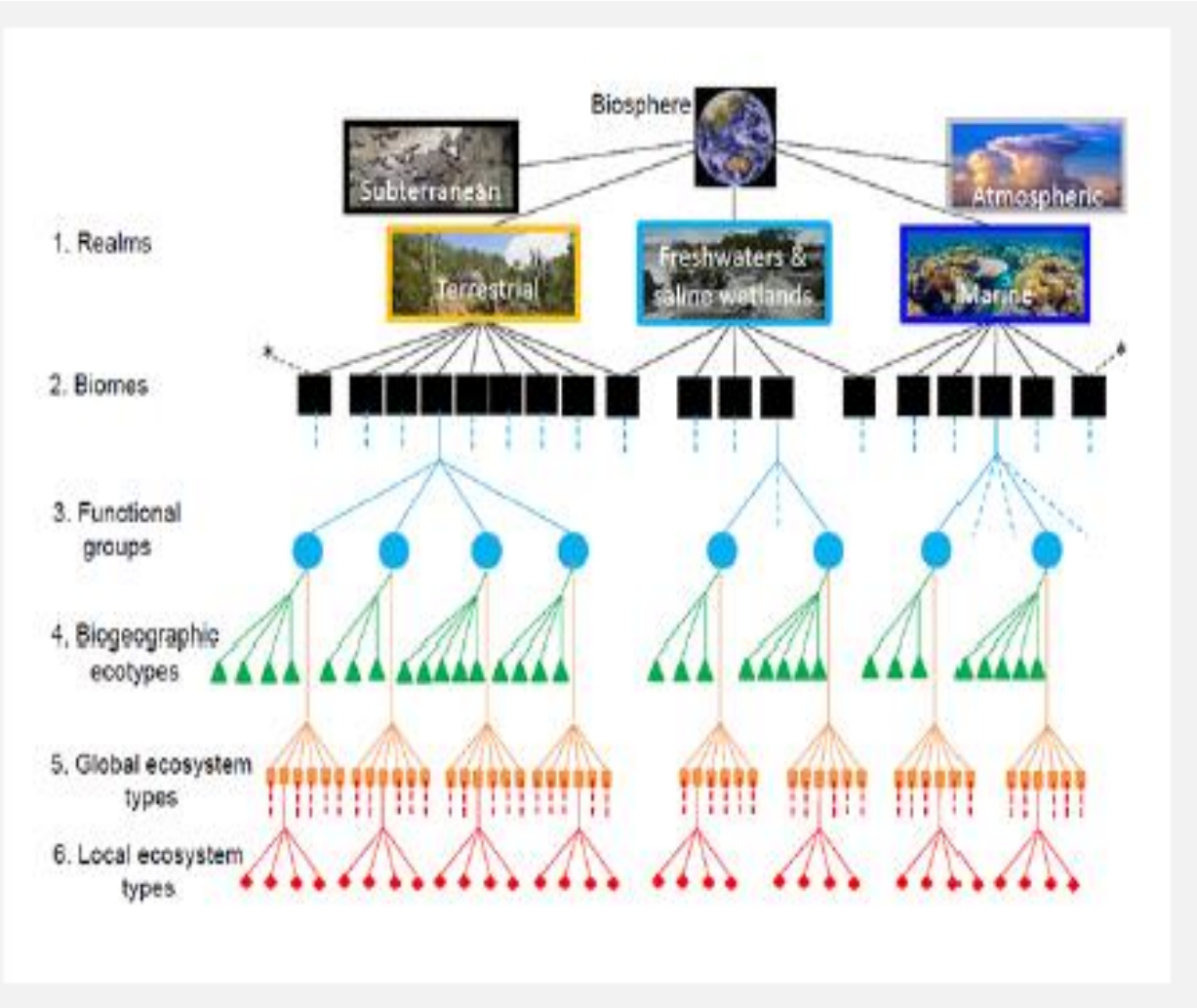




Ecosystem types

- SEEA EA endorses the IUCN GET as international reference classification
- 6 levels – accounts are compiled at level of the Ecosystem Functional Groups (e.g. tropical lowland





Realms	Biomes
Terrestrial	T1 Tropical–subtropical forests
	T2 Temperate–boreal forests & woodlands
	T3 Shrublands & shrubby woodlands
	T4 Savannas and grasslands
	T5 Deserts and semi-deserts
	T6 Polar-alpine
	T7 Intensive land-use systems
Freshwater	F1 Rivers and streams
	F2 Lakes
	F3 Artificial fresh waters
Marine	M1 Marine shelfs
	M2 Pelagic ocean waters
	M3 Deep sea floors
	M4 Anthropogenic marine systems
Subterranean	S1 Subterranean lithic
	S2 Anthropogenic subterranean voids
Transitional	TF1 Palustrine wetlands
	FM1 Semi-confined transitional waters
	MT1 Shoreline systems
	MT2 Supralittoral coastal systems
	MT3 Anthropogenic shorelines
	MFT1 Brackish tidal systems
	SF1 Subterranean freshwaters
	SF2 Anthropogenic subterranean freshwaters
	SM1 Subterranean tidal

Ecosystem extent account

	Selected ecosystem types (based on Level 3 - EFG of the IUCN Global Ecosystem Typology)																		
Realm	Terrestrial												Freshwater			Marine			
Biome	T1 Tropical-subtropical forests				T2 Temperate-boreal forests and woodlands				...		T7		F1	...	FM1	M1	...	MFT1	
Selected Ecosystem Functional Group (EFG)	Tropical-subtropical lowland rainforests	Tropical-subtropical dry forests and scrubs	Tropical-subtropical montane rainforests	Tropical heath forests	Boreal and temperate high montane forests and woodlands	Deciduous temperate forests	...	Temperate pyric sclerophyll forests and woodlands	...	...	...	Derivied semi-natural pastures and old fields	Permanent upland streams	...	Intermittently closed and open lakes and lagoons	Seagrass meadows	...	Coastal saltmarshes and reedbeds	TOTAL
	T1.1	T1.2	T1.3	T1.4	T2.1	T2.2	...	T2.6	...	...	...	T7.5	F1.1	...	FM1.3	M1.1	...	MFT1.3	
Opening extent																			
Additions to extent																			
Managed expansion																			
Unmanaged expansion																			
Reductions in extent																			
Managed reductions																			
Unmanaged reductions																			
Net change in extent																			
Closing extent																			



Source: SEEA EA

Example: Mapping of Indian forest types to IUCN GET forest ecosystem functional groups (EFG)

In India, compilation of ecosystem extent accounts is based on locally relevant ecosystem type classifications. These have been mapped to the IUCN GET classification at the EFG level for the purposes of international comparability.

The values in the cells represent the share of Indian forests that map to the GET categories:

- **Values of 1** represent a 1-to-1 match.
- **Values less than 1** indicate that the Indian forest type maps to more than one GET forest type - in proportion to the values given in the corresponding cells.

