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Respecting tenure and the bundle of rights in blue carbon guidance

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Blue carbon (BC) projects are proposed in the territories of coastal communities, small-scale fishers and Indigenous peoples, yet how the tenure security of rightsholders is conveyed or protected remains uncertain. Here, by analysing 122 BC guidance documents (scientific, policy and technical), we examine the claims, obligations and interpretations of tenure. The documents reveal overlapping and/or competing claims about interactions between BC and tenure rights, ranging from rights-eroding to rights-securing. Despite increased openness to different forms of tenure, only a subset of tenure rights consistently receive emphasis. Six core international obligations to tenure (including the Indigenous and Tribal Peoples Convention) are overlooked. Ambiguity surrounding tenure implications, coupled with disregard for global obligations and narrow rights interpretation, exposes rightsholders to potential land and resource dispossession, and exclusion from benefits. To rectify this, BC guidance must adopt a more comprehensive view of tenure, engage with international standards and rights experts, and ensure accountability to rightsholders.

Secure tenure (Box 1) is a fundamental human right for coastal communities, small-scale fishers, Indigenous peoples and Traditional Owners[1,2]. Tenure security and climate action intersect in ways that can either exacerbate dispossession and exclusion, or lead to more equitable outcomes depending on how tenure and associated rights are treated[1,3–5]. This intersection is precarious in the case of blue carbon (BC) (positioned as a nature-based climate solution[6]) as targeted ecosystems are located in the territories of coastal peoples worldwide. A concept largely derived from the global north, BC refers to the ecosystem service of capturing and storing carbon in marine habitats such as mangroves, seagrasses and tidal marshes. BC was first introduced in 2009 as a conservation and restoration strategy to sustain healthy oceans, address ecosystem decline and simultaneously increase human and natural systems resilience to change[7]. Globally, BC ecosystems are a vital resource for individual and societal well-being[8,9], underpinning the livelihoods of millions[10] and supporting fisheries that provide nutrition to billions[11]. As such, the potential for social costs and dispossession associated with changes to the governance, access and use of these ecosystems is high[12–15]. Conversely, it is argued that when BC projects (that is, those with conservation, restoration or marketization goals) and other ocean developments recognize and uphold Indigenous and community tenure, they can strengthen local governance, preserve cultural heritage[16–18] and foster enduring stewardship[19].

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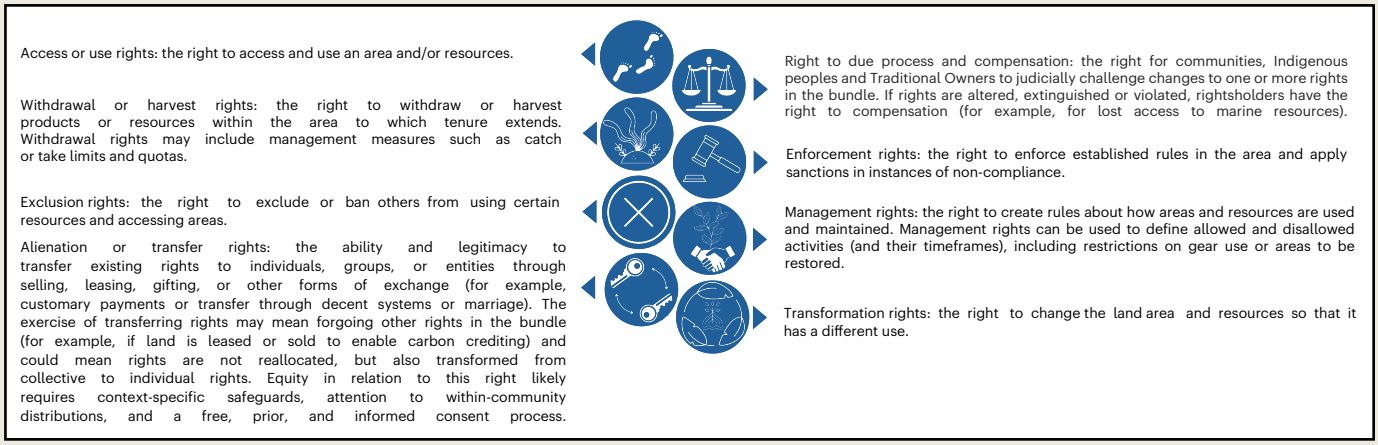
BOX 1

Tenure and the bundle of rights

Tenure refers to the ongoing relationship between people or societal groups and their land and sea resources[2,87]. Scholars of political ecology, agrarian studies and institutional and resource economics have worked over decades to improve understanding of property rights and systems of tenure, particularly for informal regimes, colonized states and marginalized groups[88–90]. A common analytical framework derived from this scholarship renders tenure as a 'bundle of rights'[57,91] that designate the rules and responsibilities about who is permitted to use, manage and govern certain resources and areas[58,86], albeit with different scholarly distinctions (figure in Box 1). In practice, the number of rights held or experienced differs by person, place and/or governing body (including community). The more rights held and experienced by peoples, the more secure their tenure[63,92]. Yet, even a complete bundle reduces tenure to rights-based categories that may not fully represent the responsibilities, relationships and spiritual dimensions through which many Indigenous peoples understand their connection to land and sea[17].



Box Fig. 1 | The bundle of rights in the context of BC. Unlike terrestrial systems, tenure designation in marine, coastal and shoreline systems can be ambiguous due to high connectivity among habitats, and convergence of (formal and informal) legal authority over inter-tidal zones where BC habitats are located[86,93]. Marine tenure designation is further complicated by the effects of sea-level rise re-shaping coasts[94], as well as forced human and animal migration in low-elevation zones[95,96]. BC ecosystems can be privately or publicly owned, but are also distributed within the territories of Indigenous and Traditional Owners[9]. In these areas, ownership can fall under communal, indigenous or customary tenure arrangements[2], which can be formally recognized in legal systems or informal and unwritten but socially recognized[1]. In contexts with informal rights, uncertainties may be high as to who owns BC, who has the right to operate BC projects or transact carbon credits, and where and how BC revenue should be distributed[22,40]. Even where formal tenure recognition exists, tenure security can be reduced in the face of competing claims, corruption and strong interests, potentially leading to the exploitation, dispossession or elite capture of benefits[62]. Notably, in cases where the transfer right is held, areas and resources may be permanently or temporarily transferred (along with use, access and management rights, for example). Whether this is an expression of agency or exploitation of either the transferer or transferee requires critical scrutiny. These unique uncertainties, combined with the growing precarity of the rights of those most dependent on coastal ecosystems, have generated rising interest in the tenure of oceans and coasts over the past two decades[12,88,89]. Credit: icons, Canva.com (refs. 63,92).

