

The Rise and Flows of Blue Carbon Credits Advance Global Climate and Biodiversity Goals

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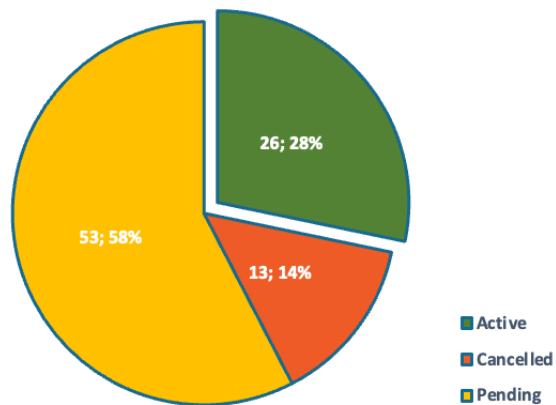
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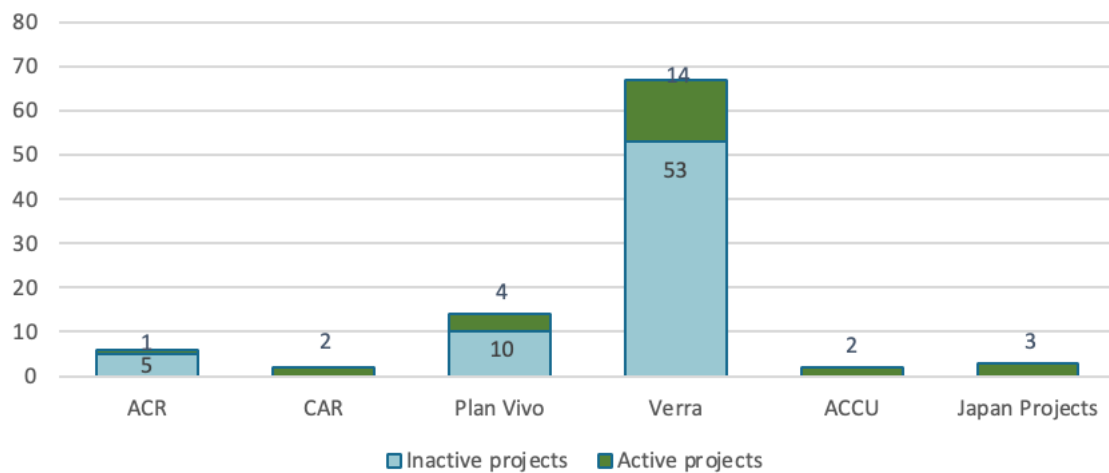
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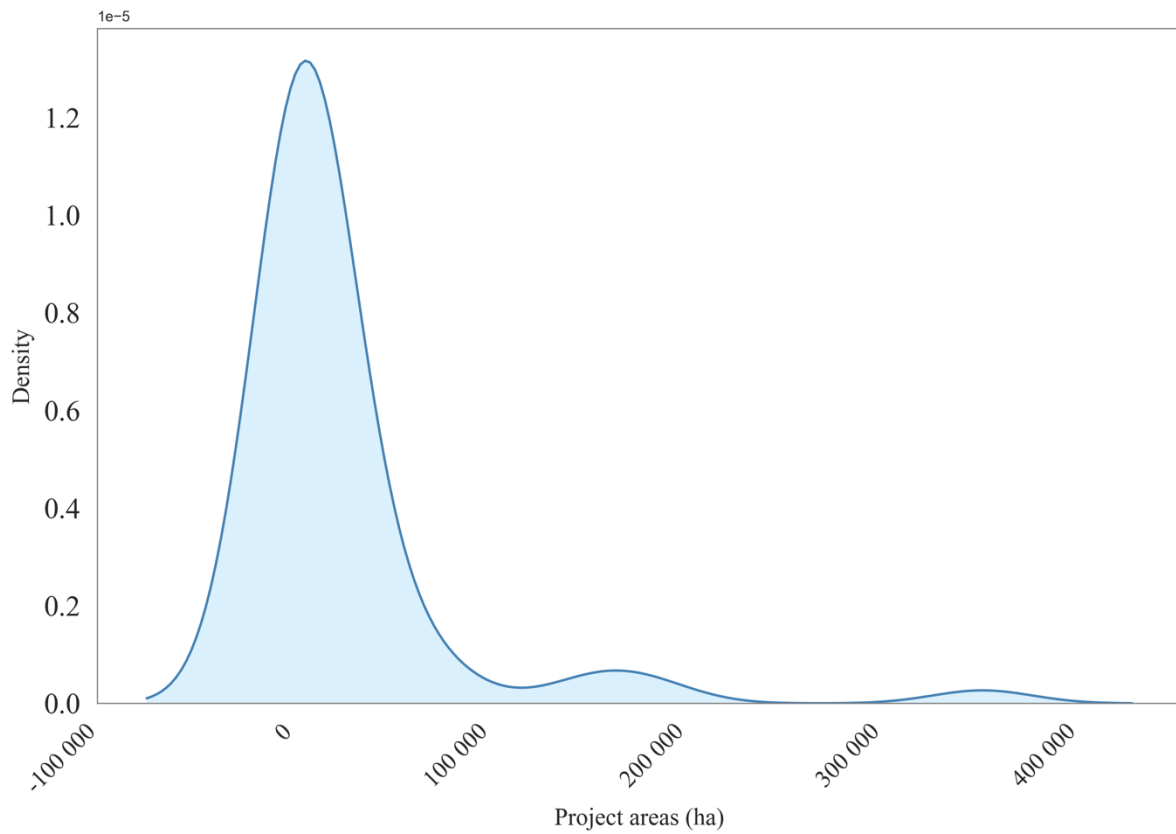
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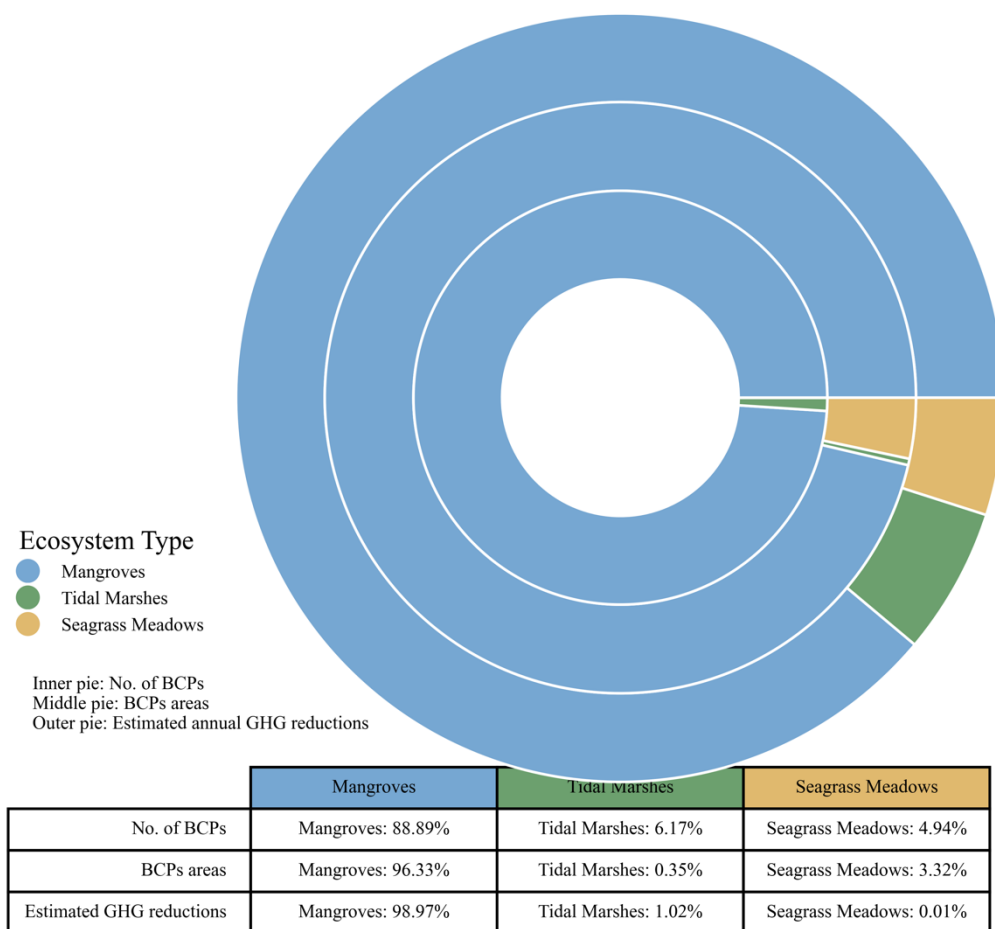
Supplementary Figure 1. Voluntary status of BCPs. The figure demonstrates current status of BCPs in the voluntary market. Active projects are projects registered and verified by ACR, CAR, Plan Vivo, VCS, ACCU, and Japan projects as well. Canceled projects are either rejected or discontinued. Pending projects are the ones under development or under verification and validation.