National Classification		IUCN EFGs							
Level I	Level II	T1.1Tropical/ subtropical lowland rainforests	T1.2 Tropical/ subtropical dry forests and scrubs	T1.3 Tropical/ subtropical montane rainforests	T2.1 Boreal and montane needle-leaved forest and woodland	T2.2 Temperate deciduous forests and shrublands	T5.2 Thorny deserts and semi-deserts	TF1.1 Tropical flooded forests and peat forests	TM2.1 Coastal shrublands and grasslands
Forest	Tropical wet evergreen forests	1							
Forest	Tropical semi evergreen forests	1							
Forest	Tropical moist deciduous forests			1					
Forest	Littoral & swamp forests							0.25	0.75
Forest	Tropical dry deciduous forests				1				
Forest	Tropical thorn forests						1		
Forest	Tropical dry evergreen Forests		1						
Forest	Subtropical broad leaved hill forests					1			
Forest	Subtropical pine forests				1				
Forest	Subtropical dry evergreen forests		1						
Forest	Montane wet temperate forests			1					
Forest	Himalayan moist temperate forests			1					
Forest	Himalayan dry temperate Forests					1			
Forest	Sub alpine forests					1			
Forest	Moist alpine scrub					1			
Forest	Dry alpine scrub					1			

SEEA

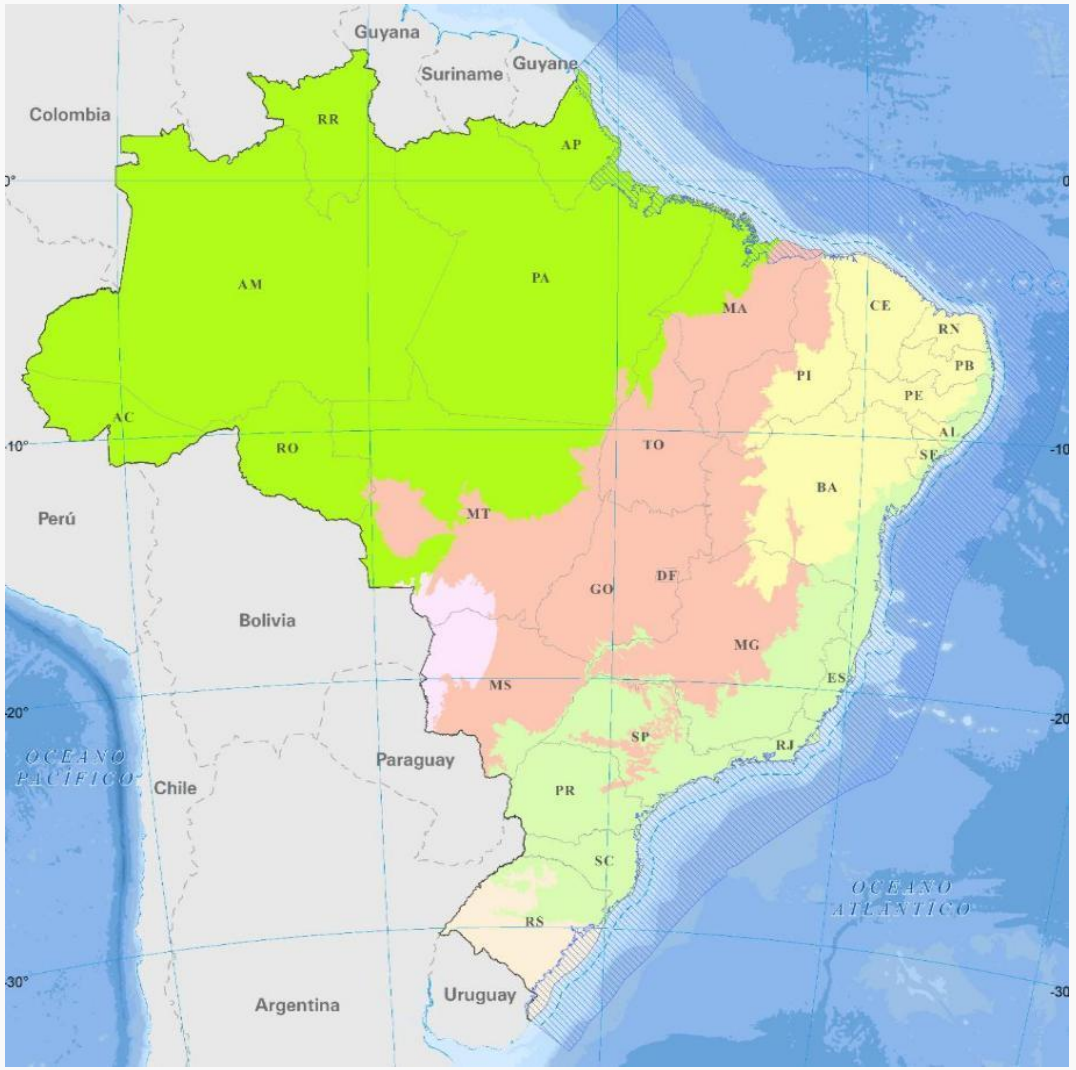
Source: Ministry of Statistics and Programme Implementation, 2021.

Anthropized areas

Natural areas



Ecosystem Extent Accounts




Spatialization of Natural Areas of the Brazilian Ecosystems 2018
AMAZÔNIA
CAATINGA
CERRADO
PANTANAL
MATA ATLÂNTICA
PAMPA
VENEZUELA
COLOMBIA
GUYANA
PERU
BOLIVIA
PARAGUAY
ARGENTINA
CHILE
URUGUAY
Conventions
State Capital
Country Capital
International Boundary
Biomes Boundary
Maritime Boundary
12 nautical miles
24 nautical miles
200 nautical miles
North Side
South Side
Legend
Natural Forestl Areas
Natural Non-forest Areas
Anthropized Areas
Water Bodies

Variáveis	Total		Bioma			
			Amazônia		Cerrado	
	Áreas naturais	Áreas antro-pizadas	Áreas naturais	Áreas antro-pizadas	Áreas naturais	Áreas antro-pizadas
2000						
Extensão de abertura	**5 877 298**	**2 510 306**	**3 684 512**	**450 865**	**1 185 192**	**790 693**
Adições	2 955	460 530	1 282	248 427	509	135 983
Reduções	326 066	137 419	193 539	56 170	96 274	40 218
2010						
Extensão	5 554 187	2 833 417	3 492 255	643 122	1 089 427	886 458
Adições	1 509	107 787	385	39 064	284	37 357
Reduções	69 316	39 980	27 376	12 073	23 068	14 573
2012						
Extensão	5 486 380	2 901 224	3 465 264	670 113	1 066 643	909 242
Adições	3 592	93 615	2 043	39 654	320	35 913
Reduções	49 030	48 177	21 123	20 574	18 392	17 841
2014						
Extensão	5 440 942	2 946 662	3 446 184	689 193	1 048 571	927 314
Adições	2 118	60 715	644	36 413	314	16 599
Reduções	36 435	26 398	23 541	13 516	8 417	8 496
2016						
Extensão	5 406 625	2 980 979	3 423 287	712 090	1 040 468	935 417
Adições	12 894	74 296	8 185	38 566	2 706	25 583
Reduções	32 098	55 245	16 761	30 057	10 688	17 671
2018						
Extensão final	**5 387 421**	**3 000 030**	**3 414 711**	**720 599**	**1 032 486**	**943 329**
Saldo das mudanças						
Absoluto (km²)	(-) 489 877	489 724	(-) 269 801	269 734	(-) 152 706	152 636
Percentual (%)	(-) 8,34	19,51	(-) 7,32	59,83	(-) 12,88	19,30
Movimentação						
Absoluto (km²)	536 013	1104 162	294 879	534 514	160 972	350 234
Percentual (%)	9,12	43,99	8,00	118,55	13,58	44,29

The higher absolute totals of natural area reduction were concentrated on the Amazônia and Cerrado biomes (86,2%)

BRAZIL - CHANGES MATRIX (KM²)

