



ForestCDB



Forest Carbon Database

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Background

Welcome

The Global Comparative Study on REDD+ provides this forest carbon database as part of the public domain. The database supports development of national and subnational monitoring, reporting and verification of REDD+ activities. We invite all practitioners who have forest inventory data, manage permanent sample plots or conduct research on carbon stocks to participate in this initiative.

This system allows you to account for five carbon pools: aboveground tree biomass, belowground tree biomass, dead woody debris, understorey and soil. You can also profile your carbon stock data with supporting information: site, land cover, climate and soil. If you want to upload your entire inventory of data, this carbon database will automatically calculate the carbon stock in that ecosystem.

Our system offers these advantages:

1. We help reduce duplicate data collection by making available data that has already been collected. This reduces costs.
2. We provide easy access to data that cannot be readily replicated, such as large surveys that are too expensive to replicate.
3. We help you compare carbon stocks across land use types provided by other contributors.

CIFOR's multiyear Global Comparative Study on REDD+ aims to inform policy makers, practitioners and donors about what works in reducing emissions from deforestation and forest degradation, and enhancement of forest carbon stocks in developing countries (REDD+). For more information, visit [the Forest and Climate Change website](#).

Please enter by registering, at no cost.

Login

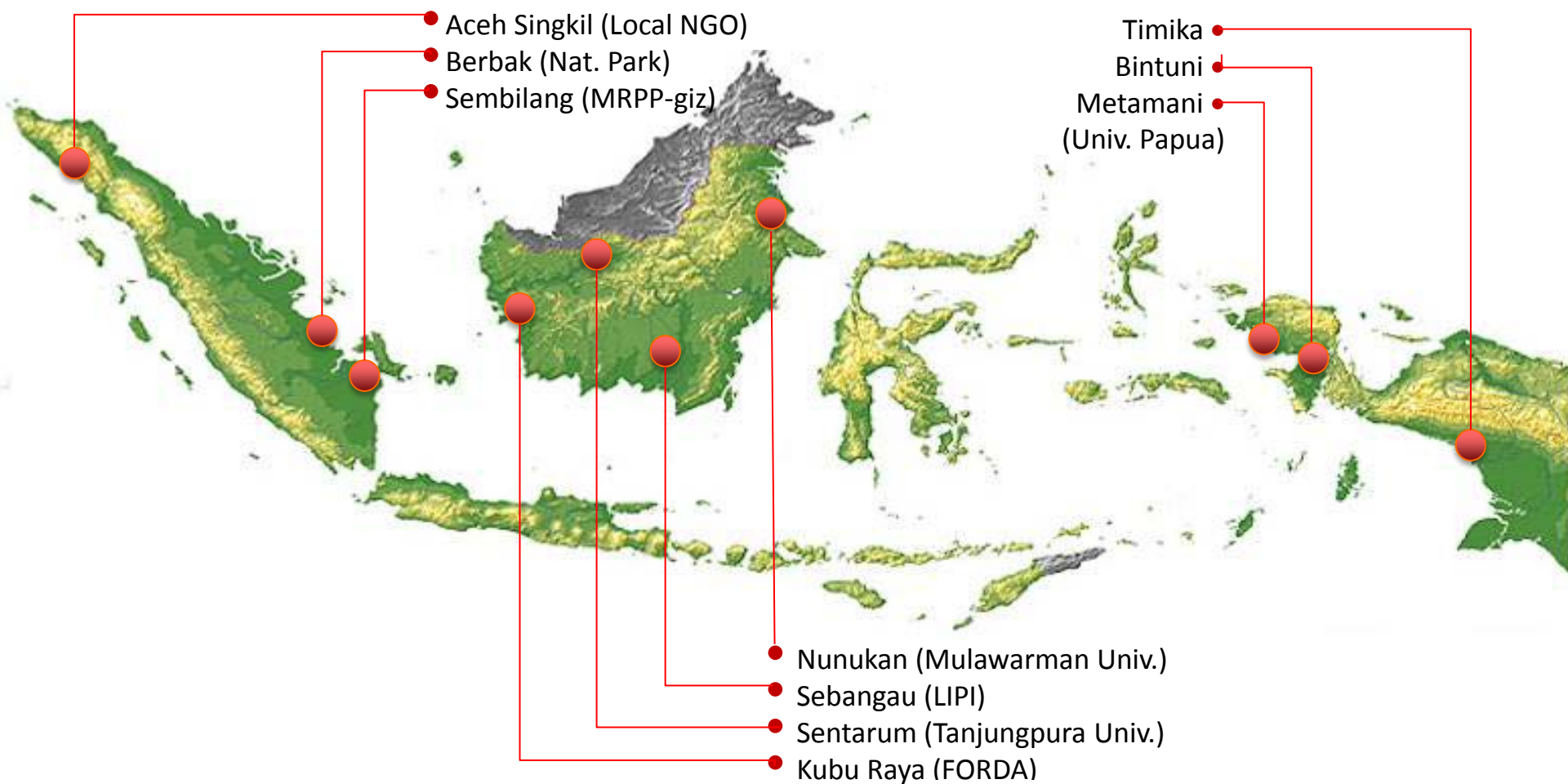
User name

Password

Sign in

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- [Want to register ?](#)

PSP network in Indonesia



THINKING beyond the canopy





Forest carbon database

A Web-based carbon stock data repository and exchange system

Sofyan Kurnianto and Daniel Murdiyarso



Australian Government
AusAID

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The alpha version

- Accommodates 5 carbon pools (IPCC 2003)
- Providing calculator and repository system
- Allowing data exchange among users
- Point data

Landing page for contributors

Guide for contributor

Thank you for your contribution to the Global Comparative Study on REDD+ carbon stock database. By clicking on the commands on the right side of this page, you can carry out the following actions.



Add new site

You can add data on new sites to the database. The system guides you through the steps to configure and upload your data sets to the database.