Interest in the climate mitigation potential of conserving and restoring BC habitats is surging globally. BC is increasingly framed as an opportunity to meet national and international climate mitigation, biodiversity and sustainable development goals, positioned as part of a solution set for delivering the ambitions of the Paris Agreement and the Kunming–Montreal Global Biodiversity Framework, as well as a key strategy for a sustainable ocean economy[20]. BC opportunities are also included within the Nationally Determined Contributions to the Paris Agreement[21], with several other global agreements providing scaffolding for recognizing the value and relevance of BC projects and policies, including the United Nations (UN) Framework Convention on Climate Change (1992), the UN Convention on Biological Diversity (1992) and the Ramsar Convention on Wetlands (1971).

Such promise has led to increasing opportunities for the commodification and marketization of coastal and marine resources through emerging BC markets[22,23]. In 2022, the scale of demand among companies and investors wishing to offset their GHG emissions through BC was estimated to exceed US$10 billion[23]. Although the global BC market is still nascent and viewed as under-capitalized by investors[23,24], new market structures and partnerships are being established to facilitate BC commodification[25]. Indeed, BC markets are supported by a burgeoning alliance of international environmental non-governmental organizations, private companies (for example, Blue Carbon Buyers Alliance), UN agencies (for example, UN Environment Programme) and a growing number of national governments[26,27]. With full BC wealth valued at >US$190 billion per year[28], public, non-profit and private actors are seeking to access and monetize this wealth and fund the potential conservation and restoration of ~185 million hectares of BC habitat globally[6] and direct carbon finance towards at least 2.6 million hectares of investable mangrove protection[24]. This demand is occurring amidst a wider suite of ocean-focused economic interests (for example, industrial aquaculture, fisheries, mining)[29–31], experimental climate interventionism (for example, marine geoengineering)[32,33] and large-scale conservation (for example, the 30×30 target)[34] that are also precipitating privatization, changing people's access and otherwise altering the nature and certainty of tenure for coastal peoples[30,35,36].

Consequently, a diversity of scholarly, policy and technical guidance has emerged to guide BC projects (for example, refs. 20,37–39).

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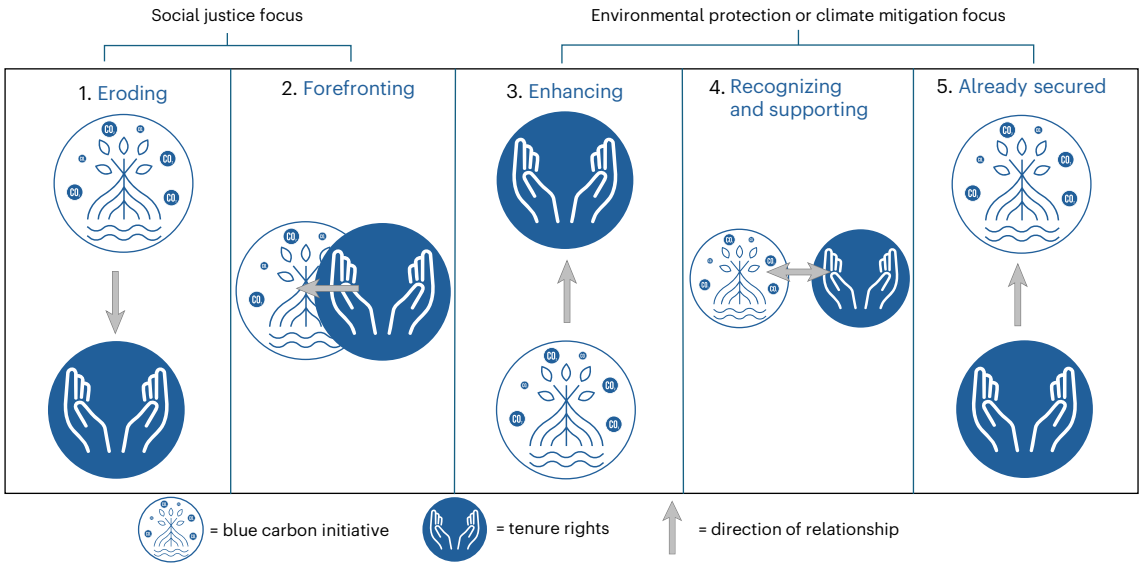

Fig. 1 | Five overlapping and/or competing claims about the relationship between BC projects and tenure rights. The first two panels show claims associated with social justice made by human rights advocates, grassroots civil society organizations, and social and environmental justice scholars. The last three panels show environmental protection and climate mitigation claims typically made by BC scholars, government agencies, private organizations and investors. Claims include (1) eroding: BC projects erode and exploit the rights of coastal communities and rightsholders; (2) forefronting: Indigenous rights must be at the forefront of BC projects; (3) enhancing: BC projects must enhance local rights; (4) recognizing and supporting: BC projects must recognize and support existing rights; and (5) already secured: secure rights are essential for viable BC projects. Notably, claims are not necessarily neatly bounded views held by certain actors, as some actor groups make assertions that span multiple claims. Credit: icons, Canva.com.

This guidance is shaping the BC policy landscape, steering decision-makers (that is, governments, carbon industry and finance actors, scientists and practitioners) contemplating their support for, and design or implementation of, BC activities at international, national and local scales. However, as the interest and potential for investment in BC projects burgeons, how these projects will be governed and their implications for coastal peoples has received limited attention (for exceptions, see refs. 8,13,14,40). Examination of the claims, treatment and obligations associated with tenure and rightsholders to determine whether current guidance effectively clarifies, defends and/or promotes the tenure security of rightsholders is, therefore, both necessary and timely.

To address this critical governance gap, we identify and examine 122 BC guidance documents that acknowledge tenure (Methods). Our analysis includes both scientific peer-reviewed scholarly literature (referred to as 'scholar' perspectives in our results) and policy and technical literature with at least some sensitivity towards tenure. We (1) employ discourse analysis to explore common assertions about the interaction between rightsholders and BC projects (that is, whether projects claim to strengthen or weaken tenure rights), (2) examine the treatment (that is, definition and prioritization) of tenure rights in BC guidance and (3) determine the extent international instruments with obligations to recognize and respect tenure rights have diffused into BC guidance.