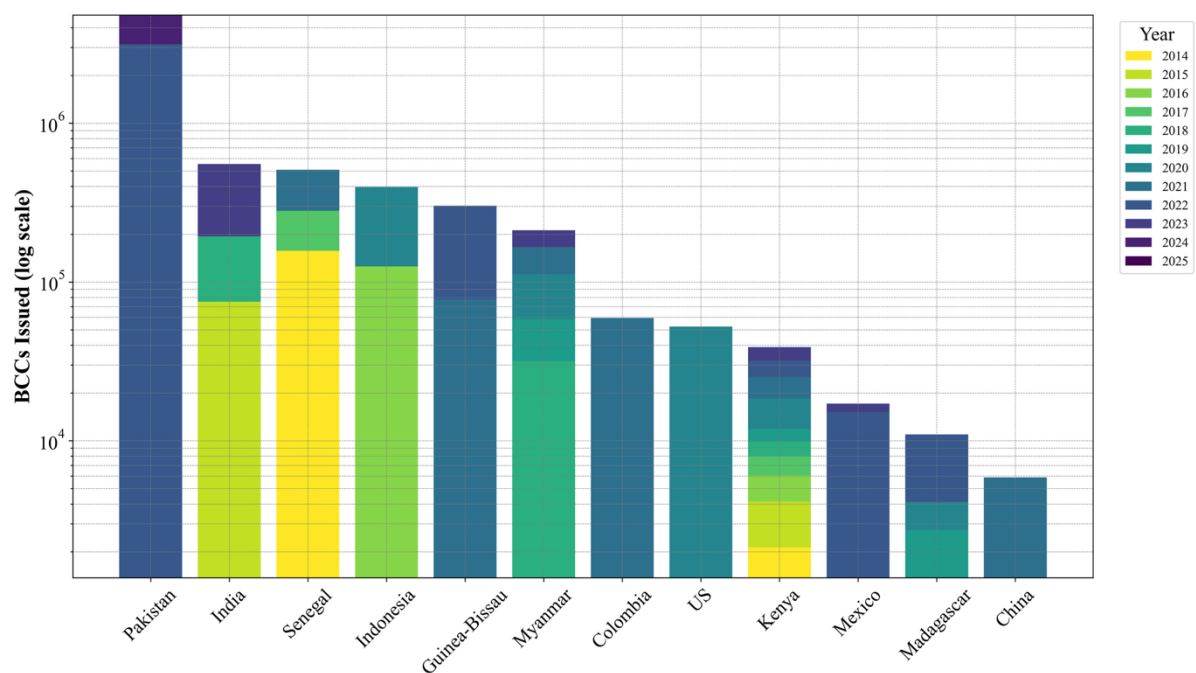
Supplementary Figure 2. BCPs by registry. The bar chart displays the number of registered projects by different registries as of March 15, 2025. The inactive category comprises of both pending and canceled groups.