- Each unique site is identified using latitude and longitude coordinates.
- You can input carbon stock data for each site for several years by using the 'Duplicate site' feature (access this feature through 'View my sites' once you have already entered original data for the site).



View my sites

Through this page, you can view, edit and duplicate any data that you have already entered.



View sites

Through this page, you can view data sets entered by other contributors.



View my profile

Use this command to view your own profile.



Edit profile

You can change all information in your profile except your user name.



Change password

Use this command to make a new password.

Mr Sofyan
Kurnianto



Home



Add new site



View my sites



View sites



View my profile



Edit profile



Change password



Log out

Registration

Registration

Step 1

Personal information

Step 2

Institutional information

Step 3

Data information

Step 4

Disclaimer

Personal information

Registration

Step 1

Personal information

Step 2

Institutional information

Step 3

Data information

Step 4

Disclaimer

Institutional information

Registration

Step 1

Personal information

Step 2

Institutional information

Step 3

Data information

Step 4

Disclaimer

Data information

* required field

Type of data: *

Species data

☒ Yes

☐ No

Diameter at breast height

☒ Yes

☐ No

Wood density

☒ Yes

☐ No

Soil carbon stock

☒ Yes

☐ No

Wood debris

☒ Yes

☐ No

Agreement

Disclaimer

* required field

Data Exchange Agreement

CIFOR's GCS-REDD Data and Information Exchange Mechanism is a non commercial service with high standards of data management and structuring to maximize sharing of data, ideas, strategies and reporting endowed to governmental/ non-governmental partner organizations, multilateral operations, and interested person. Data access will enable agencies and other related partner organizations to fully participate in this mechanism and benefit from lessons learned of the GCS-REDD.

Accessible Product:

Data exchange mechanism in public domain meant for sustainable development of the national REDD's strategy endowed by CIFOR's GCS-REDD Data and Information Sharing Policy.

Advantages of being a member:

1. To reduce costs by avoiding expensive duplicate data collection efforts by making known what data have been collected so that additional resources are not spent to gather essentially the same information.
2. To provide ready access to data that cannot be readily replicated e.g. large surveys that are too expensive to replicate.