Claims about the interaction between tenure and BC

Our sample of 122 scientific, policy and technical documents guiding science, implementation, investment and governance of BC projects reveals ten actor groups producing such guidance (Extended Data Table 1 and Extended Data Fig. 1). These groups include civil society organizations and social movements, BC standards organizations, scientists, non-profit organizations, news media outlets, private companies, governments, intergovernmental agencies, research institutes and multi-institutional collaboratives (that is, a consortium of these groups). Analysis of this guidance reveals five overlapping and/or competing claims about the interaction between tenure rights and BC (Fig. 1, expanded in Table 1). These claims are unevenly distributed among actors—for example, statements about the threat of weakened rights presented in claims one and two only appeared in 22 of the 122 documents. In contrast, the bulk of guidance ($n = 100$) produced by private organizations, international non-governmental organizations and governments supports claims three, four and five. Refer to Supplementary Box 1 and Extended Data Table 2 for an expanded analysis of the tenure claims in BC guidance.

Treatment of tenure definitions

Customary, Indigenous and Western definitions of tenure are present in BC guidance. However, we find considerable discrepancy about the definitions of tenure emphasized. Customary or informal regimes (that is, those not reflected in written laws), including collective tenure systems, are acknowledged in 57% of all guidance. Civil society organizations and social and environmental justice scholars in particular emphasize community tenure rights as a fundamental human right [43–45] and acknowledge that Indigenous conceptions of tenure embody a holistic connection between land, culture and community [80,82], inclusive of mutual stewardship, care and deep ancestral relationships [121] (numbers in square brackets correspond to guidance reviewed; Supplementary Table 1). Private property attributes associated with tenure are critiqued by civil society actors as they tend to reduce nature "to a commodity that only has true value in so far that it is used by humans" [48]. Social and environmental justice scholars warn that if the ways local people care for nature and practice environmental protection are not recognized or respected, BC projects can reinforce "colonial histories and paternalistic approaches" [80].

In contrast, the private sector, research institutions, multi-institutional collaborations and BC standards organizations consider informal property rights a substantial challenge as ownership is considered ambiguous [31,32,35,44], which can be "a bottleneck for investment in sustainable land management" [113]. Western conceptions of tenure as property, where land with clearly delineated boundaries is considered tradeable, are viewed by this subset of guidance as

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Table 1 | Five claims about the relationship between tenure, local rights and BC projects

Claim	1. BC projects erode and exploit rightsholders and coastal communities	2. Indigenous rights must be at the forefront of BC projects	3. BC projects must enhance local rights	4. BC projects must recognize and support existing rights	5. Secure rights are essential for viable BC projects
Goal	To protect communities from exploitation by discouraging engagement with BC projects	To ensure BC projects are Indigenous-led and owned, and Indigenous rights are at the forefront	To empower communities to realize their rights, and manage and benefit from their BC resources	To support effective and equitable governance of tenure for successful projects	To promote conservation, restoration and sustainable BC ecosystems where tenure is already secure
Framing of tenure	Asserts tenure rights are undermined through 'carbon colonialism' (that is, commodification of nature, and the guise of environmental protectionism)	Acknowledges Indigenous peoples as traditional custodians of BC ecosystems with a deep ancestral relationship with their land and seas	Asserts effective BC projects will strengthen tenure security, including informal and collective tenure systems	Recognizes existing tenure rights may include informal or collective ownership, potentially though a traditional system of land allocation	Asserts that secure tenure is required to attract BC project funding and investors; tenure rights need to be demonstrated through title deed or equivalent legal documentation delineating clear property boundaries
Best practice	Advises communities not to engage with BC projects	Advises that self-determination must be core to any BC project; BC governance and management methods must align with traditional systems and practices and incorporate traditional ecological knowledge	Advises projects must prioritize community as primary project beneficiary, foster genuine community participation and equitable benefit sharing, and pursue measures to help secure and strengthen statutory rights where feasible, including the right to benefit from carbon sequestration	Advises projects must recognize existing rights, support local capacity for resource management and ensure clear benefit-sharing mechanisms	Advises that projects must not proceed if tenure rights are uncertain; secure ownership and management rights must be legally demonstrated; projects must be profitable and balance community, project developer and investor interests and benefits; navigating tenure is less difficult for projects on public land
Tenure benefits	None are claimed	Claims strengthened capacity of Indigenous peoples for rights advocacy, land ownership or recognition, and management rights will assist securing collective tenure and reduce vulnerability to land grabbing	Claims BC projects can enable formal tenure rights recognition and long-term control over resource access and management; ensures rightsholders benefit from carbon markets and crediting schemes	Claims benefits to rightsholders will include finance from carbon credits and non-carbon benefits (that is, improved resource status with livelihood and well-being co-benefits). Co-benefits incentivize community acceptance and can lead to higher carbon credit cost	Claims that if BC projects offer alternative livelihood options or compensation, they can incentivize community acceptance of projects
Tenure harms or restrictions	Claims projects can result in community displacement, are culturally destructive and only lead to exploitative outcomes and human rights abuses, and can weaken access to natural resources	Claims that external actors may not have vested interests in protecting Indigenous rights; projects can change a community's relationships with natural resources; there is high potential for exploitation	Claims projects may create or fuel existing tenure disputes; those without formal title may be disadvantaged or marginalized	Claims projects may create or fuel existing tenure disputes	Claims insecure tenure and property rights are a barrier to BC projects as it is difficult to generate (or reduces value of) carbon credits; navigating tenure is costly and time consuming and may delay projects
Proponents	Human rights organizations and watchdogs (for example, Survival International); civil society organizations (that is, World Forum of Fish Harvesters and Fish Workers); social justice scholars	Civil society organizations (for example, Indigenous Carbon Industry Network); social justice scholars	Civil society organizations (for example, Indonesia Ocean Justice Initiative); non-profits (for example, Conservation International); BC standards organizations (for example, Verra)	Intergovernmental organizations (for example, World Bank; The Ocean Panel); BC standards organizations (for example, Verra); non-profits (for example, Conservation International)	Non-profits (for example, Conservation International); national governments; donors (for example, US Agency for International Development; private companies (for example, Accounting for Nature)
Guide form	Watchdog reports; news media; scientific scholarship	Indigenous-targeted advocacy; BC project guidelines; scientific scholarship	BC project guidelines; BC standards	Global voluntary guidelines and tools; BC standards; BC handbooks	Practical guidance such as BC methodologies; BC project and technical guides

necessary for determining who can undertake projects and receive carbon credits [112,121]. Such guidance ascribes tenure and associated rights through private property attributes, such as proof of legal ownership and fiscal arrangements to transfer property, extract resources or derive income from carbon credits [31,32,35,37,52,53].