		Artificial Surfaces	Cropland	Managed Pasture	Mosaic of Occupations in Forest Area	Silviculture	Forest Cover
Opening stock (2016)		37.773	643.769	1.118.893	843.927	83.646	3.7
1. Additions to stock	Artificial Surfaces	0	0	0	24	0	
	Cropland	28	0	2.172	144	298	
	Managed Pasture	49	14.039	0	2.820	1.751	
	Mosaic of Occupations in Forest Area	206	3.110	12.897	0	373	
	Silviculture	2	257	191	192	0	
	Forest Tree Cover	89	758	4.116	13.617	70	
	Wetland	0	0	1	0	0	
	Savannah, Shrubland, Grassland	58	4.744	5.579	0	443	
	Mosaic of Occupations in Savannah, Shrubland	118	1.331	1.038	0	130	
	Inland Water Bodies	0	0	0	0	0	
	Coastal Water Bodies	0	0	0	0	0	
	Barren Land	0	0	0	0	0	
	Total additions to stock	550	24.239	25.994	16.797	3.065	
2. Reductions in stock	Artificial Surfaces	0	28	49	206	2	
	Cropland	0	0	14.039	3.110	257	
	Managed Pasture	0	2.172	0	12.897	191	
	Mosaic of Occupations in Forest Area	24	144	2.820	0	192	
	Silviculture	0	298	1.751	373	0	
	Forest Tree Cover	0	0	0	10.959	0	
	Wetland	0	0	0	0	0	
	Savannah, Shrubland, Grassland	0	191	319	0	42	
	Mosaic of Occupations in Savannah, Shrubland	0	369	695	0	76	
	Inland Water Bodies	5	22	20	13	0	
	Coastal Water Bodies	0	0	0	0	0	
	Barren Land	0	0	0	0	0	
	Total reductions in stock	29	3.224	19.693	27.558	760	
Closing stock (2018)		38.294	664.784	1.125.194	833.166	85.951	3.7

(continues)

....

....

....

....

The SEEA Ecosystem Condition Typology (ECT)

ECT groups and classes	
Group A: Abiotic ecosystem characteristics	
	Class A1. Physical state characteristics: physical descriptors of the abiotic components of the ecosystem (e.g., soil structure, water availability)
	Class A2. Chemical state characteristics: chemical composition of abiotic ecosystem compartments (e.g., soil nutrient levels, water quality, air pollutant concentrations)
Group B: Biotic ecosystem characteristics	
	Class B1. Compositional state characteristics: composition / diversity of ecological communities at a given location and time (e.g., presence / abundance of key species, diversity of relevant species groups)
	Class B2. Structural state characteristics: aggregate properties (e.g., mass, density) of the whole ecosystem or its main biotic components (e.g., total biomass, canopy coverage, annual maximum normalized difference vegetation index (NDVI))
	Class B3. Functional state characteristics: summary statistics (e.g., frequency, intensity) of the biological, chemical, and physical interactions between the main ecosystem compartments (e.g., primary productivity, community age, disturbance frequency)
Group C: Landscape level characteristics	
	Class C1. Landscape and seascape characteristics: metrics describing mosaics of ecosystem types at coarse (landscape, seascape) spatial scales (e.g., landscape diversity, connectivity, fragmentation)

SEEA

Source: SEEA EA

Ecosystem condition indicator account

SEEA Ecosystem Condition Typology Class	Indicators	Ecosystem type						
		Variable values		Reference level values		Indicator values (rescaled)		
	Descriptor	Opening value	Closing value	Upper level (e.g., natural)	Lower level (e.g., collapse)	Opening value	Closing value	Change in indicator
Physical state	Indicator 1							
	Indicator 2							
Chemical state	Indicator 3							
Compositional state	Indicator 4							
	Indicator 5							
Structural state	Indicator 6							
Functional state	Indicator 7							
Landscape/waterscape characteristics	Indicator 8							

SEEA

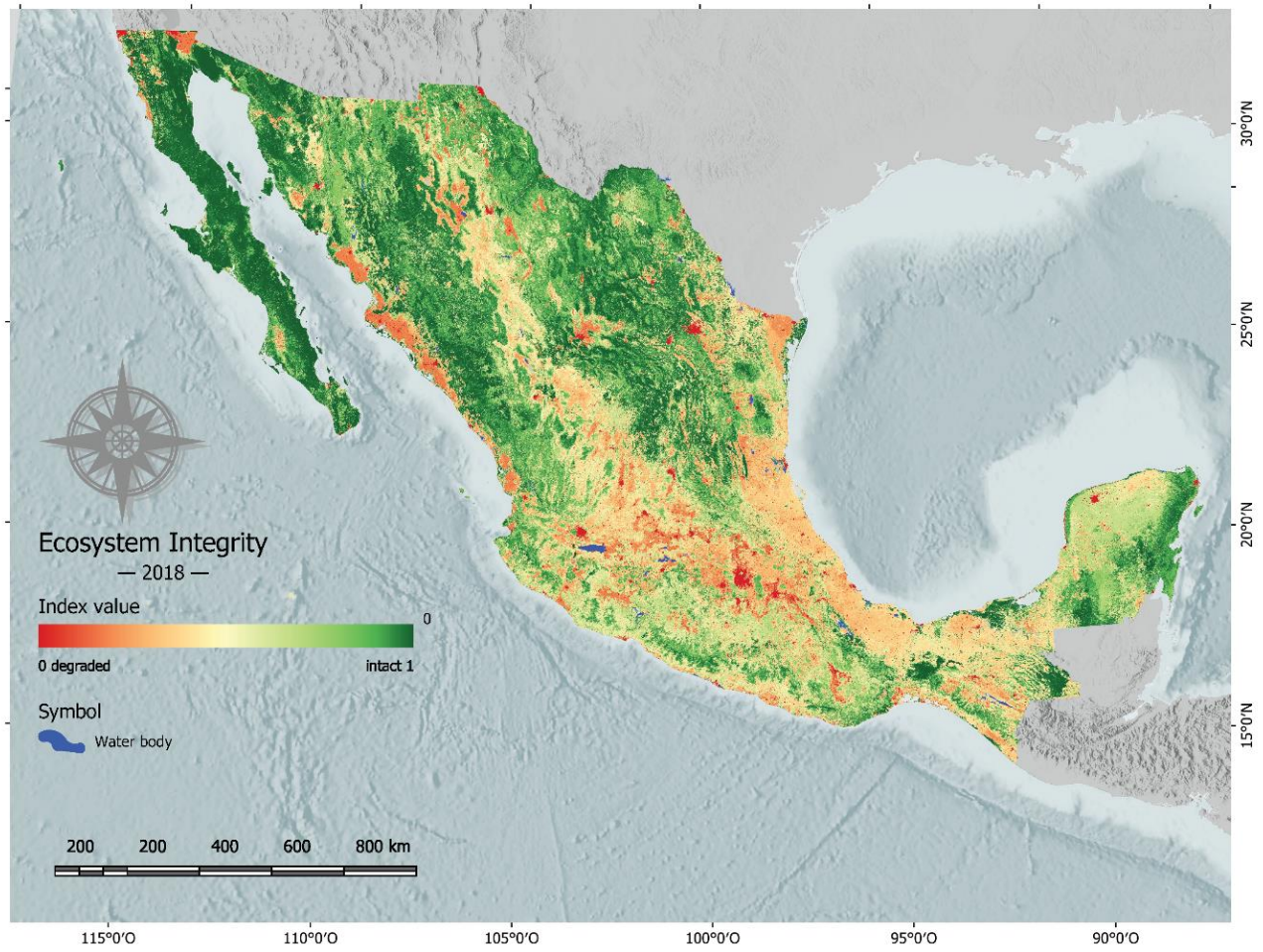
Source: SEEA EA

Example: Changes in South African estuarine ecosystem's condition

ESTUARY FUNCTIONAL TYPE	EFZ AREA (ha)	ESTUARY FUNCTIONAL TYPE CONDITION	
		Opening (~1750)	Closing (2018)
Arid Predominantly Closed	1,442	100	44.9
Estuarine Bay	12,180	100	48.3
Estuarine Lagoon	6,016	100	84.6
Estuarine Lake	86,348	100	54.2
Large Fluvially Dominated	14,358	100	56.3
Large Temporarily Closed	16,475	100	64.6
Predominantly Open	57,768	100	64.2
Small Fluvially Dominated	126	100	92.8
Small Temporarily Closed	6,022	100	63.6
NATIONAL ESTUARINE ECOSYSTEMS CONDITION INDEX RATING (arithmetic mean of nine functional types)	**200,736**	**100**	**63.7**