☒ I accept *

Please type the code shown: *



Try a new code

YEKFT

Create site's database

Step 1
Site description

Step 2
Land cover

Step 3
Climate

Step 4
Soil

Step 5
Total carbon stock

Site description

Site details

Step 1
Site description

Step 2
Land cover

Step 3
Climate

Step 4
Soil

Step 5
Total carbon stock

Land cover

Site details

Step 1
Site description

Step 2
Land cover

Step 3
Climate

Step 4
Soil

Step 5
Total carbon stock

Climate

Soil

Texture

<input type="checkbox"/> Clay	<input type="checkbox"/> Silt
<input type="checkbox"/> Sand	<input type="checkbox"/> Loam
<input type="checkbox"/> Silty clay	<input type="checkbox"/> Sandy clay
<input type="checkbox"/> Clay loam	<input type="checkbox"/> Silty loam
<input type="checkbox"/> Sandy loam	<input type="checkbox"/> Loamy sand
<input type="checkbox"/> Silty clay loam	<input type="checkbox"/> Sandy clay loam
<input type="checkbox"/> Other	

Other textures

Type

<input type="checkbox"/> Alfisols	<input type="checkbox"/> Andisols
<input type="checkbox"/> Aridisols	<input type="checkbox"/> Entisols
<input type="checkbox"/> Gelisols	<input type="checkbox"/> Histosols
<input type="checkbox"/> Inceptisols	<input type="checkbox"/> Mollisols
<input type="checkbox"/> Oxisols	<input type="checkbox"/> Spodosols
<input type="checkbox"/> Ultisols	<input type="checkbox"/> Vertisols
<input type="checkbox"/> Other	

Next

Calculated C-stocks

Living biomass pools

Import and calculate biomass value 


Upload Excel file

Trees *	Biomass (Mg/ha)	Carbon fraction (%)	Carbon stock (Mg C/ha)
Total	502.49	50	251.245

Dead biomass pools


Import and calculate total woody debris value 

Upload Excel file

Woody debris 	Biomass (Mg/ha)	Carbon fraction (%)	Carbon stock (Mg C/ha)
Fine woody debris		50	
Coarse woody debris		50	
Total	25.39	50	12.695

Upload raw data for understorey and litter

Upload Excel file

Understorey and litter 	Biomass (Mg/ha)	Carbon fraction (%)	Carbon stock (Mg C/ha)
Total	21.23	50	10.615

Below ground

Roots *	Biomass (Mg/ha)	Carbon fraction (%)	Carbon stock (Mg C/ha)
Total	99.19	50	49.595

Appendix 1. Allometric equations to estimate the aboveground biomass of trees used in this database

Site	Precipitation	Temperature	Type of forest	Species	Equation for estimating AGBT ^a	References
Pan-tropical	<1500 mm		Dry forest	Mixed Dmax ^b = 63.4 cm	0.112 (ρD ² H) ^{0.916} ρ exp(−0.667 + 1.784 ln(D) + 0.207(ln(D)) ² − 0.0281 (ln(D)) ³)	Chave <i>et al.</i> (2005)
	1500–3500 mm	Moist forest	Mixed Dmax = 138 cm	0.0509 ρD ² H ρ exp(−1.499 + 2.148 ln(D) + 0.207(ln(D)) ² − 0.0281 (ln(D)) ³)		
		Mangrove moist forest	Mangroves Dmax = 42 cm	0.0509 ρD ² H ρ exp (−1.349 + 1.98 ln (D) + 0.207(ln(D)) ² − 0.0281 (ln(D)) ³)		
	>3500 mm; no seasonality	Wet forest	Mixed Dmax = 133.2 cm	0.0776 (−D ² H) ^{0.94} ρ exp(−1.239 + 1.98 ln(D) + 0.207(ln(D)) ² − 0.0281 (ln(D)) ³)		
Tropics			Wet forest	Mixed D ^c = 4–112 cm	21.297−6.953(D)+0.740(D ²)	Brown (1997)
			Moist forest	Mixed D = 5–148 cm	exp[−2.289 + 2.649 • ln(D) − 0.021(ln(D)) ²]	Brown (1997; in IPCC 2003)
Porce Region, Colombia	2078	22.7	Primary forest	Mixed D = 0.5–198 cm	2.286 + 2.471 ln(D)	Sierra <i>et al.</i> (2007)
			Secondary forest	Mixed D = 0.9–40 cm	−2.322 + 2.422 ln(D)	
East Kalimantan, Indonesia	2000	26	Lowland mixed dipterocarp	Dipterocarpus	1.232 + 2.178 ln(D)	Basuki <i>et al.</i> (2009)

a. AGBT : aboveground biomass and trees

b. Dmax : maximum diameter at breast height

c. D : diameter at breast height

View my sites

List of my sites

Following is a list of sites for which you have already entered data.