Prioritization of tenure rights

In exploring how and which tenure, property or user rights are prioritized (that is, invoked in BC guidance) (Table 2), we find only two guiding documents [96,103] that recognize the full bundle of rights (as defined in Box 1). We find rights relating to exclusion, withdrawal and alienation are rarely invoked. The complete absence of transformation rights is most likely because projects are designed to enhance carbon storage, requiring permanence (usually 100 years), preventing other land uses without penalty [17]. Management and access rights are most frequently cited; however, we find ambiguity about how rights may be invoked in practice. For example, it is unclear whether management rights are also intended to include the right, authority and power

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Table 2 | A bundle of tenure rights in BC guidance ranked in order of priority

Right	*n*	Evidence of where rights are invoked in BC guidance
Management rights	44	"... in Kenya, community management rights can be established under a co-management agreement between the community and the Kenya Forest Service. The explicit aims of these co-management agreements are, under the Kenyan Forests Act, to increase efficiency in mangrove management, facilitate community participation in forest governance, and ensure the flow of benefits to the community." [53]
Access rights	40	Plan Vivo's assessment and utilization tool recommends the need to identify local knowledge and preferences for utilizing BC ecosystems products to ensure access and use of these resources is considered by projects. Actions include assessing and mapping historic trends, resource use and perspectives on alternative natural resource options [33]
Enforcement rights	33	Communities in Buano Island, Maluka Province, Indonesia have customary tenure rights and have appointed traditional leaders and Kewang (forest police) to enforce customary management rules to manage mangrove forests [103]
Right to due process and compensation	18	"Providing alternative livelihoods or material resources may also be needed to compensate for changes in land use and to ensure activities do not simply shift to alternative locations, causing damage elsewhere." [74]
Alienation rights	10	In the USA, "...transfer of carbon rights from tribal lands is likely to follow similar patterns as federal and state lands, with authority to alienate or otherwise transfer rights governed by the applicable treaty, tribal constitution, and tribal codes. Tribal transfers are unique, however, in that federal approval is likely to be required for transfer of tribal property." [119]
Withdrawal rights	7	BC projects located in areas with high human reliance may be able to invoke special concessions for sustainable mangrove harvesting rights [15]
Exclusion rights	3	The World Bank's report, 'Unlocking Blue Carbon Development: Investment Readiness Framework for Governments' (2023), specifies that rightsholders must not be restricted in their rights to exclude others from their resources unless they provide consent. Invocation of this right demands free, prior and informed consent before communities can be integrated into emissions reduction programmes [60].
Transformation rights	0	Not invoked in any guidance.

Source numbers in square brackets correspond to guidance reviewed in Supplementary Table 1. *n* refers to the number of guidance documents where rights are emphasized.

of rightsholders to create management rules (implying community control), or the responsibility for management (implying community onus to manage resources, areas and/or projects). The distinction between management 'rights' and management 'responsibilities' is made within Indigenous Carbon Network Industry guidance, stating that "Indigenous people are also responsible for managing significant areas of Sea Country, but these management responsibilities do not always equate to rights..." [43]. Instead, 'responsibility' may be used to promote the community management of BC projects—for example, a research institute suggests stewardship payments can serve as "... financial incentives provided to landholders or custodians for the responsible management and conservation of natural resources and ecosystems" [115].

Guidance most sensitive to tenure rights (that is, where two or more rights receive attention) include practitioner best-practice guides, a review of BC potential and government investment guidance (Table 3). Guidance produced by private companies and international non-profit organizations (with the exception of one guiding instrument) do not feature in Table 3, suggesting limited attention to the subset of tenure rights by these actors.

Obligations to tenure and rightsholders

A range of international instruments recognize the obligations and responsibilities of governments, civil society and the private sector to respect tenure rights. We examine the extent these obligations have diffused into BC guidance, finding acknowledgement through the citation of both binding ($n = 9$) and non-binding ($n = 5$) obligations (Table 4). Of these, three binding and four non-binding obligations explicitly demand commitments to tenure or secure tenure. Yet, six international instruments with substantive obligations to tenure are not cited, and there is a notable absence of both international instruments dedicated to governing BC that explicitly protect tenure and/or the interests of rightsholders. We find 46% ($n = 56$) of guidance does not cite any of the obligations in Table 4. Guidance citing obligations that 'neglect' tenure rights also cites obligations 'sensitive' to tenure in 30% of cases ($n = 37$).

Discussion

Substantial progress has been made to understand and quantify the ecological, mitigation and economic potential of BC as a nature-based climate solution[26,41,42]. While we find the anthropogenic risks and benefits of BC projects have received some attention from social justice scholars, civil society, the media and BC standards organizations (for example, refs. 13,14,43,44), far less consideration has been given by international non-profit organizations, governments, intergovernmental agencies, private companies and scientific scholars. Our examination of claims, invocations and obligations to tenure and rightsholders in BC guidance uncovers an urgent need to challenge normative assertions about rights and tenure, particularly those developed in the absence of input from human rights experts and Indigenous, fisher and community perspectives. We discuss four opportunities to do so: (1) illuminate discrepant claims about the relationship between BC and tenure rights, (2) understand and respect Indigenous conceptions of tenure, (3) recognize the full and contextualized bundle of rights and (4) facilitate further uptake of international instruments with obligations to tenure and rightsholders.

