Informing UN-assisted National Biodiversity Strategy Action Plans with Earth Observations: Application to Forest Integrity and Connectivity

Forest Integrity for Sustainable Development Planning

NASA Ecological Forecasting Meeting, April 2018, Washington DC

NASA

MONTANA STATE UNIVERSITY

NORTHERN ARIZONA UNIVERSITY

UNIVERSITY OF MARYLAND

GLOBAL PULSE

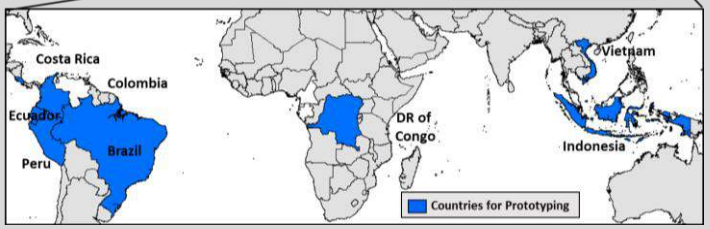
UNDP
Empowered lives. Resilient nations.

UNBC
UNIVERSITY OF NORTHERN BRITISH COLUMBIA

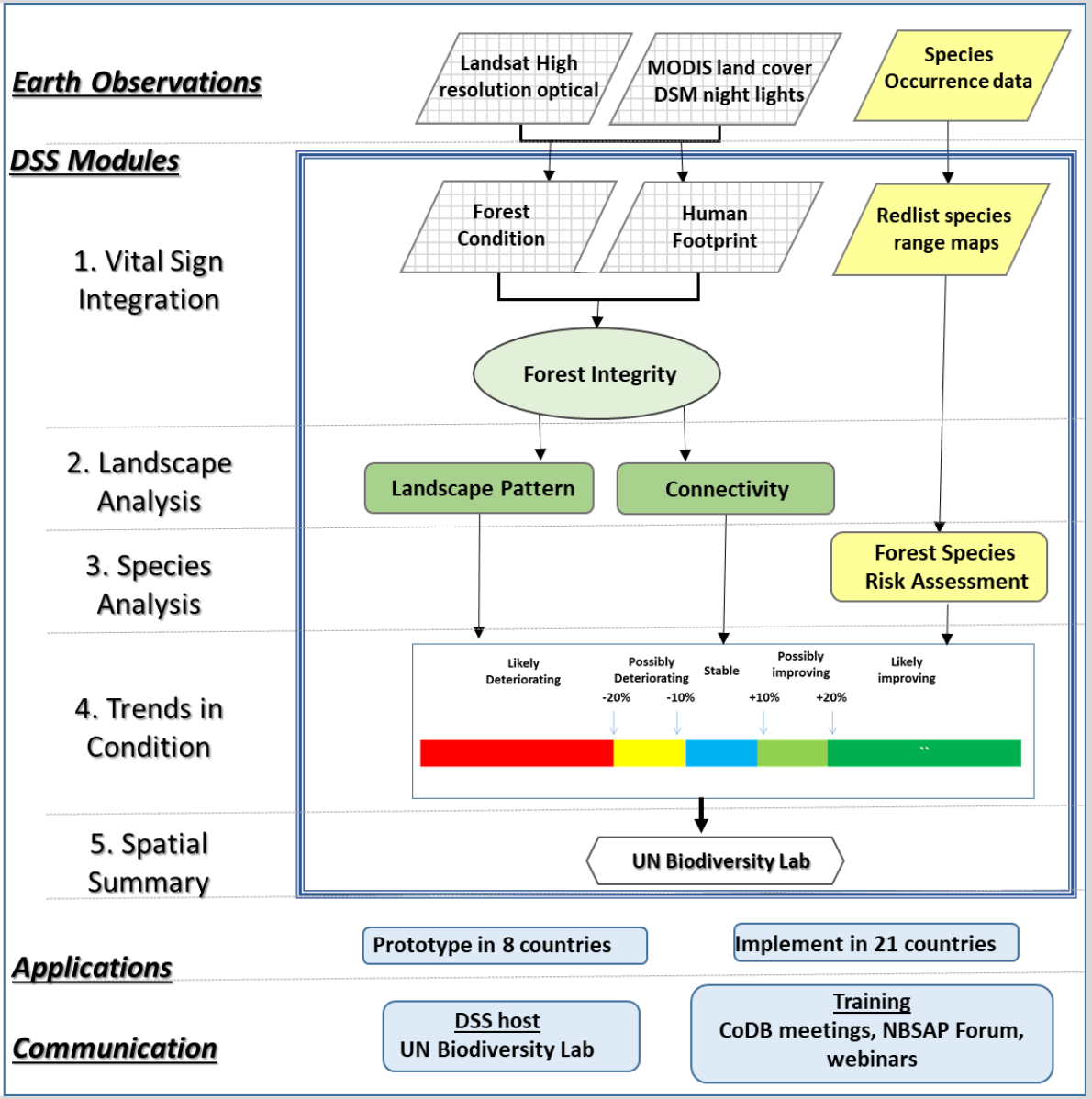
THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Wildlife Conservation Society

Project Purpose



Goal: Develop credible and consistent global satellite-based products and analysis methods to inform national reporting on Acchi Targets on forest fragmentation and connectivity



The Team

Rafael DeCarmargo, Oscar Venter, Dolors Armenteras, Scott Goetz, Annie Virnig, Andy Hansen, Cindy Schmidt, Patrick Jantz, Susana, James Watson (Matt Hansen)

UNDP
Diego Ochoa, Annie Virnig, Crissy Supples, Scott Atkinson (Jamie Ervin)

Topics

Human Footprint applications

Forest structural condition and integrity

Forest fragmentation and connectivity

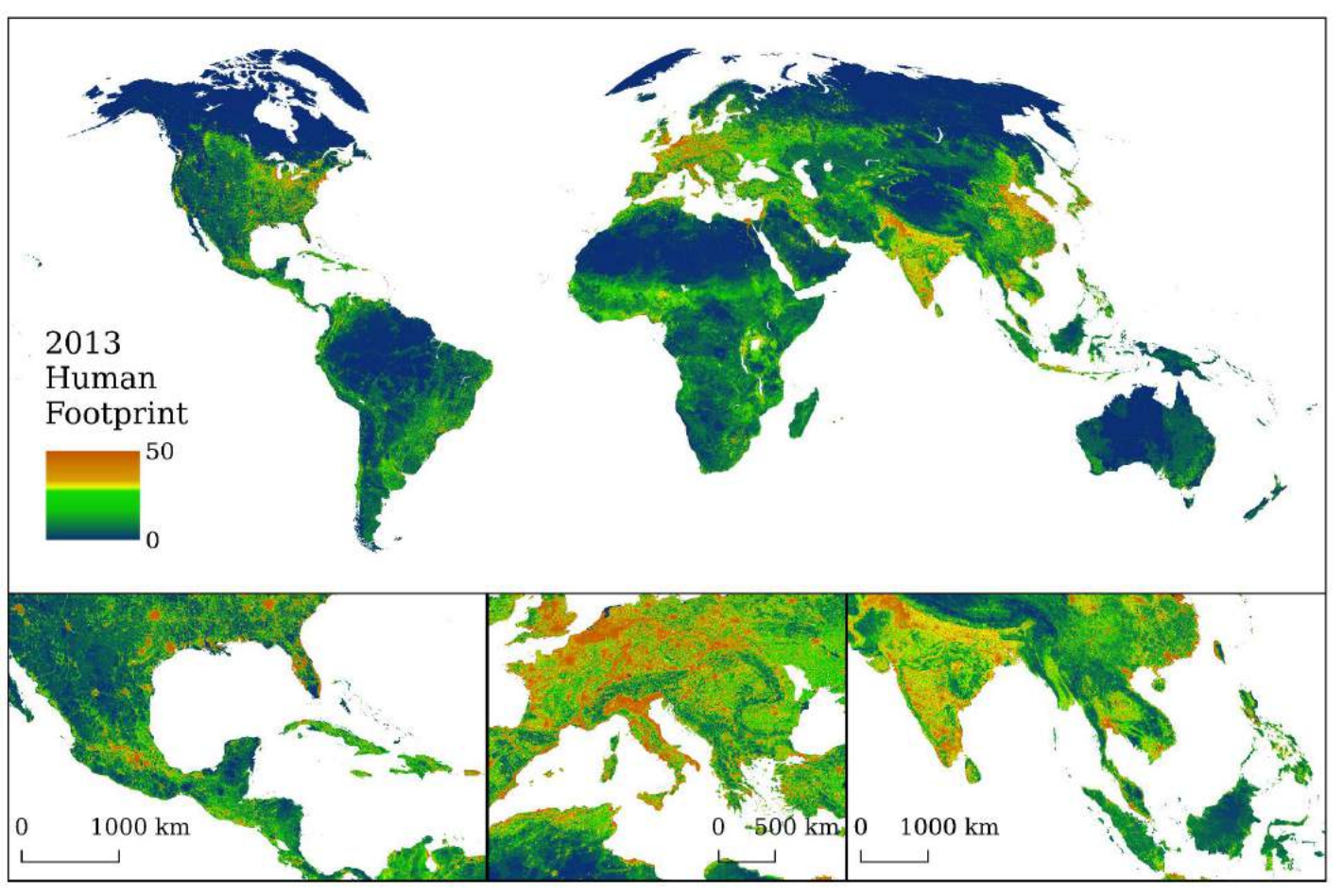
Decision Support System

Interactions with Partners

Human Footprint Update

Oscar Venter

Updated and distributed to countries for 2000, 2004, 2013 to correspond to UMD GLAD forest layers.