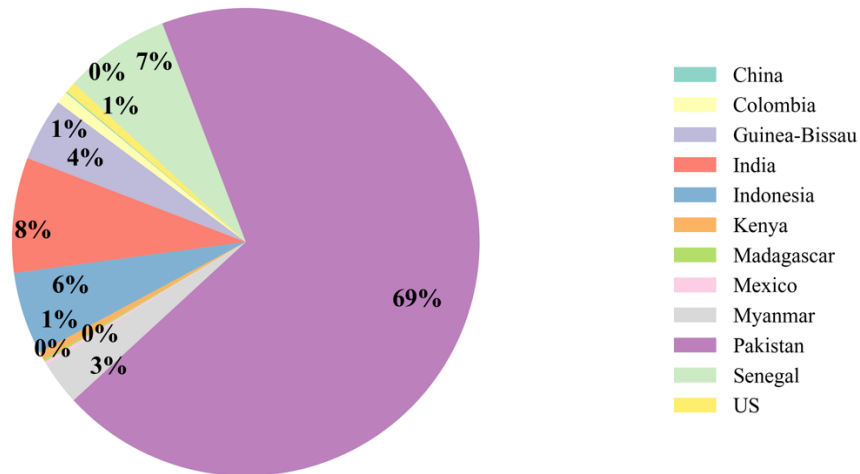
Supplementary Figure 3. Density distribution of BCP areas. This figure shows the kernel density estimation of the area sizes of BCPs. The x-axis represents the project area in hectares, while the y-axis indicates the estimated probability density. Most project areas are concentrated below 100,000 hectares, indicating a large number of small-scale projects.



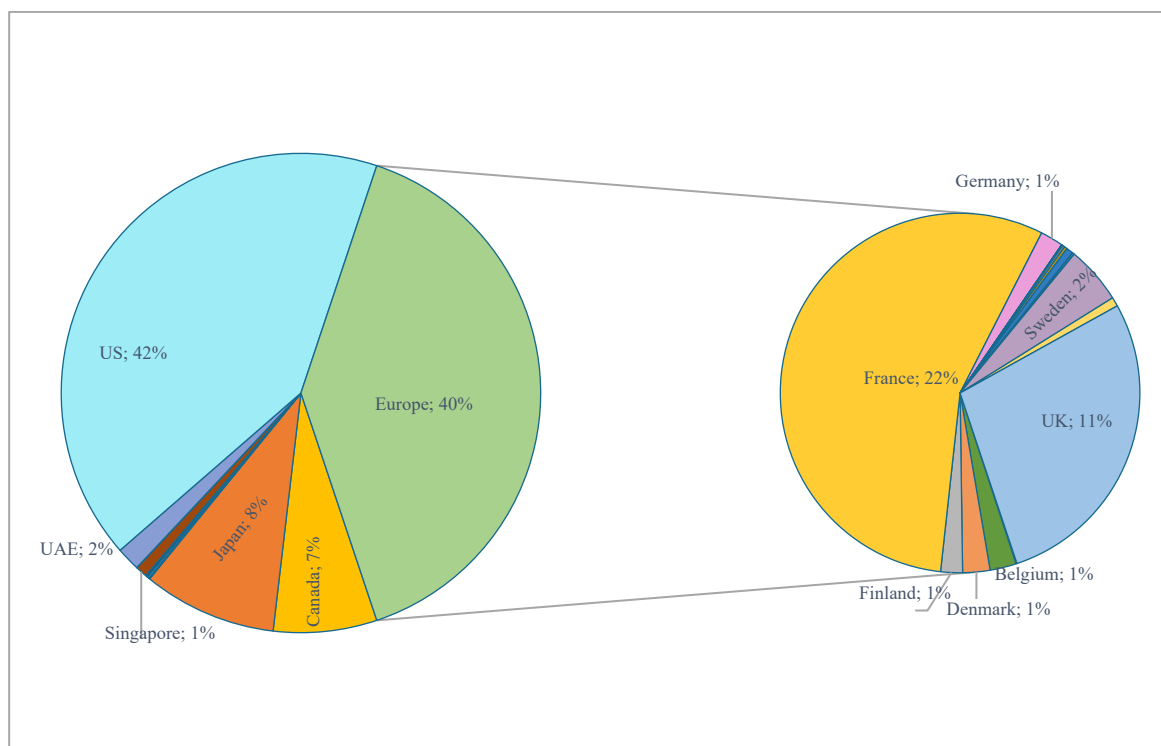
Supplementary Figure 4. The numbers, area, and estimated annual GHG reductions of BCPs by wetland type. Inner pie displays the number and percentage of BCPs, middle pie shows the distribution of areas, and outer pie illustrates the estimated annual GHG reductions of BCPs of different wetland types.