Illuminate tensions and discrepancies in claims about the relationship between BC and tenure rights

Clarifying claims about the relationship between BC and tenure rights can help determine how tenure is viewed and nested within the overarching agendas, values and preferences of BC actors[45]. We find private companies, some national governments, international non-profit organizations and BC standards organizations consider clarity of tenure as a precursor to effective BC ecosystems management or conservation, suggesting an underlying view that increasing carbon services of these ecosystems is the priority goal. In contrast, social and environmental justice scholars and civil society actors frame tenure security as an end goal, positioned alongside concerns that BC projects risk exploiting and eroding rights, community agency and self-determination. Differences in claims reflect established debates about the friction between ecologically and economically centred environmental agendas and those focused on human development goals[46–49]. These agendas can be indicative of the balancing act many organizations face meeting regulatory requirements for carbon mitigation, whilst also ensuring biodiversity co-benefits, and income generation for local communities[8]. Yet, when blue economy projects are introduced to only consider tenure as a means to achieve conservation or mitigation goals, communities can be (deliberately or inadvertently) positioned as participants to be engaged, placated, consulted or informed[50], rather than

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Table 3 | Guidance most sensitive to the subset of tenure rights (that is, where 2 or more rights are invoked) (*n*=43 documents)

BC guidance source	Management right	Access right	Enforcement right	Right to due process	Alienation right	Withdrawal right	Exclusion right	Transformation right	Actor group producing guidance
[50] Beeston et al.[39]	✓	✓	✓	✓	✓	✓			Multi-institutional collaborative
[121] Groom et al. (2023)	✓	✓	✓	✓			✓		Research institute
[60] World Bank[38]	✓	✓	✓		✓		✓		Intergovernmental agency
[53] ACES (2023)	✓		✓	✓	✓				National government
[80] Atchison et al.[14]	✓	✓	✓	✓					Most recent academic scholarship
[9] Dencer-Brown et al.[8]	✓	✓	✓	✓					Most cited academic scholarship
[12] Fujita et al. (2013)		✓	✓	✓	✓				Most cited academic scholarship
[15] Herr et al. (2017)	✓	✓	✓			✓			Most cited academic scholarship
[43] ICIN (2024)	✓	✓	✓				✓		Civil society or grassroots organization
[101] Rakotomahazo et al. (2023)	✓	✓	✓		✓				Most cited academic scholarship
[63] Bandiaky-Badji (2024)	✓	✓	✓						News media
[59] Conservation International et al.[37]	✓	✓		✓					Multi-institutional collaborative
[88] Fu et al. (2024)	✓	✓	✓						Most cited academic scholarship
[120] Groom et al. (2024)	✓	✓	✓						Research institute
[46] Januar et al. (2024)	✓	✓		✓					Civil society or grassroots organization
[69] Mukpo (2023)		✓		✓	✓				News media
[57] Murray et al.[20]	✓	✓	✓						Multi-institutional collaborative
[103] Salampessy et al. (2024)	✓	✓	✓						Most recent academic scholarship
[21] Sidik et al. (2018)	✓	✓	✓						Most cited academic scholarship
[22] Song et al.[61]	✓	✓	✓						Most cited academic scholarship
[24] Stewart-Sinclair et al. (2020)	✓	✓	✓						Most cited academic scholarship
[28] Vanderklift et al. (2019)	✓	✓	✓						Most cited academic scholarship
[37] Verra (2017)	✓	✓		✓					BC standards organization
[115] Wartman et al. (2023)	✓	✓	✓						Research institute
[2] Aziz et al. (2016)	✓		✓						Most cited academic scholarship
[3] Barbesgaard et al. (2018)	✓	✓							Most cited academic scholarship
[48] Barbesgaard (2016)	✓	✓							Civil society or grassroots organization
[74] Beeston et al. (2020)	✓			✓					International non-profit organization
[4] Benessaiah (2012)	✓		✓						Most cited academic scholarship
[8] Damastuti et al. (2022)	✓		✓						Most cited academic scholarship

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Table 3 (continued)| Guidance most sensitive to the subset of tenure rights (that is, where 2 or more rights are invoked) (*n*=43 documents)

BC guidance source	Management right	Access right	Enforcement right	Right to due process	Alienation right	Withdrawal right	Exclusion right	Transformation right	Actor group producing guidance
[41] Fern (2023)	✓	✓							Civil society or grassroots organization
[13] Gatt et al. (2022)	✓	✓							Most cited academic scholarship
[31] Gold Standard Foundation (2014)		✓				✓			BC standards organization
[14] Hejnowicz et al. (2015)		✓		✓					Most cited academic scholarship
[45] Indonesia Ocean Justice (2023)		✓	✓						Civil society or grassroots organization
[92] Iñiguez-Gallardo and López-Rodríguez (2024)	✓		✓						Most recent academic scholarship
[16] Locatelli et al. (2014)	✓	✓							Most cited academic scholarship
[54] Lutz and Barnes (2014)	✓		✓						National government
[96] Merk et al. (2022)	✓		✓						Most recent academic scholarship
[27] Thompson and Friess (2019)			✓	✓					Most cited academic scholarship
[29] Warner et al. (2016)	✓	✓							Most cited academic scholarship
[33] Plan Vivo Foundation (2023)[a]	✓	✓							BC standards organization
[36] Plan Vivo Foundation (n.d.)[a]		✓	✓						BC standards organization

Source numbers within square brackets in the first column correspond to guidance reviewed in Supplementary Table 1. Actors in last column correspond to groups producing BC guidance in Extended Data Table 1. [a]Modular tools in Plan Vivo guidance explicitly sensitive to tenure. Further rights may be invoked in other tools (that is, stakeholder analysis), which fall outside the study sample.

self-determining and empowered entities. By contrast, BC projects that seek to enhance existing rights, by genuinely recognizing and enabling communities as both primary project leaders and beneficiaries[9,51,52], help to ensure the co-benefits and/or generated income are controlled by, and directed towards, communities[40,53,54].

We also find a point of convergence about the relationship between tenure and BC whereby all five claims acknowledge that projects may create or fuel existing disputes over resources or space, and/or make tenure security less certain. This risk has been illustrated in Australia where the native title system can escalate pre-existing conflict within Indigenous communities and families[55]. Acknowledgement of such risk also highlights the precarity of claims that BC will clarify or enhance tenure security, particularly if there are no genuine opportunities for Indigenous peoples and local communities to support their own self-determination and actively participate in and lead BC projects[54,56] (refer to guidance from the Aboriginal Carbon Foundation at https://www.abcfoundation.org.au/). As such, interrogating claims around tenure, including the degrees of inclusion and empowerment that communities experience within BC projects, will help determine the key areas of social risk and opportunity[51,52].