The new FIP maps have better:

- **data**
- **temporal inter-comparability**
- **validation**

Human Footprint Applications

nature COMMUNICATIONS

ARTICLE

DOI: 10.1038/s41467-018-07049-5 OPEN

Changes in human footprint drive changes in species extinction risk

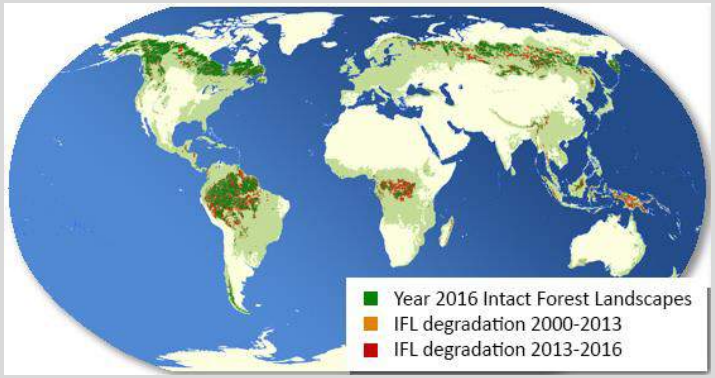
Moreno Di Marco[1,2], Oscar Venter[3], Hugh P. Possingham[1,4] & James E.M. Watson[1,5]

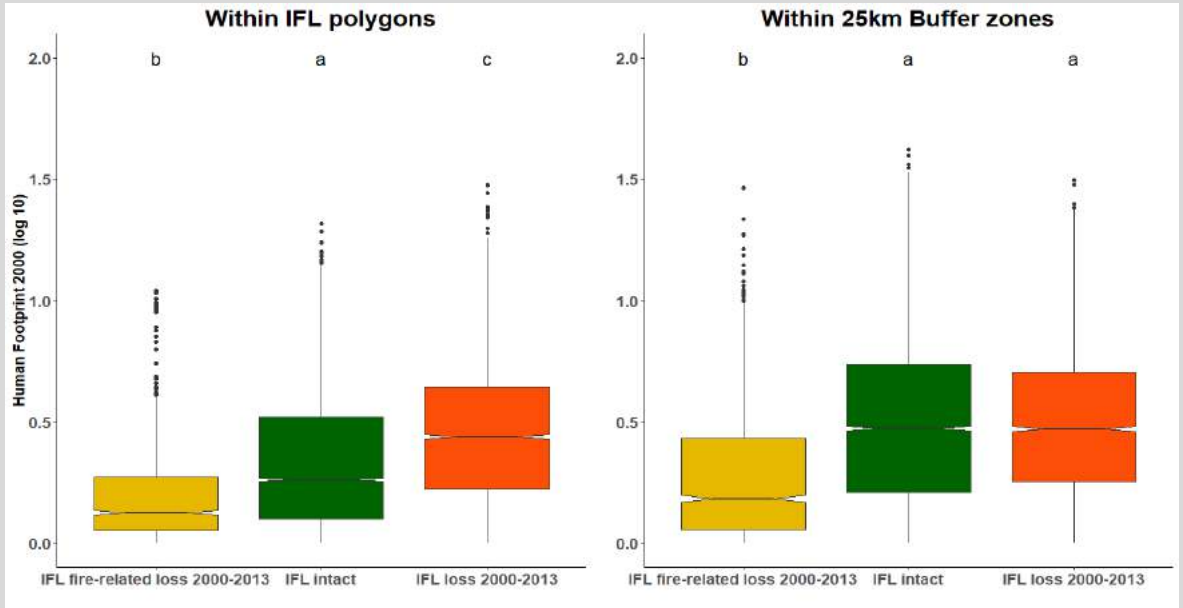
HFP is the strongest extrinsic predictor of change in extinction risk for 4400 mammal species

Human Footprint Applications

Global human footprint predicts loss of Intact Forest Landscapes

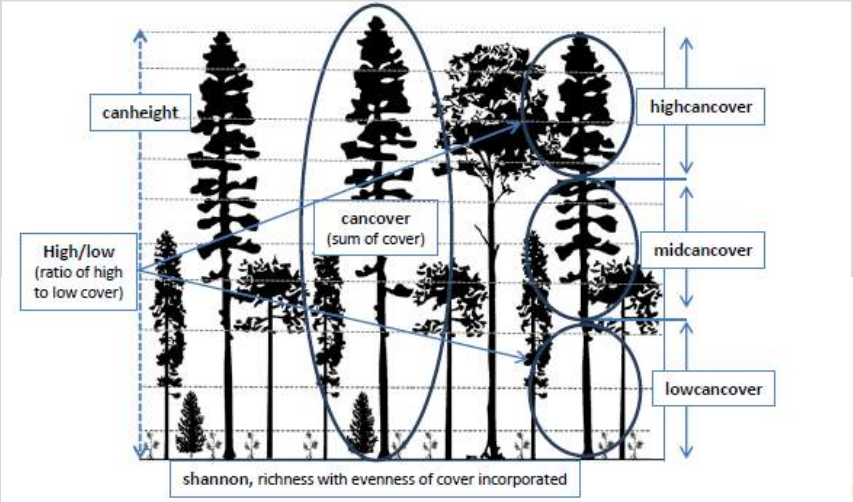
De Camargo, R., O. Venter, J. Watson, A Hansen, K Barnett, P. Jantz, S. Goetz