Source: CSIR, 2020

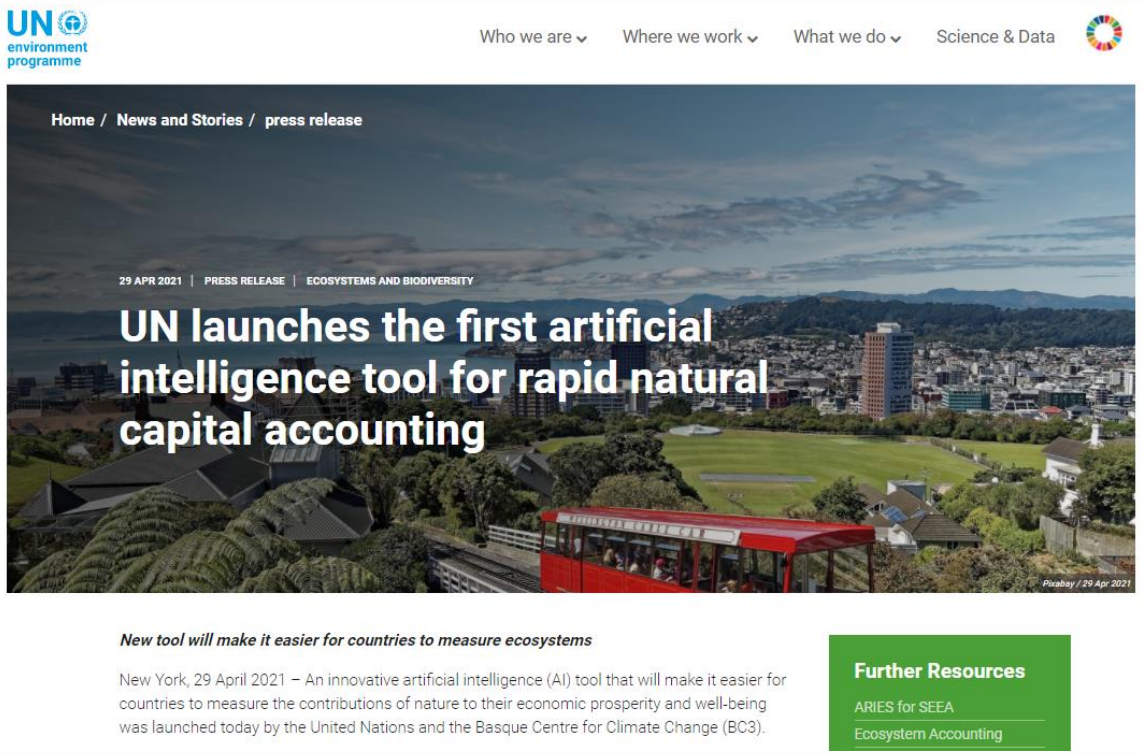
Mexico – Ecosystem Integrity index -2018



Ecosystem type	Opening value 2004	Opening value 2018	Change
Aquaculture	0.78	0.55	-0.23
Annual cropland	0.34	0.35	0.00
Perennial cropland	0.41	0.41	0.00
Human settlements	0.12	0.10	-0.03
Planted forest	0.55	0.55	0.00
Coniferous forest	0.81	0.83	0.02
Oak forest	0.77	0.78	0.02
Montane cloud forest	0.76	0.78	0.02
Special other woody vegetation types	0.65	0.65	0.00
Special other non-woody vegetation types	0.74	0.72	-0.02
Woody xeric shrubland	0.84	0.85	0.01
Non-woody xeric shrubland	0.88	0.87	-0.01
Other lands	0.81	0.68	-0.13
Grassland	0.47	0.52	0.05
Deciduous tropical forest	0.70	0.73	0.02
Evergreen tropical forest	0.78	0.79	0.01
Semideciduous tropical forest	0.69	0.71	0.01
Woody hydrophytic vegetation	0.81	0.83	0.01
Non-woody hydrophytic vegetation	0.74	0.81	0.07

What is ARIES for SEEA?

- Tool that uses ARIES technology to compile ecosystem accounts that are consistent with the SEEA Ecosystem Accounting
- Includes land cover accounts consistent with the SEEA Central Framework
- Uses same definitions, classifications, accounting rules as the SEEA
- Can help automate production of maps and tables
- Provides infrastructure for the SEEA community to share and reuse interoperable data and models



Conclusions

- **SEEA adopted as statistical standard major milestone**
- **Makes nature count** within economic planning and decision-making
- **Standardization is important** in order to obtain high-quality, and comparable statistics
- **Provides framework for deriving indicators** to support various monitoring and reporting frameworks such as SDGs, Biodiversity, Climate Change, Green Economy
- **SEEA EA implementation strategy:**
  - **Guidelines and tools** are developed to facilitate accounts compilation
  - Enhanced collaboration between various communities (statistical, geospatial, biodiversity, policy makers)



Adding value to monitoring of ecosystem extent and integrity through derivation of habitat-based biodiversity indicators

Simon Ferrier | 27 September 2021

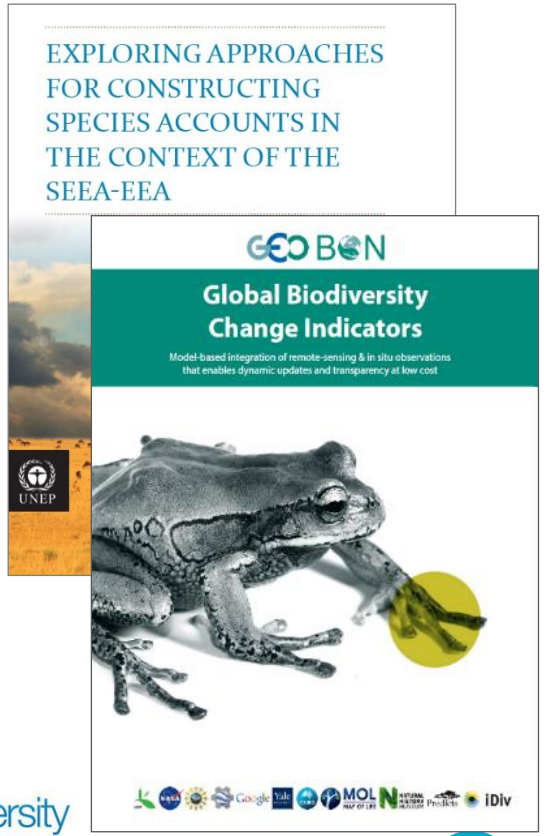
With thanks to: Chris Ware, Becky Schmidt, Tom Harwood, Andrew Hoskins, Karel Mokany (CSIRO)
Andy Purvis (NHM), Hedley Grantham (WCS)

GEO BON
Group on Earth Observations
Biodiversity Observation Network

CSIRO

Habitat-based biodiversity indicators can play an important role in large-scaled biodiversity assessment