Understand and respect Indigenous conceptions of tenure

Embracing Indigenous and local conceptions of tenure and values of nature could enhance the delivery of intended BC project benefits[9]. We find Western views of tenure (whereby natural resources are perceived as a good from which property rights are determined and resources can be delineated, extracted and commodified[57,58]) are potentially at odds with local and Indigenous views of humans and their stewardship in mutual relations with nature[16,17]. Market-based projects in particular require the imposition of Western views of property rights and profit-making ideologies, prioritizing financial returns and income generation[54], forging new distributions of both wealth and decision-making power[14]. Such conflicting views mean BC projects may undermine Indigenous social or environmental goals[16,54], local cultural heritage and carry the real risk of representing new forms of interventionism or neo-colonialism[4,5,59]. Without substantial consideration of the effects on rightsholders who value nature in more holistic ways, local communities can lose access and use of these areas and resources for livelihood and food-provision services. In fact, only 9% of BC market-based projects operating globally are considered to be under community-based control, with the private sector, governments and non-governmental organizations representing 68% of project proponents[25]. Although there is a promising rise in attention to social co-benefits and justice within BC markets[25,60], and efforts have been made to develop community-specific standards[44], many remain voluntary. As such, asking critical and contextual questions about how to capture other realities, beyond neoliberal understandings of how to govern and manage nature, could be key to understanding how best to address the climate crisis whilst respecting rightsholders and their tenure systems[61].

Recognize the full and contextualized bundle of rights

Improving tenure recognition in BC guidance is an obligation to rightsholders, not a precondition for better project outcomes. BC guidance and projects that recognize a broader range of rights (and also account for social context and complexity) will better reflect the social relationships that enable or constrain benefit and use[40]. Communities must have the right to place limitations on their own rights to engage

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Table 4 | BC guidance documents cite 14 international instruments with obligations to support community rights, 7 demonstrate sensitivity toward to tenure rights and 7 neglect them entirely, while the most substantive international instruments with tenure obligations remain uncited

Cited instruments with obligations supporting the rights of communities		Proportion of guidance where obligation is acknowledged (%)	Binding or non-binding
Instruments with substantive tenure obligations	International Labour Organization's Indigenous and Tribal Peoples Convention (1989)[67]	0	Binding
	Convention on the Elimination of All Forms of Discrimination against Women (1979)[68]	0	Binding
	The Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests (2012)[69]	0	Non-binding
	UN Sustainable Development Goals specific to tenure: 1.4, 2.3, 5.A, 14.B (2015)[70]	0	Non-binding
	Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (2015)[71]	0	Non-binding
	UN Declaration on the Rights of Peasants and Other People Working in Rural Areas (2018)[72]	0	Non-binding
Instruments with obligations sensitive to tenure rights	UN Framework Convention on Climate Change (1992)[73]	43	Binding
	UN Convention on Biological Diversity (1992)[74]	27	Binding
	UN Convention on the Law of the Sea (1982)[75]	5	Binding
	Kunming–Montreal Global Biodiversity Framework (2022)[76]	13	Non-binding
	UN Declaration on the Rights of Indigenous Peoples (2007)[64]	8	Non-binding
	Universal Declaration of Human Rights (1948)[77]	<1	Non-binding
	UN Guiding Principles on Business and Human Rights (2011)[78]	<1	Non-binding
Instruments that neglect tenure rights	Paris Agreement (2015)[79]	21	Binding
	Ramsar Convention on Wetlands (1971)[80]	21	Binding
	World Heritage Convention (Cultural and Natural Heritage) (1972)[81]	4	Binding
	High Seas Treaty (2023)[82]	1	Binding
	Commonwealth Blue Charter (2018)[83]	4	Binding
	IPCC Wetlands Supplement (2013)[84]	11	Binding
	UN Blue Carbon Code of Conduct (2017)[85]	3	Non-binding

All guidance instruments include at least some sensitivity towards tenure (n=122). Instruments include both hard laws that are legally binding (n=11) and soft laws that are non-binding (n=9). Instruments with substantive tenure obligations are determined based on global commitments to Indigenous peoples, coastal communities and/or small-scale fisher tenure rights (outlined in refs. 63,86). Instruments with obligations sensitive to tenure refer to those where explicit reference to tenure, land, property or user rights are acknowledged. Instruments that neglect tenure refer to those where no explicit reference to tenure, land, property or user rights are acknowledged. Percentage calculations exclude guidance pre-dating the formal publication or adoption of each instrument. These adjustments are made to account for the following: 40% of guidance predates the High Seas Treaty (2023); 28% predates the Kunming–Montreal Global Biodiversity Framework (2022); 14% predates the Commonwealth Blue Charter (2018) and the UN Declaration on the Rights of Peasants; 12% predates the UN Blue Carbon Code of Conduct (2017); and 5% predates the Paris Agreement (2015), the UN Sustainable Development Goals (2015) and the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (2015).

with BC projects. Further safeguards are required to ensure that any limitations upon, or complete transfer of, rights are determined by rightsholders through adequate participatory processes that uphold, for example, cultural process and authority, or international standards of free, prior and informed consent[62]. However, our analysis shows that there is limited guidance as to how such changes to tenure rights should be defined, prioritized and navigated. Of the eight rights in the bundle, management and access rights are most frequently invoked (Table 2), yet whether rightsholders have the autonomy and decision-making power to invoke such rights is unclear. For example, we find instances where management 'rights' (that is, the power of rightsholders to create management rules) are interchanged with management 'responsibilities' whereby the onus for project implementation activities is upon rightsholders. We also find rights pertaining to exclusion, withdrawal, alienation and transformation are least emphasized. Our findings are supported by Cohen et al.[63], who argue that viewing tenure for a particular objective or end, such as to fulfil mitigation or commodification goals as is the case for many BC projects, can lead to focusing only on a subset of rights or, in the case of management, a distortion of 'rights' versus 'responsibilities'. These narrow methodological views of tenure can limit, undermine or shortchange the agency, autonomy and power of rightsholders.