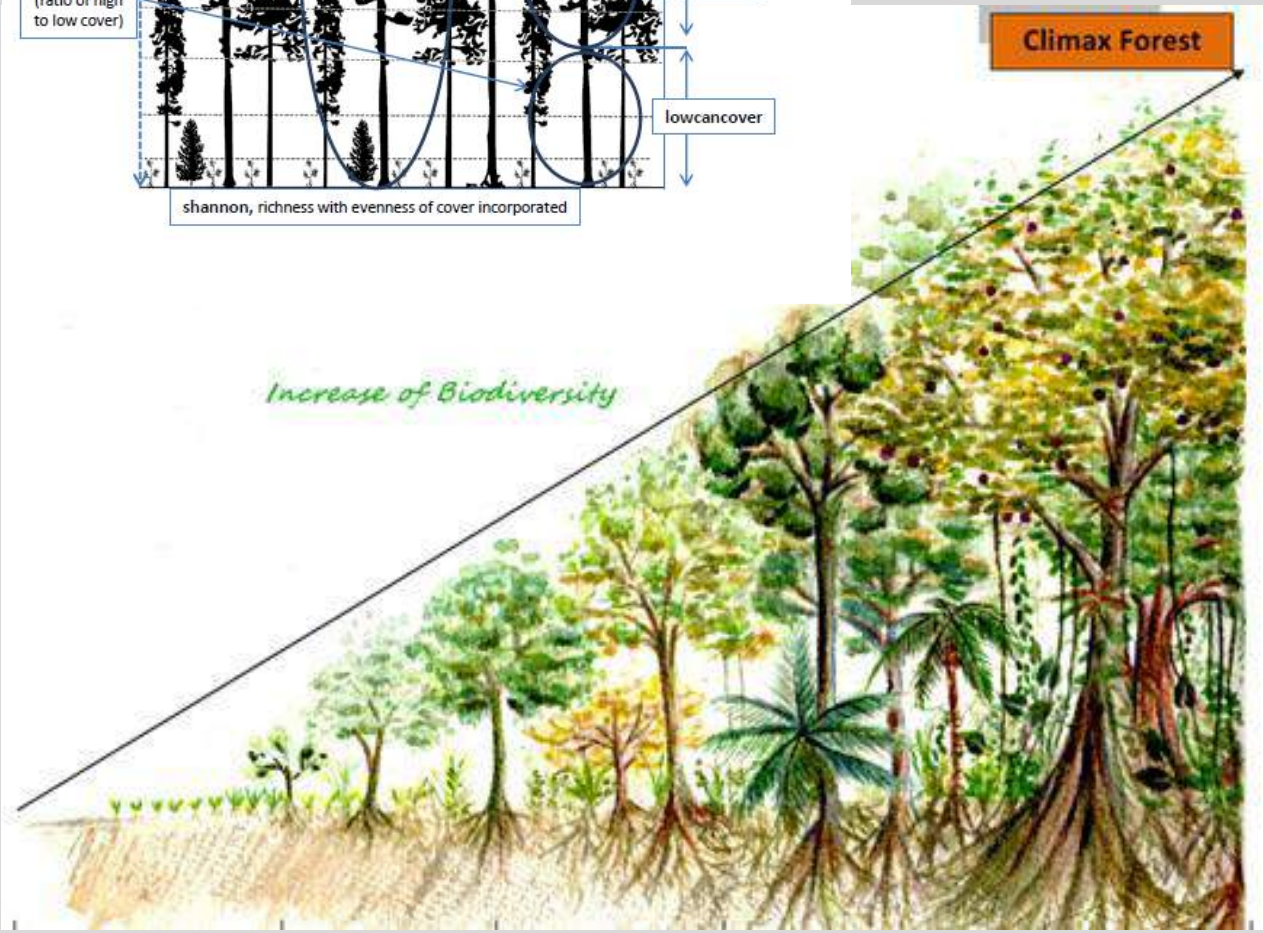




Forest Structural Condition and Forest Structural Integrity

Forest Structure



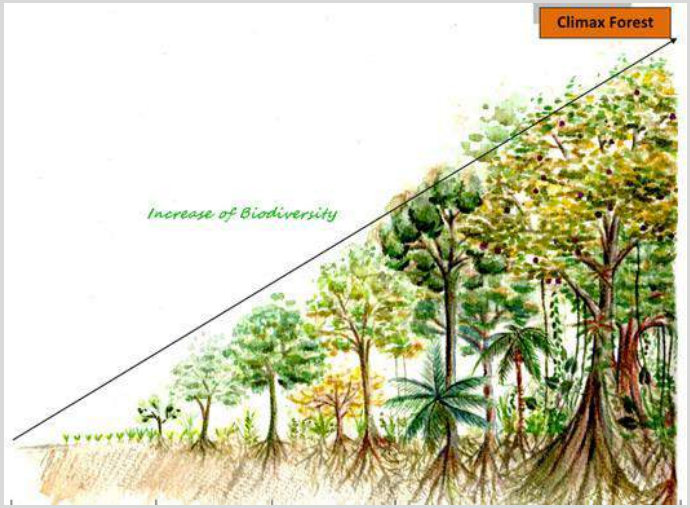


Structural complexity promotes:

- **Species richness**
- **Forest productivity**
- **Carbon uptake and storage**
- **Water yield**
- **Forest products**

Forest Structural Integrity

Forest Structural Condition



+

Human Footprint

=

Forest Structural Integrity

Forest Structural Condition	Canopy cover (%), Loss year Canopy height
Forest Structural Integrity	Canopy cover (%), Loss year Canopy height Human footprint

High integrity forests are those that are likely most valuable for supporting biodiversity and ecosystem services.

Structure Condition Index

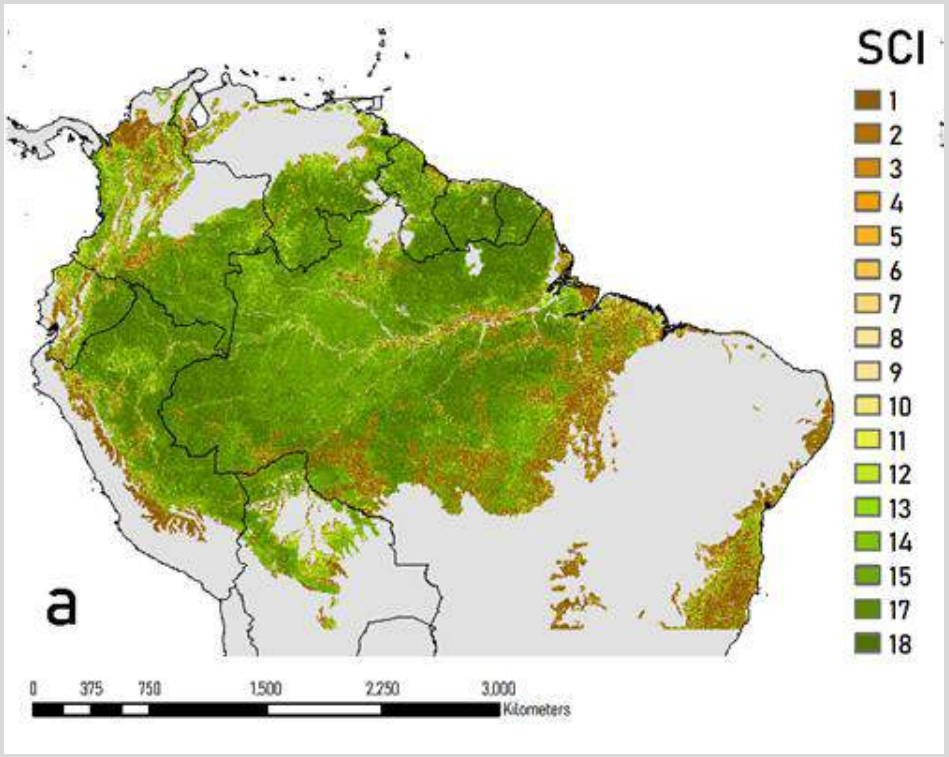
Loss Year	Forest height (m)										
		0-5	>5-15			>15-20			>20		
	Canopy cover (%)		Canopy cover (%)			Canopy cover (%)			Canopy cover (%)		
	<25		25-75	>75-95	>95	25-75	>75-95	>95	25-75	>75-95	>95
2013-2017	1	1	1	1	1	1	1	1	1	1	1
2001-2012	1	1	2	3	4	5	6	7	8	9	10
<=2000	1	1	10	11	12	13	14	15	16	17	18

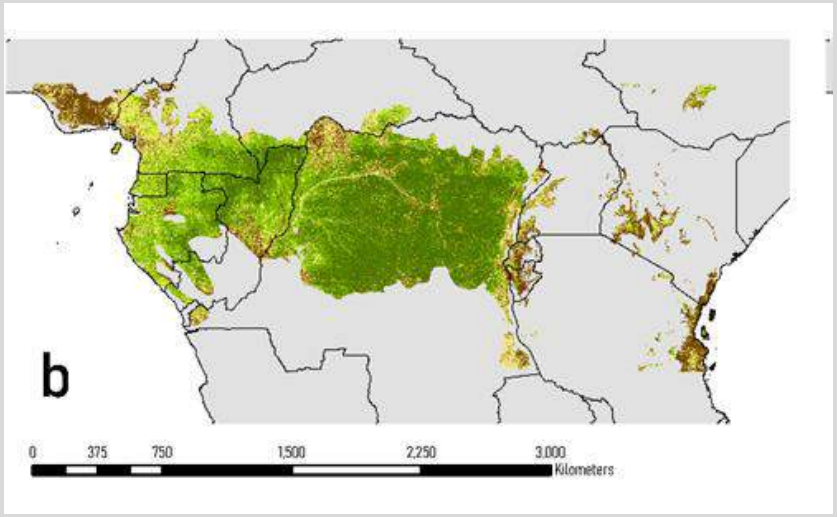
Cells with high stature and cover and not recently disturbed have the highest SCI value.