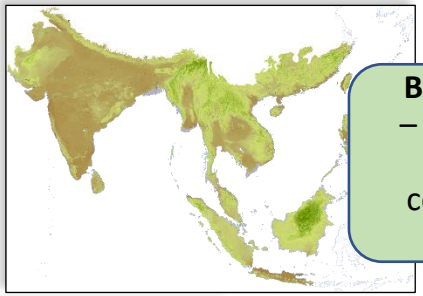
- Habitat-based biodiversity indicators assess how changes in ecosystem extent and condition (integrity) are expected to affect retention of species diversity
- They therefore offer one simple means of linking the ecosystem and species components of draft GBF Goal A
- Habitat-based indicators employ mapping either of individual species distributions (e.g. the *Species Habitat Index*) or of overall variation in community composition
- This presentation focuses on a community-level indicator generated by CSIRO – the *Biodiversity Habitat Index*



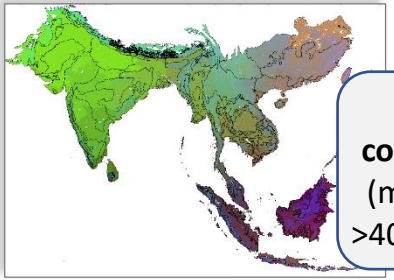
https://geobon.org/ebvs/indicators/

https://seea.un.org/content/exploring-approaches-constructing-species-accounts-context-seea-eea

The Biodiversity Habitat Index (BHI) translates ecosystem extent & integrity mapping into an indicator of biodiversity retention

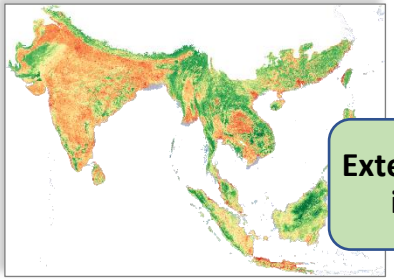


Biodiversity Habitat Index (BHI) – expected impact of ecosystem extent, local integrity [and connectivity] on <u>regional/global</u> retention of species diversity



Spatial variation in community composition (modelled from data for >400,000 species globally)

Spatial habitat connectivity analysis (with or without effects of climate change)



Extent and <u>local</u> (per grid-cell) integrity of ecosystems

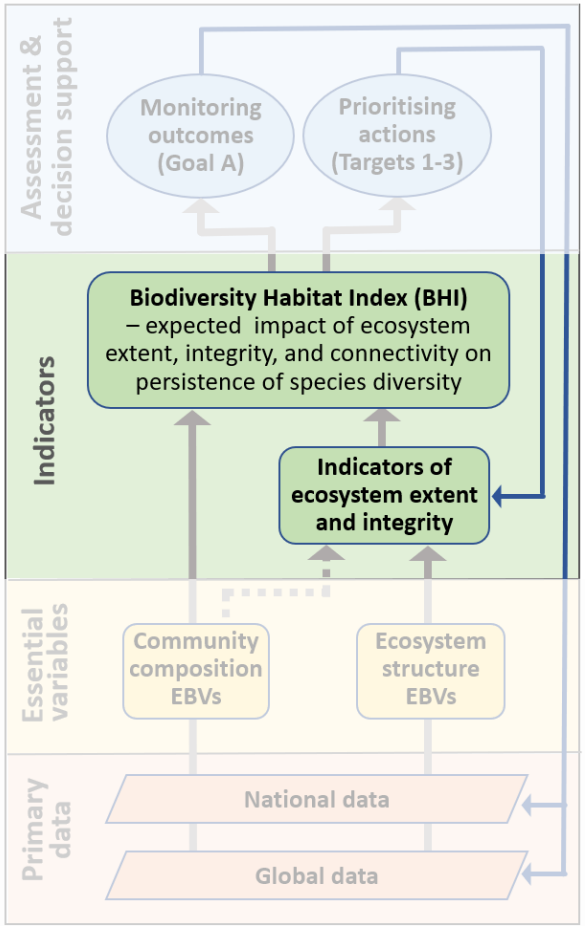
The BHI can be scaled either as *"effective proportion of habitat remaining"* or as *"proportion of species expected to persist"* (by invoking the species-area relationship)

Optional incorporation of connectivity analysis from CSIRO's Bioclimatic Ecosystem Resilience Index (BERI) indicator

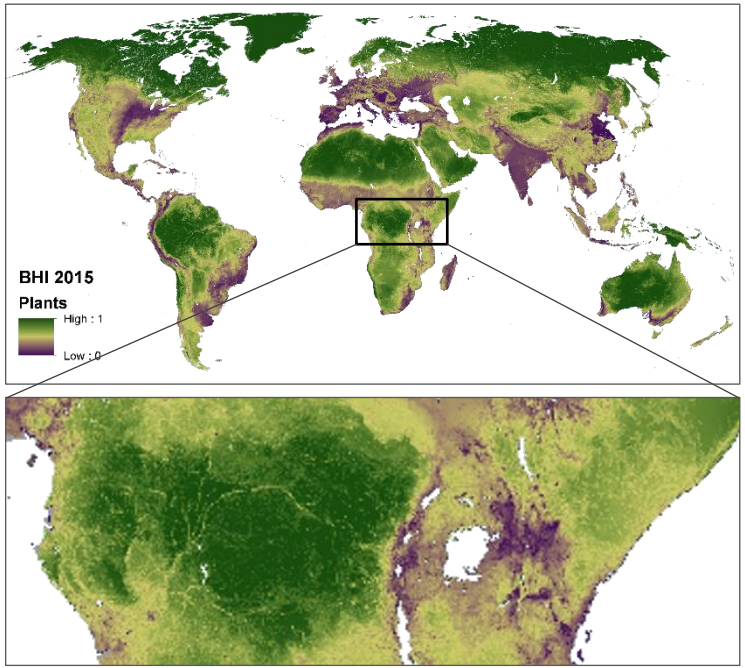
Hoskins AJ *et al* (2020) *Environmental Modelling & Software* 132: 104806

Ferrier S *et al* (2020) *Ecological Indicators* 117: 106554

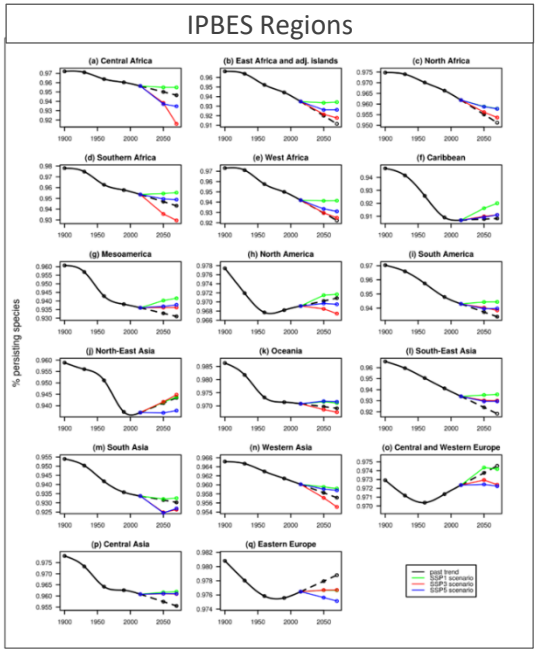
The BHI has been generated globally at 1km grid-resolution across all terrestrial biomes