Sort by:

Carbon stock 

Year	Site	Province	Country	Land cover type	Carbon stock (Mg C/ha)	Action
2009	Api api	North Sulawesi	Indonesia	Natural forest	983.30	Edit Duplicate
2009	Jerumbun	Central Kalimantan	Indonesia	Natural forest	1,183.22	Edit Duplicate
2009	Seluang	Central Kalimantan	Indonesia	Natural forest	401.23	Edit Duplicate
2009	Simpang kancil	Central Kalimantan	Indonesia	Natural forest	803.11	Edit Duplicate
2009	Sintuk	Central Kalimantan	Indonesia	Natural forest	1,238.58	Edit Duplicate

Mr Sofyan Kurnianto



Home



Add new site



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View sites



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THINKING beyond the canopy



View other contributors' sites

List of all sites

Following is a list of all sites that have been entered into the database. Select the Site or Contributor name for more information.

Sort by:

Carbon stock 

Year	Site	Province	Country	Land cover type	Contributor	Carbon stock (Mg C/ha)
2009	Sintuk	Central Kalimantan	Indonesia	Natural forest	Sofyan Kurnianto	1238.58
2009	Jerumbun	Central Kalimantan	Indonesia	Natural forest	Sofyan Kurnianto	1183.22
2009	Peramuan	Central Kalimantan	Indonesia	Natural forest	Administrator of Forest Carbon Database	1061.00
2009	Api api	North Sulawesi	Indonesia	Natural forest	Sofyan Kurnianto	983.30
2009	Risam	Central Kalimantan	Indonesia	Natural forest	Administrator of Forest Carbon Database	977.53
2009	Simpang kancil	Central Kalimantan	Indonesia	Natural forest	Sofyan Kurnianto	803.11
2009	Seluang	Central Kalimantan	Indonesia	Natural forest	Sofyan Kurnianto	401.23

Mr Sofyan Kurnianto

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THINKING beyond the canopy



Two recent publications

Opportunities for reducing greenhouse gas emissions in tropical peatlands

D. Murdiyarso¹, K. Hergoualc'h, and L. V. Verchot

Center for International Forestry Research, Jalan CIFOR, Situagede, Bogor 16115, Indonesia
Edited by Ruth S. Defries, Columbia University, New York, NY, and approved October 12, 2010 (received for review October 22, 2009)

The upcoming global mechanism for reducing emissions from deforestation and forest degradation in developing countries should include and prioritize tropical peatlands. Forested peatlands in Southeast Asia are rapidly being converted into production systems by introducing perennial crops for lucrative agricultural products, such as oil-palm and pulpwood plantations, causing large greenhouse gas (GHG) emissions. The intergovernmental Panel on Climate Change Guidelines for GHG Inventory on Agriculture, Forestry, and Other Land Uses provide an adequate framework for emissions inventories in these ecosystems; however, specific emission factors are needed for more accurate and compact, physical processes, such as peat decomposition and water table level, which are affected by management practices. We estimate that total carbon loss from converting peat swamp forests into oil palm is 59.4 ± 10.2 Mg of CO₂ per hectare per year during the first 25 yr after land-use cover change, of which 61.6% arise from the peat. Of the total amount (1,486 ± 183 Mg of CO₂ per hectare over 25 yr), 25% are released immediately from land-clearing activities. In order to maintain high palm-oil production, nitrogen inputs through fertilizer are needed and the magnitude of the resulting increased N₂O emissions compared to CO₂ losses remains unclear.

drainage/respiration/gain-loss approach | stock-difference approach

Global peatlands cover an area of 400 million hectare, which is equivalent to 3% of the Earth's land area. These ecosystems store a large fraction of terrestrial carbon, as much as 528 Pg (Pg = 1 × 10¹⁵ g), or one-third of global soil carbon (1, 2). This quantity is equivalent to the amount of carbon that would be emitted to the atmosphere from burning fossil fuels at the current rate (approximately 7 Pg in 2007) for the next 75 yr. One-third of the carbon stored in peatlands (191 Pg) is located in the tropics (3, 4), of which 60% is in Southeast Asia with an estimated area of 25 million hectare (Mha). The majority (84%) of Southeast Asian peatlands are found in Indonesia (around 21 Mha), whereas Malaysia harbors 2–2.5 Mha. Thailand has around 45,000 ha, and relatively small areas are found in Vietnam, Brunei, and the Philippines (5).