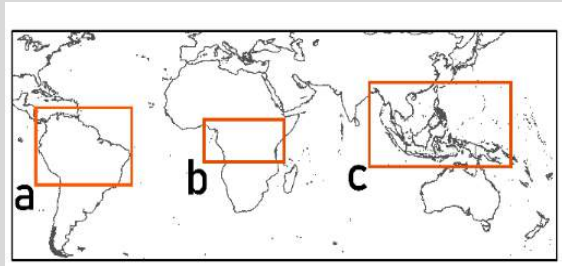
Riparian Meadows

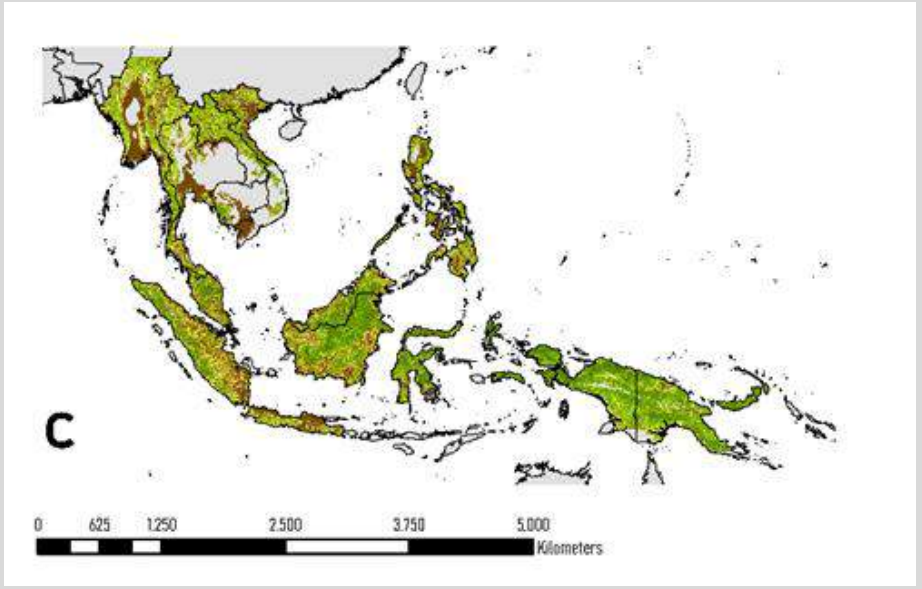
Deforestation and Primary Forest

Forest Structural Condition









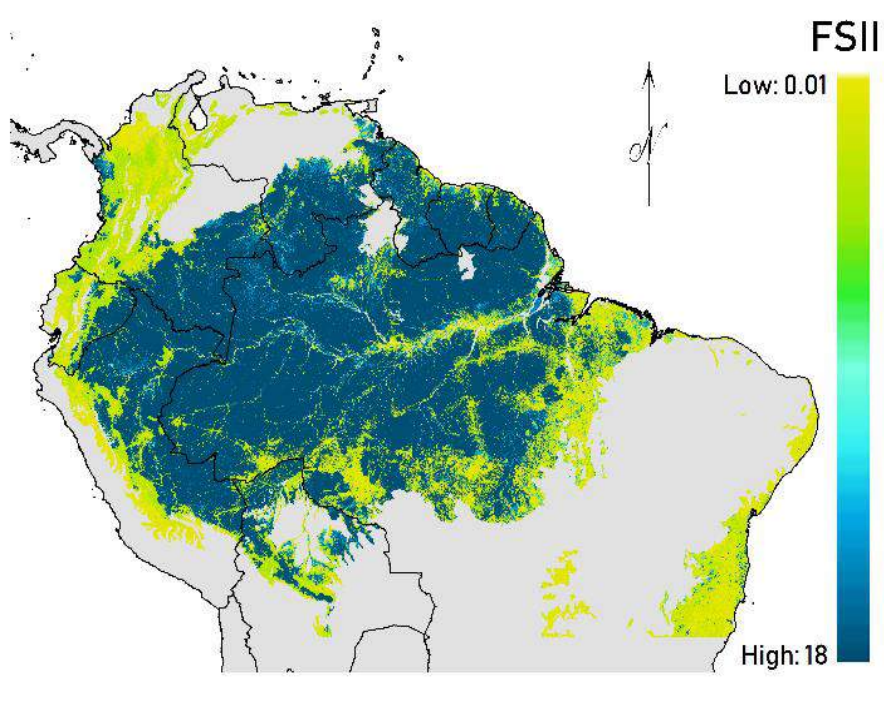
Forest Structural Integrity Index

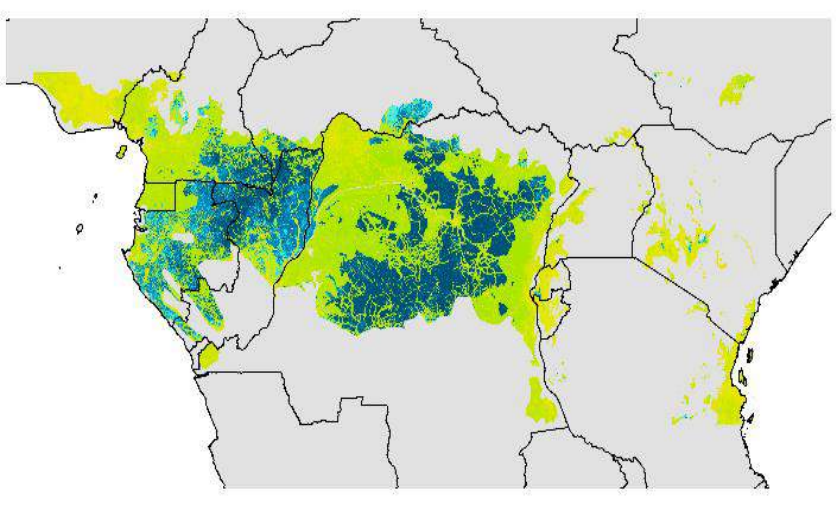
HFP Value	Class
<4	Low (1)
5-15	Medium (5)
>15	High (10)

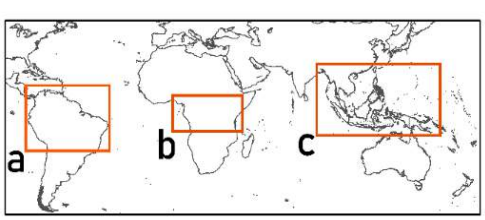
Forest Structural Integrity Index is calculated as:
forest structural condition index weight x
1 / human pressure weight

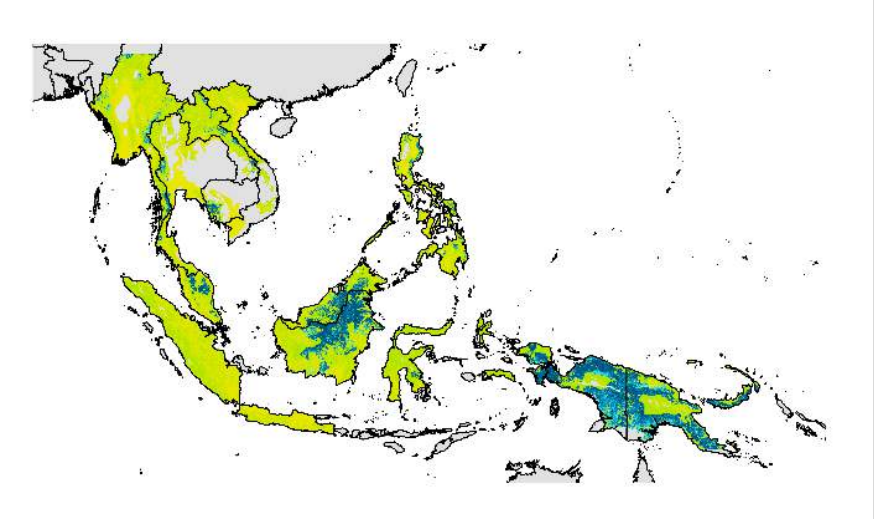
SCI Value		HFP Class	
	Low (1)	Med (5)	High (10)
1	1	0.2	0.1
7	7	1.4	0.7
8	8	1.6	0.8
9	9	1.8	0.9
10	10	2.0	1.0
11	11	2.2	1.1
12	12	2.4	1.2
13	13	2.6	1.3
14	14	2.8	1.4
15	15	3.0	1.5
16	16	3.2	1.6
17	17	3.4	1.7
18	18	3.6	1.8