Results can be mapped at raw grid-cell resolution …



… or reported by any specified set of spatial units

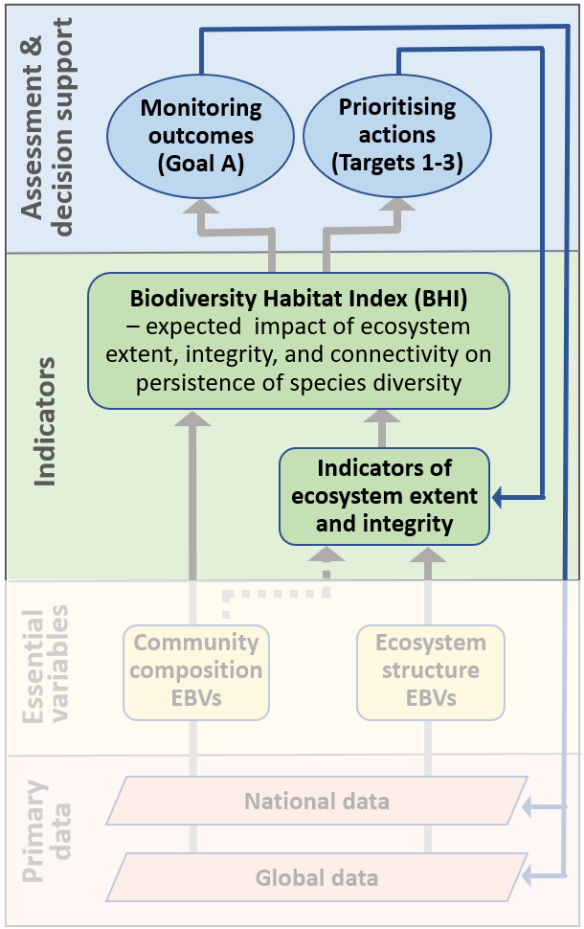


Hoskins AJ *et al* (2020) *Environmental Modelling & Software* 132: 104806

Di Marco M *et al* (2019) *Global Change Biology* 25: 2763-2778

CSIRO

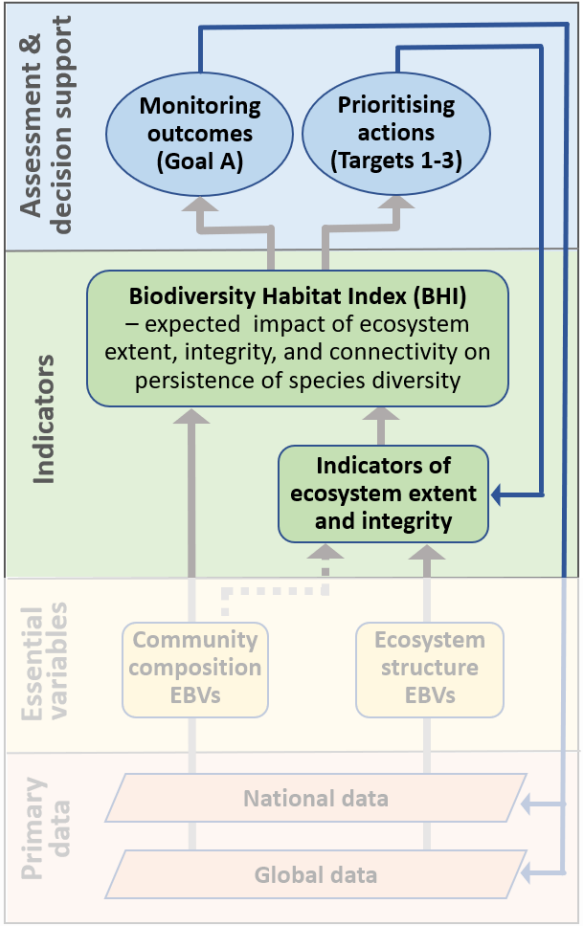
This capability is already being used to assess global and regional trends in the state of habitat supporting biodiversity …

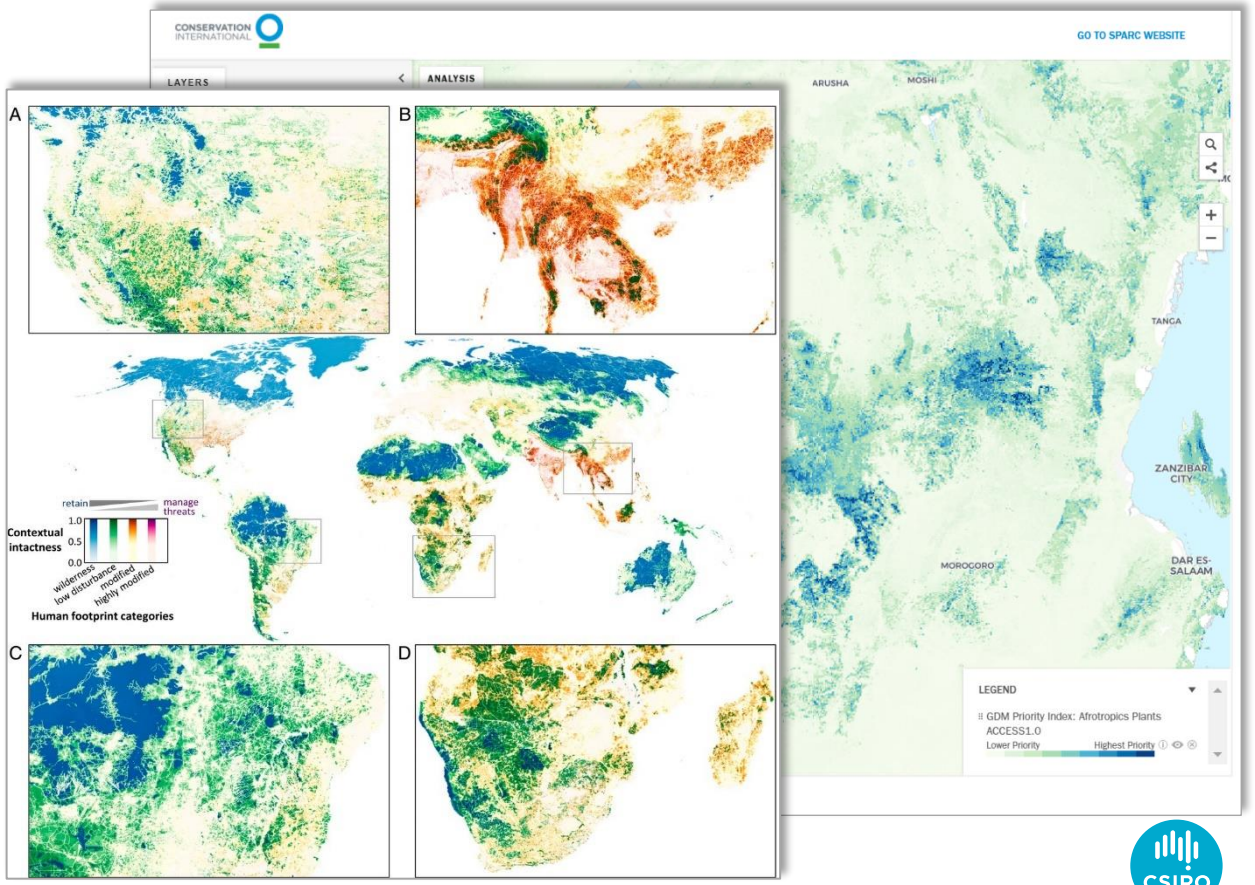




https://epi.yale.edu/ https://ipbes.net/global-assessment http://chm.aseanbiodiversity.org/

… and to prioritize areas for habitat protection or restoration to enhance prospects for biodiversity persistence