Tropical peatlands are an important terrestrial carbon pool, but they are highly vulnerable and have become a major source of carbon emissions that requires policy changes to allow mitigation measures to take place. During the period of 2000–2005, the deforestation rate in Indonesian peatlands was estimated around 0.1 Mha per annum (6). Adding to this, the area of peatlands burnt during the big fire in 1997 was 2.12 Mha (7). The main driver of tropical peatlands deforestation is Indonesia's development of oil-palm and pulpwood plantations (8). Indonesia and Malaysia, which currently account for 85% of the world's supply of crude palm oil, aim at supplying Chinese, Indian, and European markets. If crude palm oil demand increases, there could be much more pressure on the forested land in the region. For example, in order to substitute 1% of fossil fuel use with biofuels for electricity production, Europe would consume the oil production of at least 2 Mha of oil-palm plantations (9).

It was estimated that converting a hectare of forest to palm-oil production yields net present values (NPV) of \$3,835–\$9,630 to land owners (10, 11). The conversion is more profitable than leaving the forests standing for carbon credits from voluntary markets of \$614–\$894 per hectare although belowground carbon in peatland is also considered. Unless post-2012 global climate policies create significant financial incentives to overcome the economic drivers of deforestation, reducing emissions from deforestation and forest degradation (REDD) will not be able to compete financially with factors that expand oil-palm agriculture (12). The Bali Action Plan paves the way for REDD implementation as a climate change mitigation measure (13). The Action Plan invites countries to consider incentives on issues relating to the management of forests, and enhancement of forest carbon stocks, known as "REDD+." Because the rules and modalities of REDD+ are to be decided, it is now the right time to promote the peatlands sector to be included in the new climate regime under the REDD+ scheme.

In this review we explore existing data for these ecosystems and suggest areas for scientific support in meeting the methodological challenges to assess greenhouse gas (GHG) emissions from tropical peatlands. Identifying research gaps with respect to improved management in these carbon-rich ecosystems merits significant elaboration to support effective REDD+ implementation.

Current Status and Trends of Tropical Peatlands

Peatland Development. In 1981, "planned deforestation" in Indonesia was legislated, involving 30 Mha of conversion forests (14). In addition to plantation forests, most of the conversions were allocated for agricultural land development, such as oil palm. Furthermore, in early 2009, the government of Indonesia issued a regulation that allows the development of oil-palm plantations in peatlands with peat depth less than 3 m, which could potentially trigger further deforestation and peatlands degradation. In late May 2010, however, a letter of intent (LoI) between the government of Indonesia and the government of Norway on REDD+ was signed. The development of REDD+ operation on REDD+ will trigger (i) the development of REDD+ strategies to address key drivers of forest and peatland-related emissions, (ii) the establishment of an independent REDD+ agency to address key drivers of forest and peatland-related emissions, (iii) the establishment of monitoring, reporting, and verification institutions, and (iv) the financial mechanisms. Thus far, the LoI has generated extensive debates about government agencies, private sectors, and civil society regarding opportunity costs, institutional settings, and new regulatory framework.

Author contributions: D.M. and L.V.V. designed research; D.M. and K.H. performed research; D.M., K.H., and L.V.V. analyzed data; and D.M., K.H., and L.V.V. wrote the paper. The authors declare no conflict of interest. This article is a PNAS Direct Submission. To whom correspondence should be addressed: E-mail: d.murdiyarso@CIFOR.org. This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.0911961107/-DCSupplemental.