Forest Structural Integrity Index

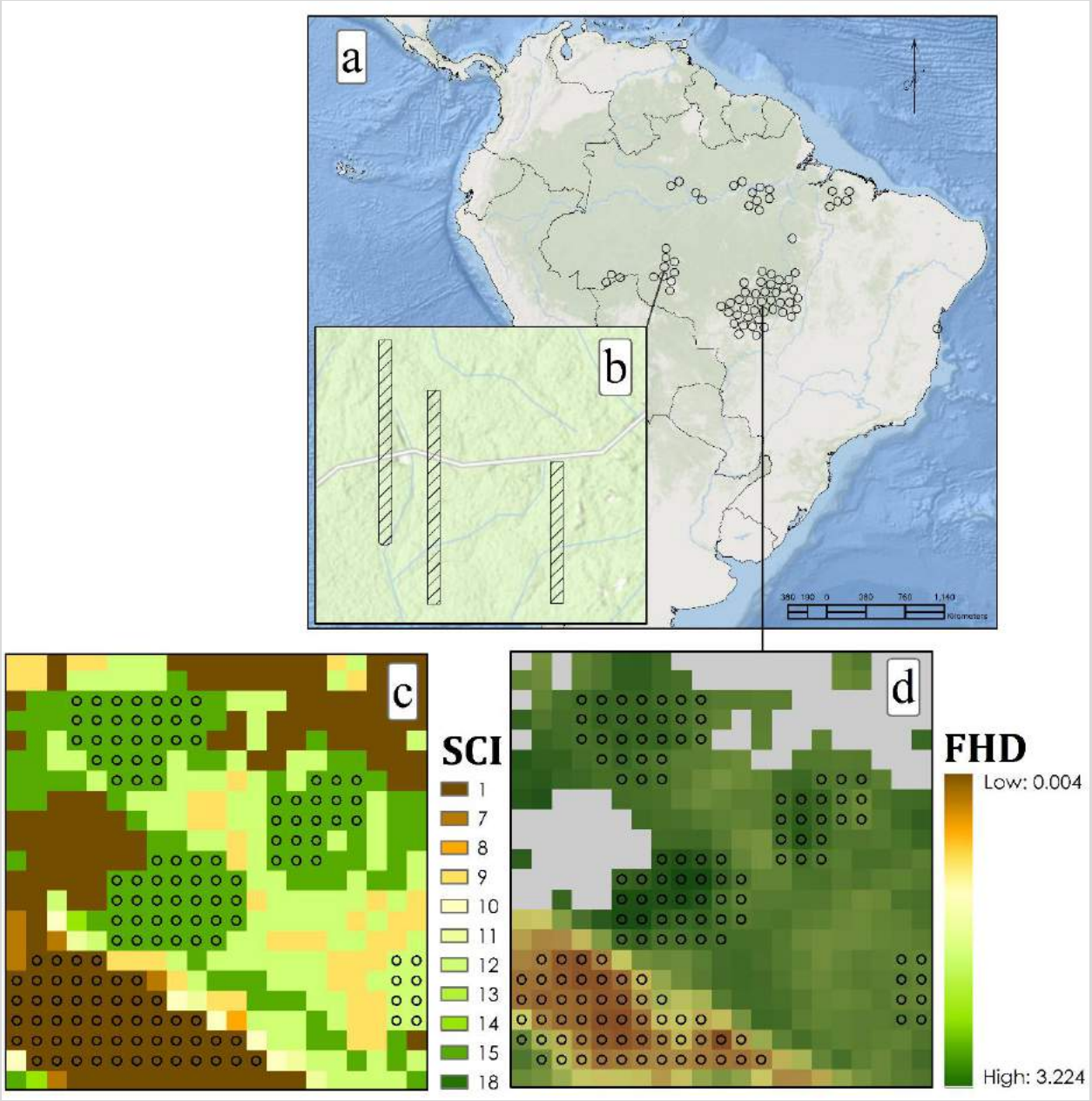








Validation of SCI



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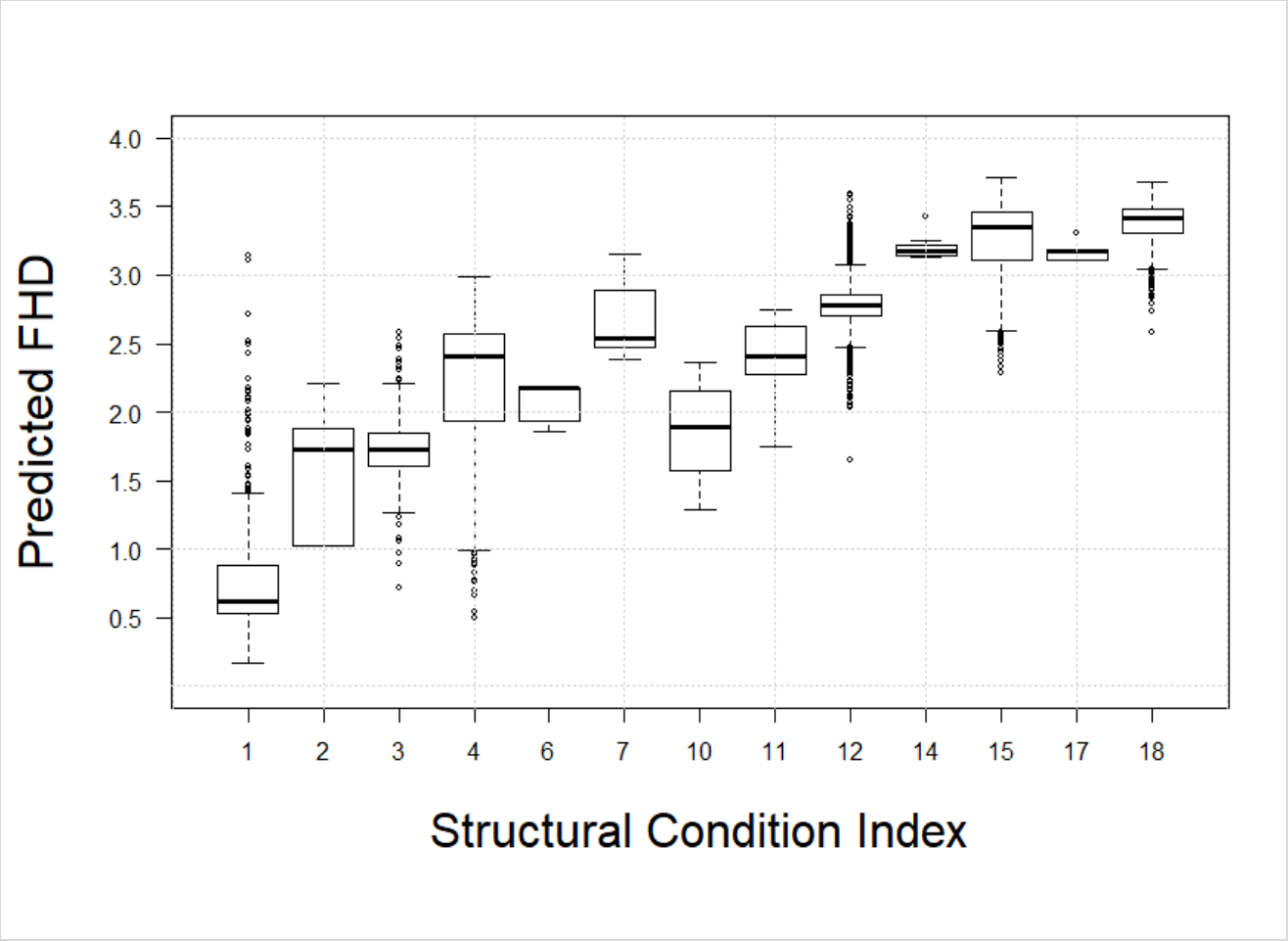
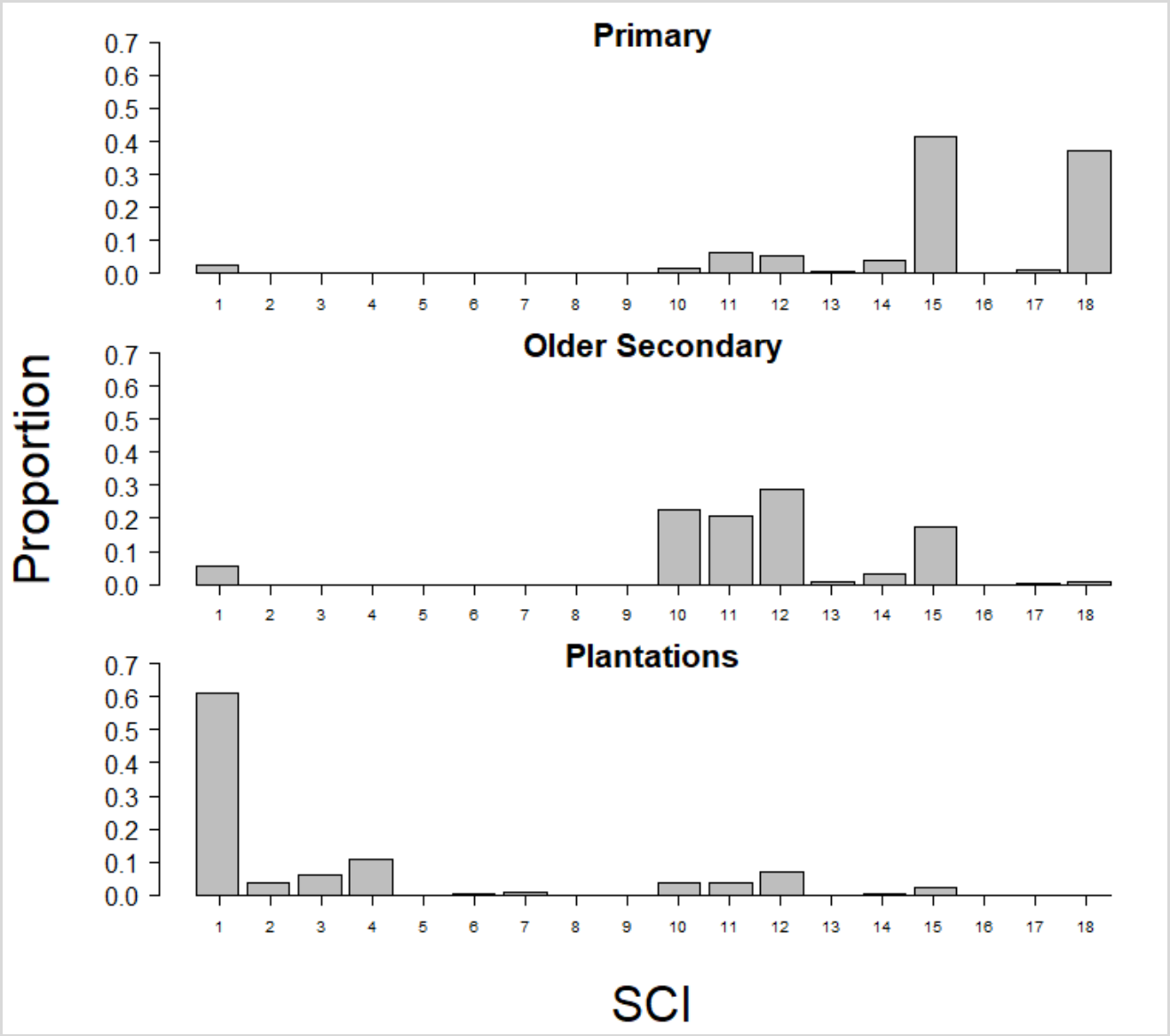