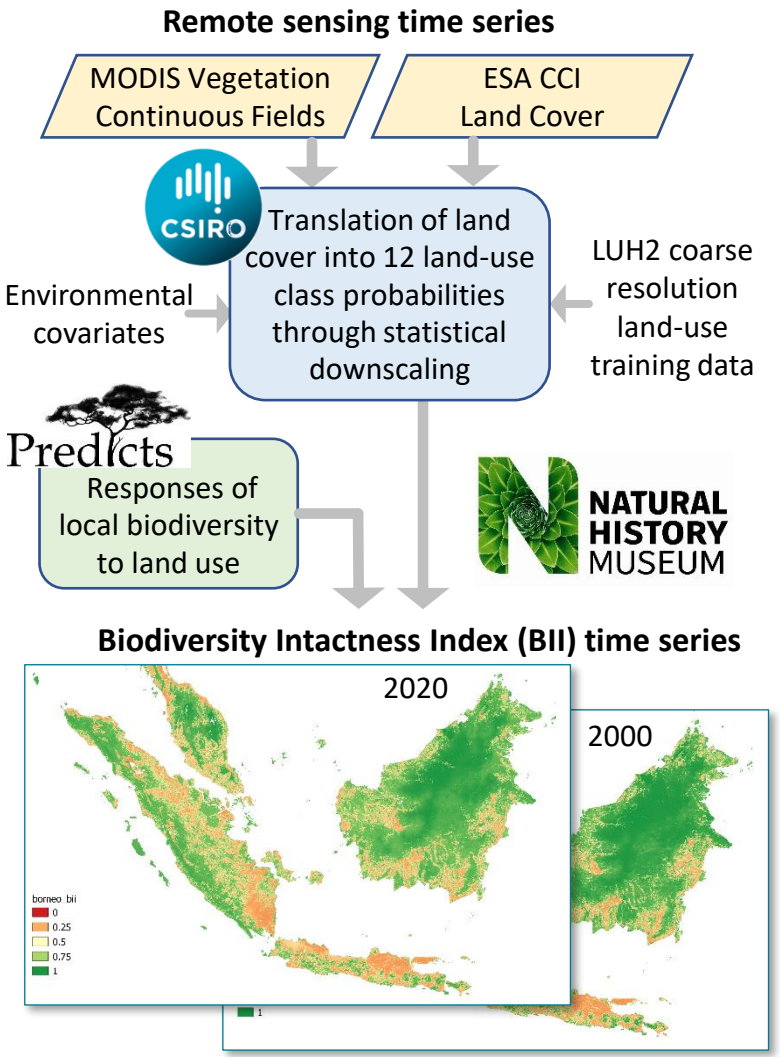


Mokany K *et al* (2020) *PNAS* 117: 9906-9911

http://www.sparc-website.org/

The source of data on local ecosystem integrity used most extensively in the BHI is the Biodiversity Intactness Index (BII)

- Derived by coupling CSIRO's downscaled land-use time series with the Natural History Museum PREDICTS project's meta-analysis of land-use impacts on local biodiversity
- Recently updated to provide 1km-resolution mapping of change for every year from 2000 to 2020 globally
- The Natural History Museum have committed to continuing production of the BII post-2020

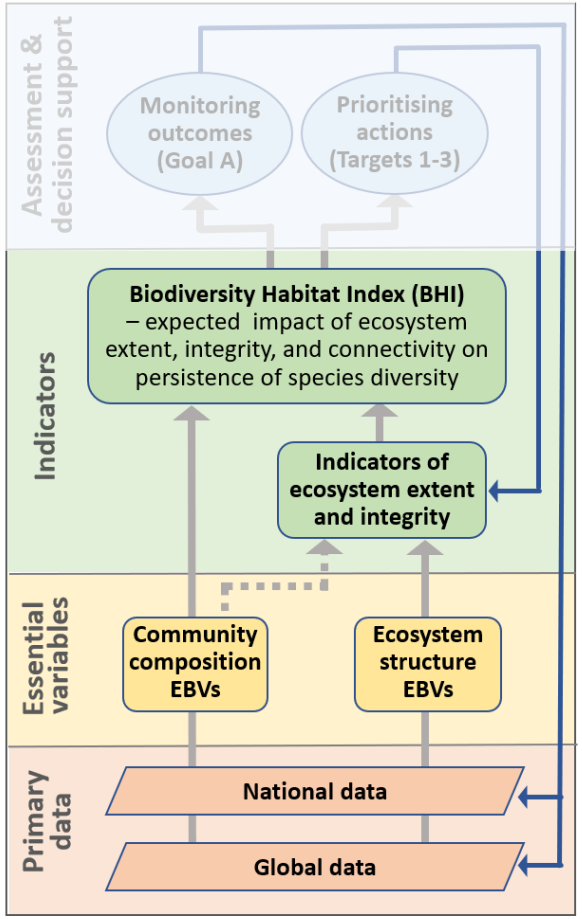


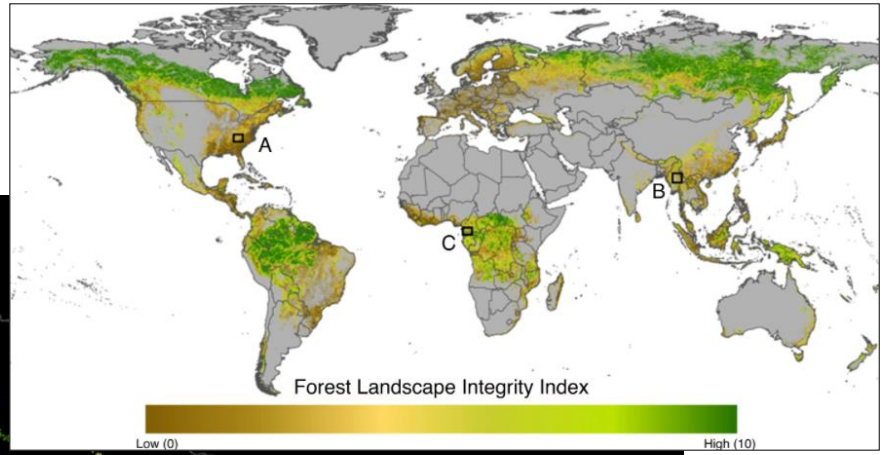
https://www.nhm.ac.uk/our-science/our-work/biodiversity/predicts.html

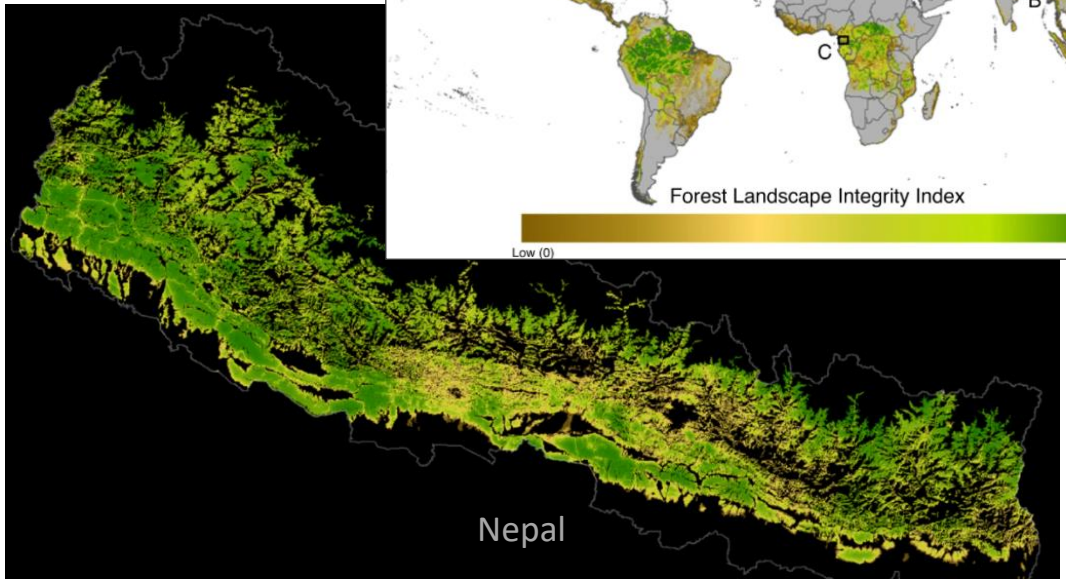
Hoskins AJ *et al* (2016) *Ecology and Evolution* 6: 3040-3055