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nature
geoscience

Mangroves among the most carbon-rich forests in the tropics

Daniel C. Donato^{1*}, J. Boone Kauffman², Daniel Murdiyarso³, Sofyan Kurnianto³, Melanie Stidham⁴ and Markku Kanninen⁵

Mangrove forests occur along ocean coastlines throughout the tropics, and support numerous ecosystem services, including fisheries production and nutrient cycling. However, the areal extent of mangrove forests has declined by 30–50% over the past half century as a result of coastal development, aquaculture expansion and over-harvesting^{1–4}. Carbon emissions resulting from mangrove loss are uncertain, owing in part to a lack of broad-scale data on the amount of carbon stored in these ecosystems, particularly below ground⁵. Here, we quantified whole-ecosystem carbon storage by measuring tree and dead wood biomass, soil carbon content, and soil depth in 25 mangrove forests across a broad area of the Indo-Pacific region—spanning 30° of latitude and 73° of longitude—where mangrove area and diversity are greatest^{6,7}. These data indicate that mangroves are among the most carbon-rich forests in the tropics, containing on average 1,023 Mg carbon per hectare. Organic-rich soils ranged from 0.5 m to more than 3 m in depth and accounted for 49–98% of carbon storage in these systems. Combining our data with other published information, we estimate that mangrove deforestation generates emissions of 0.02–0.12 Pg carbon per year—as much as around 10% of just 0.7% of tropical forest area^{8,9}.

Deforestation and land-use change currently account for 8–20% of global anthropogenic carbon dioxide (CO₂) emissions, second only to fossil fuel combustion¹⁰. Recent international climate agreements highlight Reduced Emissions from Deforestation and Degradation (REDD+) as a key and relatively cost-effective option for mitigating climate change; the strategy aims to maintain terrestrial carbon (C) stores through financial incentives for forest conservation (for example, carbon credits). REDD+ and similar programs require rigorous monitoring of C pools and emissions¹¹, underscoring the importance of robust C storage estimates for various forest types, particularly those with a combination of high C density and widespread land-use change¹².

Tropical wetland forests (for example, peatlands) contain organic C reserves in the terrestrial biosphere^{13–15}. Peatlands' disproportionate importance in the link between land use and climate change has received significant attention since 1997, when peat fires associated with land clearing in Indonesia increased atmospheric CO₂ enrichment by 13–40% over global annual atmospheric CO₂ enrichment¹⁶. This importance has prompted calls to specifically address tropical peatlands in international climate change mitigation strategies^{17,18}.

Overlooked in this discussion are mangrove forests, which occur along the coasts of most major oceans in 118 countries, adding ~30–35% to the global area of tropical wetland forest over peat swamps alone^{19,20}. Renowned for an array of ecosystem services, including fisheries and fibre production, sediment regulation, and storm/tsunami protection^{21–24}, mangroves are nevertheless declining rapidly as a result of land clearing, aquaculture expansion, overharvesting, and development^{25–27}. A 30–50% areal decline over the past half-century¹³ has prompted estimates that mangroves may functionally disappear in as little as 100 years (refs 1, 2). Rapid threat to mangroves²⁸ has also been cited as a primary challenge by migrating landward or upward²⁹.

Although mangroves are well known for high C assimilation and flux rates^{30–32}, data are surprisingly lacking on whole-ecosystem carbon storage—the amount which stands to be released with land-use conversion. Limited components of C storage have been reported, most notably tree biomass^{33,34}, but evidence of deep organic-rich soils^{35–37} suggests these estimates miss the vast majority of total ecosystem carbon. Mangrove soils consist of a variably thick, tidally submerged suboxic layer (variously called 'peat' or 'muck') supporting anaerobic decomposition pathways and having moderate to high C concentration^{38,39}. Belowground C storage in mangrove soils is difficult to quantify^{40,41} and is not a simple function of measured flux rates—it also integrates thousands of years of variable deposition, transformation, and erosion dynamics associated with fluctuating sea levels and episodic disturbances⁴². No studies so far have integrated the necessary measurements for total mangrove C storage across broad geographic domains.

In this study we quantified whole-ecosystem C storage in mangroves across a broad tract of the Indo-Pacific region, the geographic core of mangrove area (~40% globally) and diversity⁴⁴. Study sites comprised wide variation in stand composition and stature (Fig. 1, Supplementary Table S1), spanning 30° of latitude (8°S–22°N), 73° of longitude (90°–163°E), and including eastern Micronesia (Kosrae); western Micronesia (Sundarbans (Ganges-Brahmaputra Delta, Bangladesh); and transects running inland from the seaward edge, the combined above- and below-ground C pools as a function of distance from the seaward edge in two major geomorphic settings: estuarine/river-delta and oceanic/fringing. Estuarine mangroves (n = 10) were situated on large alluvial deltas, often with a protected lagoon; oceanic mangroves (n = 15) were situated in

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