Model name	Model formula	AIC	R^2
Random effect – patch nested in transect	FHD = SCI + (1 | transect/patch) + ε	-59424.04	0.93

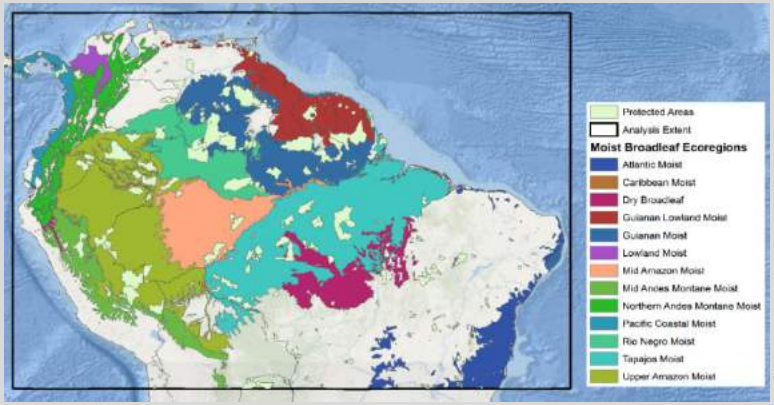
Validation of SCI



Tropical Forest Structural Integrity: Sustaining the Best of the Rest

Which of the remaining forests are highest in ecological integrity and most merit conservation planning?

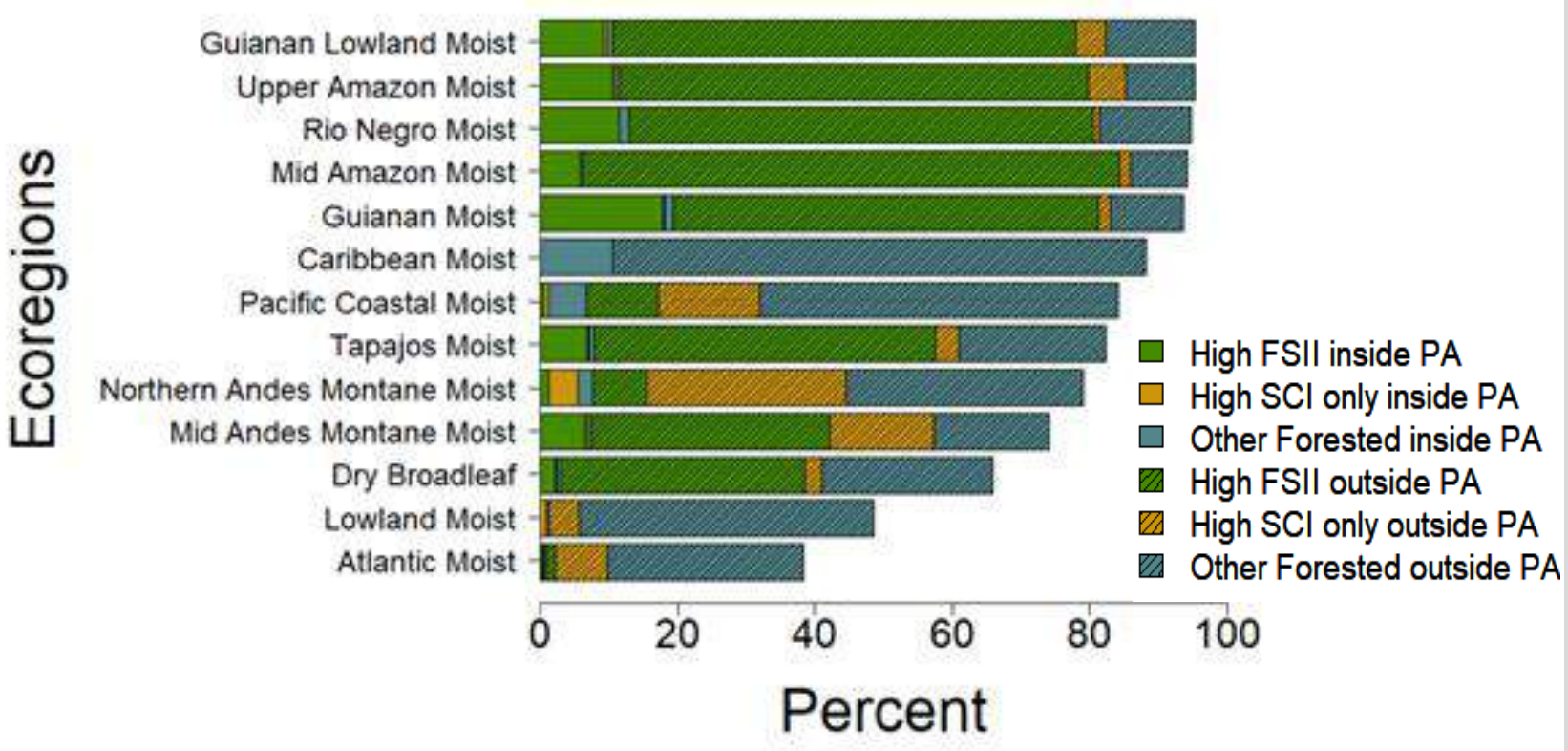
Tropical Forest Structural Integrity: Sustaining the Best of the Rest



Questions

What proportion of remaining forests are high in SCI and in FSII?

How well are high FSII forests represented in protected areas?



Tropical Forest Structural Integrity: Sustaining the Best of the Rest

Questions

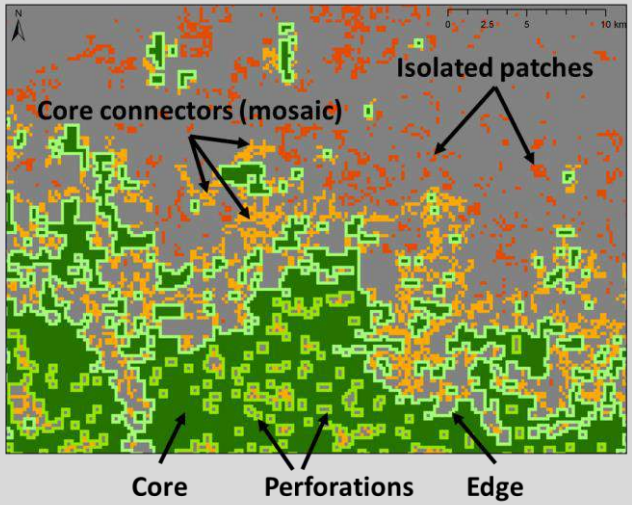
- **Which unprotected forests are the highest priorities for conservation (the best of the rest)?**
  - **Criteria**
    - **Least fragmented**
    - **Most contribute to representativeness of finer scale ecoregions**
    - **Best contribute to connectivity of large high FSII forests**
    - **Helps ecoregion get to 17% protected**

The results should be of high interest for conservation planning for the 2030 COB and SDG targets.

Fragmentation Index

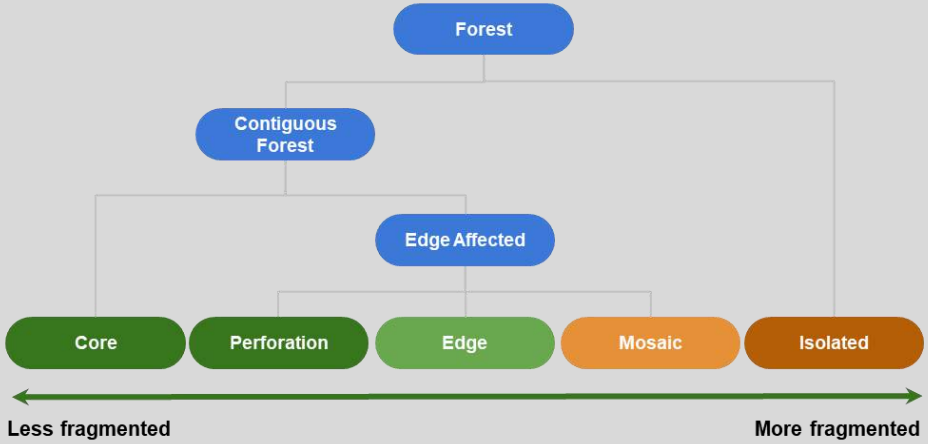
Patrick Jantz

Morphological Spatial Pattern Analysis



Vogt, P. and Riitters, K., 2017. GuidosToolbox: universal digital image object analysis. *European Journal of Remote Sensing*, *50*(1), pp.352-361.