Facilitate further uptake of global instruments with obligations to rightsholders

Recognizing and respecting tenure rights is an overarching obligation under various international conventions, treaties and laws that stipulate a set of responsibilities for governments, civil society and the private sector[1,2,64]. Strengthening BC guidance to better reflect these international obligations could set a powerful minimum standard for progressing tenure security within BC projects, ensuring greater transparency and accountability to such obligations. We find 14 instruments making international obligations to rightsholders cited. Of these instruments, half are sensitive to tenure rights and the other half do not attend to issues of tenure or land rights. We find six substantive international instruments with obligations to recognize and respect tenure have not diffused into BC guidance, raising concern about the extent projects will meet international tenure rights obligations (acknowledging some guidance may contain content that reflects the spirit of those obligations without citing them). Updating BC guidance to reflect international obligations could also be undertaken in tandem with cross- and trans-disciplinary awareness and training of key decision-makers (that is, restoration practitioners, biophysical scientists, private investors and governments)[65], and establishing partnerships where all members of communities and scientists are positioned as equals[9]. Such

strategies can help to ensure the unique needs and rights of different social groups (that is, women or marginalized identities) are considered and accounted for in obligations guiding best-practice[66].

Conclusion

As anticipation for BC as a nature-based climate solution intensifies, how the tenure rights of coastal communities, small-scale fishers, and Indigenous peoples and Traditional Owners are conveyed, protected and/or promoted is in question. Despite increased openness to different forms of collectivized tenure rights, we find only a subset of rights consistently receive emphasis, often embed within Western conceptions of tenure. BC is emerging on the heels of a raft of blue economy activities seeking the privatization of natural resources and threatening local tenure security. The degree to which BC projects pose risks or opportunities to tenure will be determined by the ways in which communities and their rights are positioned—as participants of BC projects who might play a stewardship role, or as project leaders with the power to determine (or resist) how arrangements are made. Updating and strengthening guidance to challenge inconsistencies in tenure claims and definitions (particularly those developed in the absence of Indigenous and community perspectives or without input from rights experts) could set a powerful minimum standard for progressing tenure security within BC projects, ensuring greater transparency and accountability to rightsholders. Given the pace and scale of BC expansion, there is an urgency to ensure that guidance explicitly recognizes the rights of peoples in the territories proposed for BC projects—not as a condition for project success, but as a legal and ethical duty.

Online content

Any methods, additional references, Nature Portfolio reporting summaries, source data, extended data, supplementary information, acknowledgements, peer review information; details of author contributions and competing interests; and statements of data and code availability are available at https://doi.org/10.1038/s41558-026-02651-8.

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Methods

We analysed BC guidance to determine the claims, treatment and obligations associated with tenure and rightsholders[97]. Given the emergent nature of BC projects, rather than evaluating the small number of projects that have been established, we purposively investigated the guidance materials and guiding perspectives shaping the BC policy landscape.

BC guidance sample

Our sample included both scientific peer-reviewed scholarly literature (referred to as 'scholar' perspectives in our results) and policy and technical literature with at least some sensitivity towards tenure. We used search engines Web of Science for sourcing the peer-reviewed literature, and Google for the policy and technical literature in English language. Our search was undertaken in December 2024. Search parameters included: 'blue carbon' AND 'tenure' OR 'property rights' OR 'land rights' OR 'user rights'. For both the peer-reviewed literature and the policy and technical literature, we examined each source for relevance and excluded those that did not specifically address issues of tenure and BC, resulting in a sample of 122 documents (60 peer-reviewed literature and 62 policy and technical literature) (see Supplementary Table 1 for the full list of sources). Our review of the peer-reviewed literature purposively included the 30 most cited and the 30 most recent peer-reviewed articles to ensure we captured the most influential and up-to-date literature, and achieved a closely weighted sample with the policy and technical literature. This literature is a non-exhaustive representation of BC guidance produced by diverse actor groups. We acknowledge that important voices and perspectives may not be reflected in our sample, particularly those less represented in the English language and those published after December 2024. Future research could consider broadening search parameters to include specific BC habitats (for example, seagrasses, mangroves and tidal marshes), as well as looking more broadly at issues of social justice, in which tenure and property rights are deeply intertwined.

Our combined searches returned guidance in a variety of forms, including scholarly perspectives in peer-reviewed literature, BC standards, implementation and investment guides, and BC roadmaps, which are outlined further in Extended Data Table 1. Guidance publication dates ranged from 2012 to 2024 (Extended Data Fig. 1). At the time of data collation in December 2024, the reviewed literature represented the most current guidance and guiding perspectives on BC projects and tenure. This guidance is important because it directs decision-makers and practitioners who are either contemplating, designing or already undertaking BC activities. This body of guidance is also influencing the BC policy landscape, as well as carbon market and financing options at international, national and local scales.

Once our sample was finalized, we collated the literature into two overarching literature sets based on whether they were peer-reviewed or policy and technical literature. We then grouped the literature into ten subsets based on who they were produced by (Extended Data Table 1). Grouping the literature in this way enabled us to differentiate between who was presenting particular perspectives about BC and tenure, and to determine patterns within the discourse related to who the groups are. Stakeholders producing BC guidance included civil society organizations and social movements, BC standards organizations, scientists, non-profit organizations, news media outlets, private companies, governments, intergovernmental agencies, research institutes and multi-institutional collaboratives (that is, a consortium of these groups).

Data analysis

Our analysis was guided according to the following pre-identified areas of enquiry: (1) claims about the relationship between tenure and BC; (2) treatment of tenure; and (3) international obligations to recognize and respect tenure rights invoked in BC guidance. We employed discourse analysis[98] to examine the range of claims made about tenure (enquiry area (1)), including the extent tenure was claimed to be strengthened or weakened, claimed best-practice guidance for navigating tenure, and potential harms and barriers. We employed frames analysis[99] to investigate the treatment (that is, the definition and prioritization) of tenure rights (enquiry area (2)). This also involved quantifying and categorizing the presence of specific rights using a pre-defined 'bundle of rights' framework[92] to highlight priority areas and areas of neglect. To explore enquiry area (3), we examined the extent obligations to tenure and rightsholders had diffused into BC guidance (following a similar method to that used in ref. 100). Specifically, we compared obligations to rightsholders cited in the guidance with global obligations to Indigenous peoples, coastal communities and/or small-scale fisher tenure rights (outlined in ref. 63, Table 1; and ref. 86, p.7). We note that some guidance may have contained the spirit or content that met some of the standards of these obligations without citing them. We also acknowledge other voluntary frameworks exist to guide implementation at national scales, such as the International Union for Conservation of Nature National Blue Carbon Policy Assessment Framework, which has dedicated obligations to tenure security[101]. As such, future analyses of national-scale obligations to tenure rights and BC would be warranted.