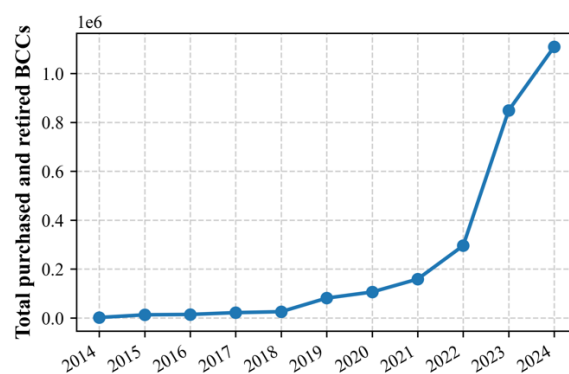
Supplementary Figure 5. Annual issuance of BCCs by country, 2014–2025. The stacked bar chart displays the annual volume of blue carbon credits (BCCs) issued by source countries over 2014-2025. The data reveal a highly uneven geographic distribution, with Pakistan, India, and Senegal issuing disproportionately large volumes relative to others. A logarithmic scale is applied to preserve the visibility of lower-volume contributors, enabling a clearer comparison across countries and years.



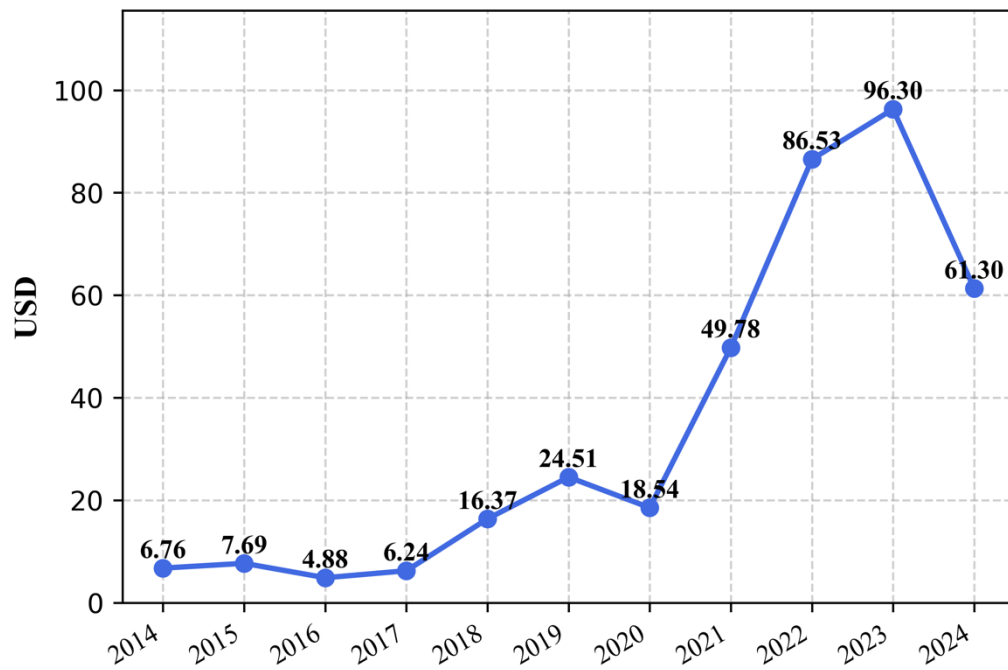
Supplementary Figure 6. BCC market share distribution among source countries. This pie chart illustrates the percentage shares of lead suppliers in the BCC market. Percentages are shown only for countries with significant shares; countries with smaller shares are included in the chart but their specific shares are not labeled due to size constraints.



Supplementary Figure 7. BCCs market share distribution among buyer countries. This pie-in-pie chart displays the distribution of market shares among all buyers, with a secondary focus on the European countries. Larger shares are labeled directly; smaller shares are represented but not individually labeled due to their relatively small size.