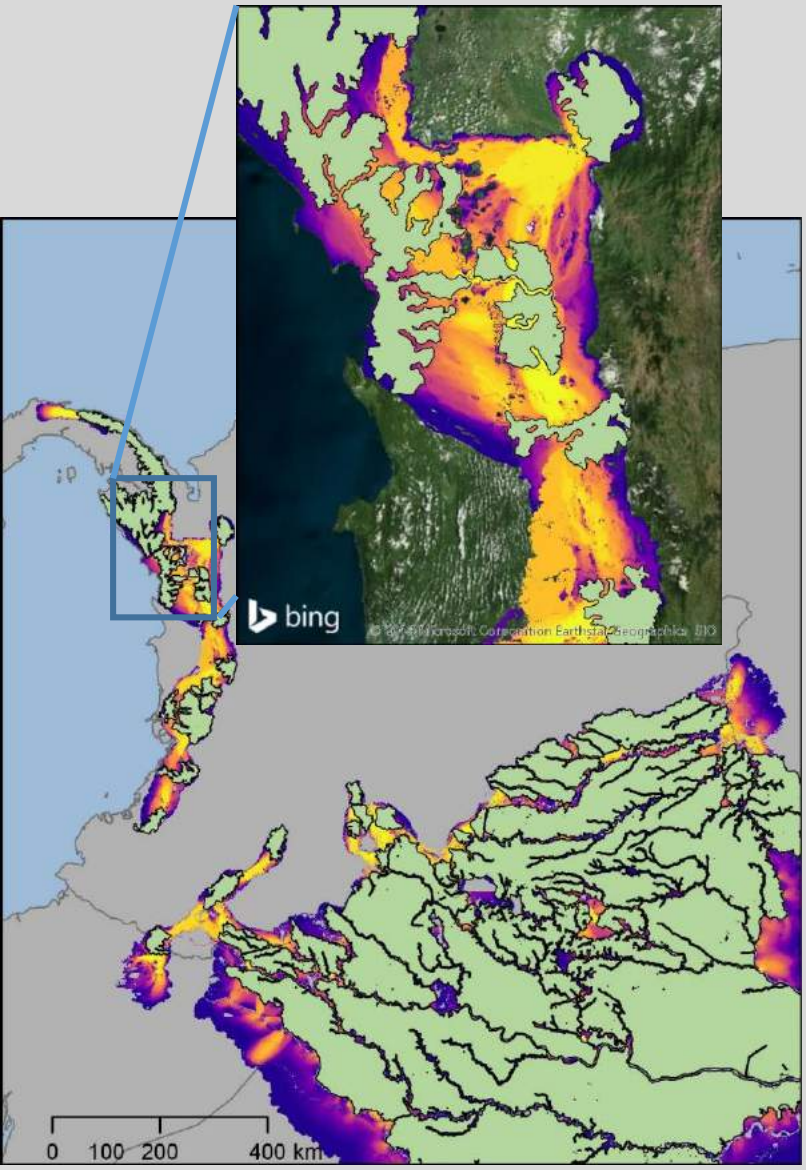
MSPA Hierarchy



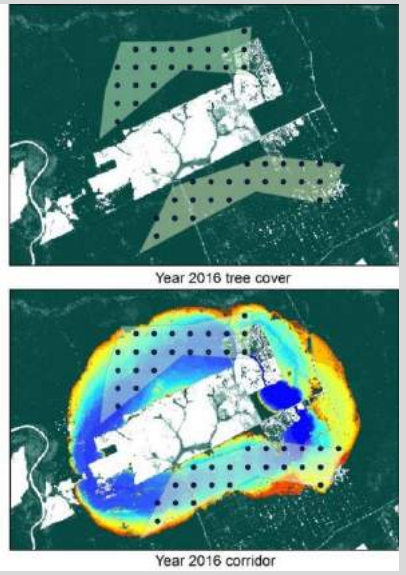
Fragmentation Index

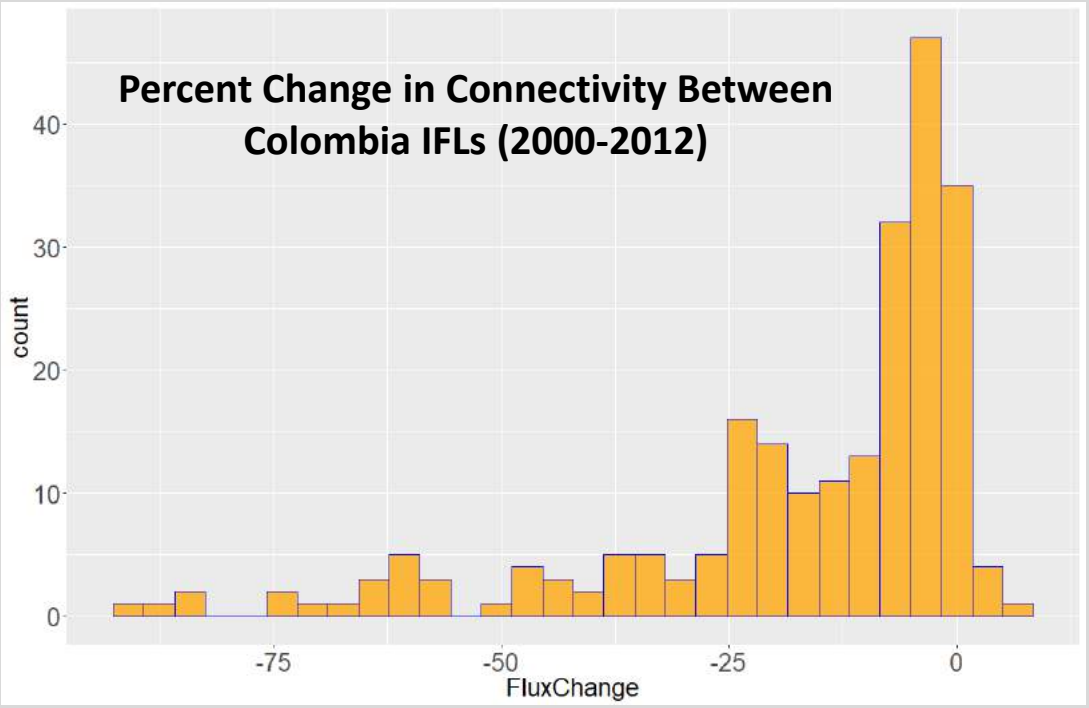
	Core	Perforation	Edge	Mosaic	Isolated
Percent high FSII	40	10	20	20	10
Weight	0	0.25	0.5	0.75	1
Product	0	2.5	10	15	10
Fragmentation Index	37.5				