The BHI can additionally be derived from other ecosystem integrity inputs

e.g. from the recently developed 300m-resolution Forest Landscape Integrity Index, in a current collaboration with WCS and University of Queensland



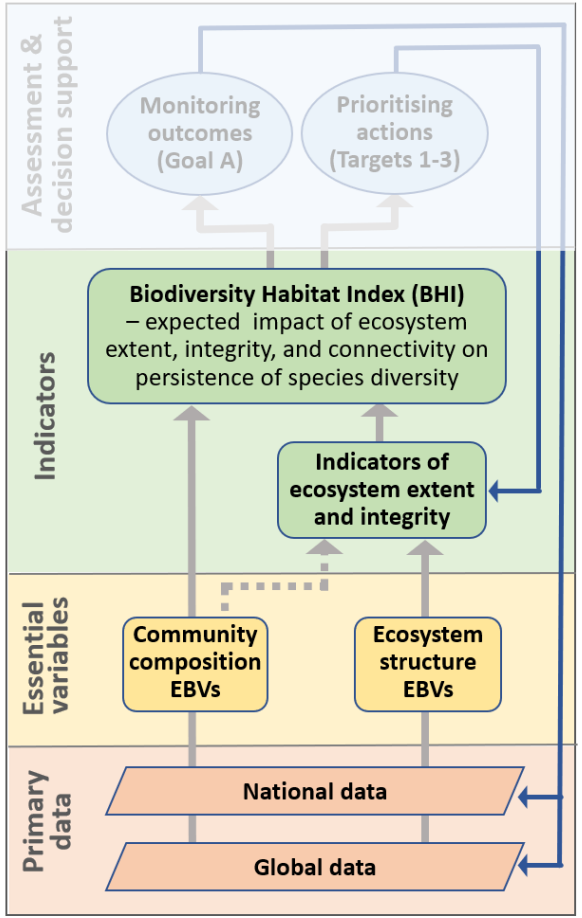




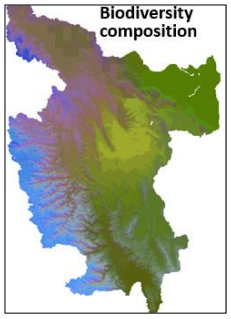
Grantham HS *et al* (2020) *Nature Communications* 11: 5978

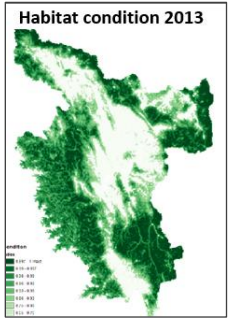
https://www.forestintegrity.com/

The BHI is also derivable at national & subnational scales – including from UN SEEA-EA ecosystem extent & condition accounts data



Applications from the San Martin Region of Peru …





Ecosystem type	Invertebrates (% biodiversity retained)			Vascular plants (% biodiversity retained)			Vertebrates (% biodiversity retained)		
	2009	2011	2013	2009	2011	2013	2009	2011	2013
Palm swamps	90.3%	90.1%	90.0%	87.0%	86.9%	86.8%	91.2%	91.1%	91.1%
Humid forest with high hills	88.3%	87.8%	87.4%	89.2%	88.8%	88.4%	83.7%	83.3%	83.1%
Humid forest with low hills	87.7%	87.3%	86.9%	88.6%	88.2%	87.8%	83.2%	82.8%	82.6%
Humid montane forest	91.1%	90.8%	90.5%	91.1%	90.7%	90.5%	87.5%	87.3%	87.1%
Lowland terra firme forest	86.5%	86.0%	85.6%	86.1%	85.5%	85.1%	80.9%	80.5%	80.3%
Floodplain forest	86.7%	86.2%	85.8%	86.6%	86.1%	85.7%	81.9%	81.5%	81.3%

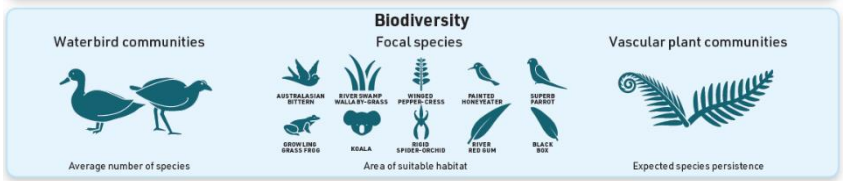


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https://www.wavespartnership.org/en/planning-tool-peru

… to the Murray-Darling Basin of Australia

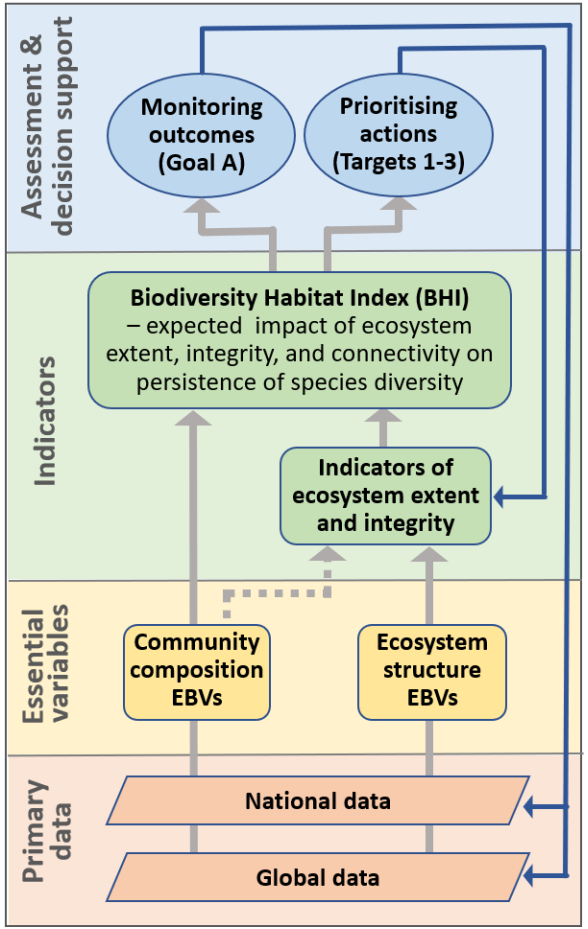




Australian Government Department of Agriculture, Water and the Environment · MARSDEN JACOB ASSOCIATES · IDEEA Group · GHD · CSIRO · CSIRO

https://eea.environment.gov.au/accounts/ecosystem-accounts

What can habitat-based biodiversity indicators, such as the BHI, contribute to post-2020 GBF implementation?



Better linking monitoring of progress towards achieving Goal A with prioritization of actions under Targets 1 to 3

Better integrating consideration of multiple ecosystem-focused (extent, integrity, connectivity) and species-focused components of Goal A

Better enabling seamless indicator derivation across scales, employing best-available global, national and subnational datasets

Thank you

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