Supplementary Figure 8. Dynamics of BCCs demand (2014–15 March 2025). The trend line displaying accumulated BCCs purchased and retired over time.



Supplementary Figure 9. The price trend of carbon credits in EU-EST (2014 – 2024). This line chart, based on data from the World Bank⁵³, illustrates a steady carbon credit price increase until 2019, a slight decline in 2020, and a sharp rise thereafter, highlighting carbon market volatility.

Supplementary Table 1. The number, size, and estimated annual GHG emission reductions of BCPs by wetland type

	Mangroves	Tidal Marshes	Seagrass Meadows
Number of BCPs	72	5	4
Size of BCPs (ha)	1 929 999	6 974	66 471
Estimated annual GHG reductions (tCO ₂ e yr ⁻¹)	20 178 690	207 763	1 536

This table aggregates the total number, size, and estimated GHG reductions of BCPs by wetland type from their inception in 2009 through March 15, 2025, based on the gathered data from all registries after the exclusion of cancelled BCPs. It offers an overview of BCPs composition by the wetland type.

Supplementary Table 2. Accumulated numbers, sizes, and estimated annual GHG emission reductions of BCPs (2009-2026)

Year	Number of BCPs	Size (ha)	Estimated annual GHG reductions (tCO ₂ e yr ⁻¹)
2009	1	10 415	30 000
2010	3	18 530	121 679
2011	5	169 228	1 166 821
2012	5	169 228	1 166 821
2013	5	169 228	1 166 821
2014	7	331 659	1 354 852
2015	13	758 152	3 983 286
2016	20	903 095	6 343 412
2017	20	903 095	6 343 412
2018	23	969 952	6 591 224
2019	27	972 977	6 918 912
2020	36	1 012 547	8 109 922
2021	47	1 085 756	12 161 026
2022	61	1 139 290	13 888 912
2023	69	1 636 324	16 853 891
2024	75	1 716 071	18 022 061
2025	80	1 997 037	20 124 628
2026	81	2 003 443	20 387 989

This table displays yearly cumulated data on the number, size, and estimated annual GHG reductions of BCPs from 2009 through 2026, providing a chronological overview of BCP trends and their growth, and the environmental impacts, as well.

Supplementary Table 3. The duration of BCPs

Lifespan	Number of BCPs	Size (ha)	Estimated annual GHG reductions (tCO ₂ e yr ⁻¹)
20 years	26	211 161	3 620 599
25 years	3	16 487	196 274
30 years	21	898 385	8 097 056
40 years	14	164 144	2 386 073
50 years	2	75 332	267 774
60 years	4	626 154	5 663 675
100 years	3	6 894	82 861
No data	6	2 719	-

This table presents the duration of BCPs and their characteristics, highlighting patterns in their longevity and operational timelines. For 6 BCPs, the data of projects' duration are not available.

Supplementary Table 4. The numbers, sizes, and estimated annual GHG emission reductions of BCPs by country

Country	Number of BCPs	Size (ha)	Estimated annual GHG reductions (tCO ₂ e yr ⁻¹)
Australia	2	5000	-
Cameroon	2	2760	17918
China	4	2275	21423
Colombia	3	233875	464991
Combodia	1	3000	28650
Congo	1	23684	587187
Djibouti	1	2900	45694
Egypt	1	6406	263361
Gambia	1	10000	110002
Ghana	1	1536	16566
Guinea-Bissau	1	145698	920436
Honduras	1	1400	-
India	8	20355	354233
Indonesia	5	122840,78	2716334
Italy	1	1734	150531
Japan	3	18,5	186,5
Kenya	3	2070,95	36202,71
Madagascar	3	2417	23155
Mexico	11	185538,6	5653336,66
Mozambique	1	155000	338957
Myanmar	7	22355	1528009
Nigeria	2	271920	2014501
Oman	1	2168	73490
Pakistan	2	600000	4421493
Peru	1	5213,37	-
Republic of São Tomé e Príncipe	1	600	-
Senegal	5	25227,12	224488
Sierra Leone	1	74034	258000
Sri Lanka	1	1031	45484
Tanzania	1	1426	14286,1
Timor-Leste	1	566	10267
US	4	70394	48807
World	81	2003443,32	20387988,97

This table provides a comprehensive overview of the global distribution of BCPs, including their numbers and key characteristics by country.