Forest Connectivity



Multi-Corridor Mapping





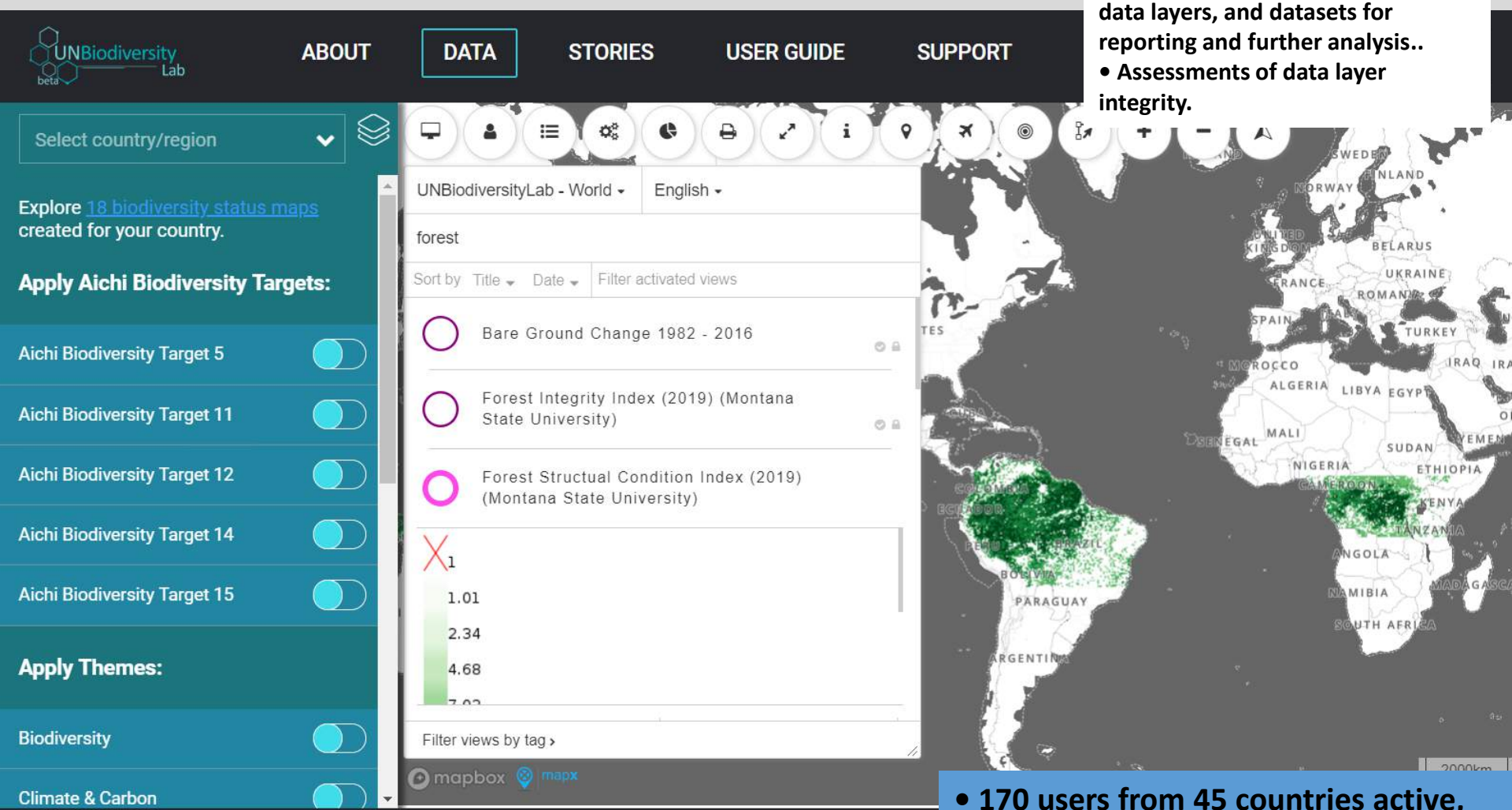
Applications

Acchi Target	Data Sets	Analyses
Target 5: Loss of natural forests	GLAD primary forest Human Footprint (2000, 2013) GLAD tree cover 2000 GLAD lossyear 2000-2017 Resolve 2017 ecoregions	Define natural forests based on treecover 2000, primary forests, human footprint. Subtract areas of forest loss from UMD loss year to quantify rates of natural forest loss. Summarize the rates of natural forest loss 2000-2017 by ecoregion and country.
Target 5: Degradation	Forest Structure Condition 2000, 2017 (forthcoming Forest Integrity Index 2000, 2017 (forthcoming Land allocation types Land cover land use	How has the distribution of degraded forests (SCI<14, FI<14) changed 2000 to 2017 summarized by land allocation type, ecoregion, country. How degraded are human-altered and secondary forests relative to natural forests?
Target 5: Fragmentation	Layers above GLAD gain 2000-2017 (forthcoming) GLAD height 2000-2017 (forthcoming)	Natural forests as defined above. Define forest types and age classes Run morphological Spatial Pattern Analysis for the maps for 2000, 2017. Define edge effects thresholds based on forest types
Target 11: Protected area connectivity	Layers above	Use Multi-Corridor Mapping procedures to assess change in connectivity of protected areas by natural forests from 2000 to 2017, weighting resistance of natural forests with the spatial pattern parameters

Decision Support

- free, open source online platform that allows policymakers to access essential global data layers, to upload their own datasets, and to analyze multiple datasets in order to be able to provide key information on the CBD Aichi Biodiversity Targets and on SDGs.

- **Access to nearly 100 global spatial data layers.**
- **Ability for countries to upload national datasets to private National Projects.**
- **Ability for users to export maps, data layers, and datasets for reporting and further analysis..**
- **Assessments of data layer integrity.**



https://unbiodiversitylab.org/

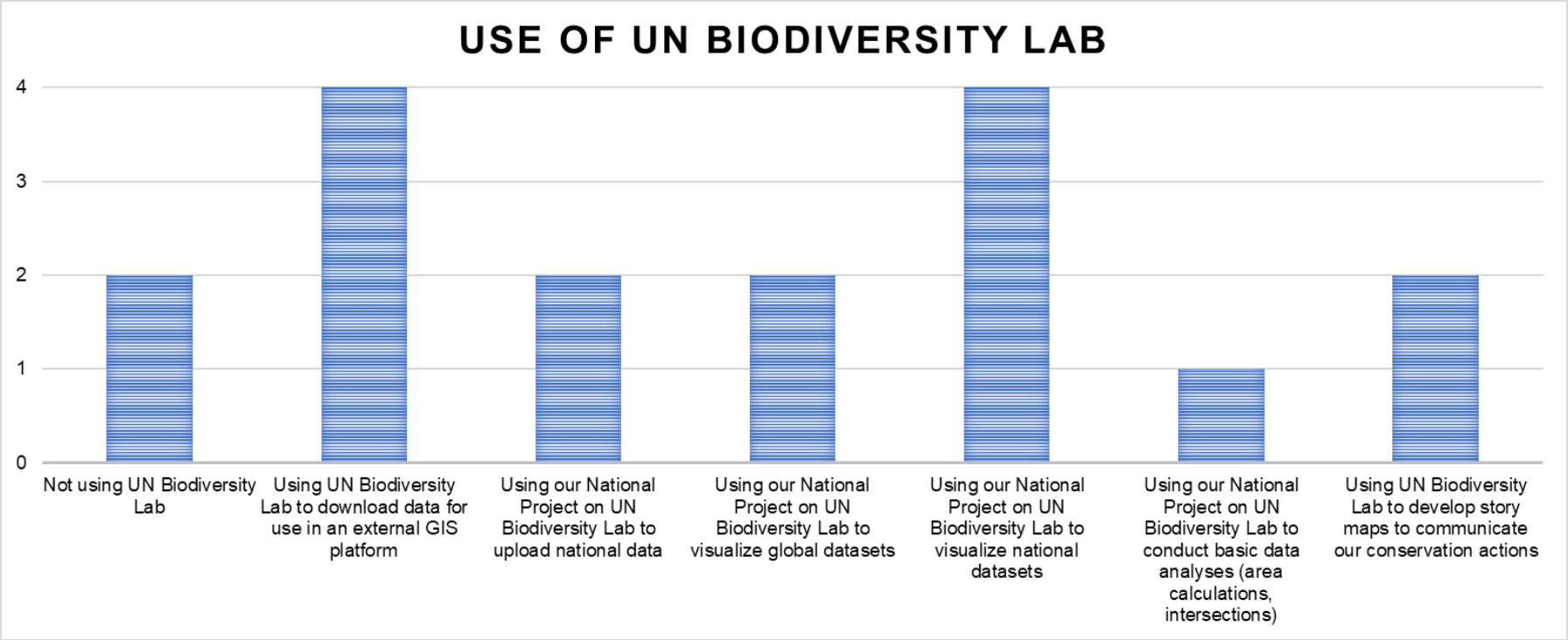
- **170 users from 45 countries active, including seven of the Forest Integrity Project pilot countries.**

Decision Support

Engagement and Training

Webinar: May 2019

	UN Biodiversity Lab Launch SBSTTA 22 July 2018	6NR Help Desk SBSTTA 22 July 2018	6NR Help Desk COP14 Nov 2018	6NR Workshop COP14 Nov 2018	UN Biodiversity Lab Webinar: Regional Orientation Aug-Sept 2018	UN Biodiversity Lab Webinar: Uploading National Data Sept 2018	UN Biodiversity Lab Webinar: Conducting Basic Analyses Sept 2018	UN Biodiversity Lab Webinar: Story maps Oct 2018
Brazil	√	√	X	X	√	√	√	√
Colombia	√	√	√	√	√	√	√	√
Costa Rica	X	X	X	√	√	√	√	√
DRC	X	X	X	X	√	X	X	X
Ecuador	√	√	√	√	√	√	√	√
Indonesia	X	X	X	X	√	√	√	√
Peru	X	√	√	X	√	√	√	√
Viet Nam	X	X	√	√	√	√	√	√



Fulbright in Colombia: In Pursuit of Primary Forests

Pacific Coast

Rio Magdelena

Andes

Orinoco Ilanos

Amazon

Restoration Heroes