Supplementary Table 5. BCCs issued by issuance year (2014-15 March 2025)

Country	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
China	0	0	0	0	0	0	0	5880	5880	5880	5880	5880
Colombia	0	0	0	0	0	0	0	59363	59363	59363	59363	59363
Guinea-Bissau	0	0	0	0	0	0	0	77857	302043	302043	302043	302043
India	0	75081	75081	75081	194220	194220	194220	194220	194220	554016	554016	554016
Indonesia	0	0	125391	125391	125391	125391	397071	397071	397071	397071	397071	397071
Kenya	2125	4144	6056	7968	9880	11923	18472	25207	32071	38935	38935	38935
Madagascar	0	0	0	0	1371	2742	4113	4113	10968	10968	10968	10968
Mexico	0	0	0	0	0	0	0	0	15160	17159	17159	17159
Myanmar	0	0	0	0	31744	58359	111728	165865	165865	211636	211636	211636
Pakistan	0	0	0	0	0	0	0	0	3147440	3147440	4802658	4802658
Senegal	157368	157368	157368	281274	281274	281274	281274	509816	509816	509816	509816	509816
US	0	0	0	0	0	0	52405	52405	52405	52405	52405	52405

This table presents the annual supply of BCCs provided by source countries (2014–2025), illustrating supply flows of BCCs to the carbon market.

Supplementary Table 6. BCCs purchased by country

Country	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Aggregate purchased BCCs
Australia							3			487	26	516
Austria							1	6	20		345	372
Belgium	237		74	479	190	287		369		3400	5400	10436
Canada	10					100		500	193	76644		77447
China									326			326
Denmark					599	10098	50	68				10815
Finland								494		8140		8634
France		8500		5500		23042	8346	250	79536	120672		245846
Germany						60			40	8876	142	9118
Greece										10		10
Ireland										17		17
Italy										331	88	419
Japan								5000		20000	75000	100000
Kenya						238	222	1000				1460
Korea										3		3
Lebanon							12					12
Luxemburg										950		950
Netherlands					9	620	35		4	312	140	1120
New Zealand											1500	1500
Norway					282	24				2500		2806
Portugal	34											34
Scotland		660				15						675
Singapore								3010	1	5454	200	8665
Spain									70			70
Sweden	720	700	1369	224	500	500	4159	2000		10125	2500	22797
Switzerland				1200	943					470	1000	3613
Taiwan									194	3	4	201
UAE									17650	45		17695
UK	22				911	658	1995	2003	21004	70439	26100	123132
US	1030	1200		9	472	19925	10108	38077	17610	224352	147737	460520
Aggregate purchased BCCs	2053	11060	1443	7412	3906	55567	24932	52777	136648	553230	260182	1109210

Supplementary Table 7. The available price data for BCCs

BCP	Country	Registry	Year	Sold BCCs	Revenues	(Estimated) price
Mikoko Pamoja	Kenya	Plan Vivo	2014	1,010	6,081	6.0
			2015	814	9,834	12.1
			2016	2,789	29,574	10.6
			2017	1,733	22,229	12.8
			2018	3,196	18,216	5.7
			2019	1,912	23,225	12.1
			2020	1,897	22,999	12.1
			2021	2,143	27,401	12.8
			2022	1,756	25,472	14.5
			2023	2,330	43,939	18.9
Tahiry Honko	Madagascar	Plan Vivo	2019	1,317	24,845	18.1
VANGA Blue Forest	Kenya	Plan Vivo	2021	3,855	46,555	12.1
			2022	4,878	72,268	14.8
Delta Blue Carbon – 1	Pakistan	VCS	2022			27.8
VIDA MANGLAR	Colombia	VCS	2022			15.0

We estimated the price of BCPs registered by Plan Vivo using the data provided for sold credits and revenues in each project document⁴⁹⁻⁵¹. However, for BCPs registered under the VCS registry, we had limited data available from published documents⁵². Further details have been provided in Methods.