For each literature set, we used an online research and literature synthesis tool, Notebook LM©, to explore the three areas of enquiry (see Supplementary Table 2 for a full list of questions asked of the synthesis tool). We used qualitative coding software NVivo 14 to analyse the research summaries for each literature set individually, and then compared our results across sets. We used a combination of deductive and inductive coding to determine themes. Deductive coding involved assigning data to a pre-determined set of codes (or parent codes) based on our three areas of enquiry[102]. We then used inductive coding, where sub-themes (or child codes) were determined based on emergent themes in the data. To ensure coding reliability (refer to ref. 103), the deductive codes were developed and reviewed by three authors to ensure consensus on the areas of enquiry explored. Inductive codes were initially generated by one author while reviewing the literature, and then further reviewed and refined by two other co-authors to reduce bias and ensure any conflicts between codes were resolved before finalizing the coding scheme.

During the inductive coding process, manual content analysis of individual literature was undertaken to establish the validity of synthesized results and further explore nuances in the data. For example, we reviewed each literature source to determine whether a particular subset of tenure rights was invoked or undermined in the guidance based on an established 'bundle of rights' framework[63,92], and coded for descriptive evidence. We also explored data illustrating obligations to tenure and rightsholders in BC guidance. Our analysis differentiated between those obligations considered 'sensitive' or 'negligent' to tenure and rightsholders, and those considered to be 'substantive' tenure rights instruments. The 'sensitive' and 'substantive' categories were determined by reviewing relevant environmental and fisheries literature outlining intervention conventions and agendas that include obligations to Indigenous peoples, coastal communities and/or small-scale fisher rights (Table 4). These obligations also included those that advocate for respecting and upholding traditional and customary tenure rights. To determine those obligations considered 'sensitive' and/or 'negligent' to tenure, each obligation was reviewed by the lead author independently to establish the presence or absence of obligations to rights.

Data availability

All materials drawn upon in this study are listed in Supplementary Information. The data are publicly available at https://doi.org/10.25903/782s-m536 (ref. 97).

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Author contributions

S.L., P.J.C. and T.H.M. conceptualized the study and methodology, conducted the analysis, and interpreted the results. S.L. prepared the original draft. S.L., P.J.C., R.D., E.E.-I., C.E.L., B.M., E.O., S.P. and T.H.M. wrote, reviewed and edited subsequent drafts. S.L., P.J.C. and T.H.M. acquired funding to support the study.

Competing interests

The authors declare no competing interests.

Additional information

Extended data is available for this paper at https://doi.org/10.1038/s41558-026-02651-8.

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Extended Data Table 1 | Blue carbon guidance sample consisting of 122 peer-reviewed and policy and technical literature

Literature set	*n*=	Description of guidance forms
Peer-reviewed literature, n=60 documents		
Scholarly perspectives (most cited articles): These actors include scientists or academics with expertise in blue carbon science, restoration, biology, economics, environmental policy, law, or social sciences.	30	Peer-reviewed scholarly literature referencing blue carbon and tenure rights (citations ranged between 35 to 366 times)
Scholarly perspectives (most recent articles): These actors include scientists or academics with expertise in blue carbon science, restoration, biology, economics, environmental policy, law, or social sciences.	30	Most recently published peer-reviewed scholarly literature referencing blue carbon and tenure rights (as of December 2024)
Policy and technical literature, n=62 documents		
Civil society / grassroots organizations: These actors include a range of grassroots organizations including the Aboriginal Carbon Foundation; social movements including World Forum of Fish Harvesters and Fish Workers; and human rights watchdogs including Amnesty International.	11	Grassroots organization statements on blue carbon; Indigenous land and carbon rights guidance; Civil society recommendations for blue carbon and social-economic benefit provision; Human rights watchdog reports on blue carbon and rights abuses.
News media outlets: These actors include news outlets reporting on blue carbon projects in Africa, Asia, the Middle East and Europe (that is, The Financial Times, the Middle East Eye and Mongabay).	10	Media articles and commentaries on blue carbon project investments and controversial carbon credit deals.
International non-profit organizations: These actors include non-profit and charitable organizations operating both domestically (that is, the Blue Marine Foundation, United Kingdom), and internationally (that is, the Worldwide Fund for Nature).	9	Blue Marine Foundation - blue carbon as a new frontier publication; Fair Carbon - blue carbon workshop presentation; WWF - responsible finance for blue carbon guidance
Research institutes: These actors include institutes undertaking research on blue carbon often housed within universities (that is, the Blue Carbon Lab, Deakin University; Marine Affairs Institute; Roger Williams University).	9	Blue carbon research strategies, reviews of status and potential of blue carbon restoration, and localized blue carbon roadmaps and opportunity reports.
Blue carbon standards organizations: These actors include organizations responsible for developing international standards for blue carbon projects within carbon crediting frameworks (that is, Plan Vivo, Verra, and Gold Standard).	8	International standards for blue carbon projects and crediting.
Governmental and intergovernmental agencies: These actors include federal funded scientific agencies including the Commonwealth Scientific and Industrial Research Organisation (Australia), and intergovernmental agencies such as the World Bank and UN member states such as those represented in the High-Level Panel for a Sustainable Ocean Economy.	8	National blue carbon implementation plans and handbooks, and voluntary blue carbon principles guidance.
Private companies: These actors include for-profit companies financing or providing financial advice on blue carbon projects (that is, BHP and Climate Seed).	4	Guidance on financing blue carbon, voluntary carbon markets, and legal frameworks for blue carbon ecosystem management.
Multi-institutional collaboratives: These actors include coalitions of institutions working together to produce blue carbon guidance (for example, the Global Mangrove Alliance who represent several universities, donors, scientific agencies, research institutes, and international non-profit organizations).	3	Blue carbon best practice principles and guidelines, and global dialogue summary reports.

The sample is grouped into 10 literature sets according to the actors producing the guidance (n= number of documents).

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Extended Data Table 2 | Best-practices for recognising and respecting tenure promoted in blue carbon guidance categorized according to dominant themes

Theme	Practice	No. of sources
Community engagement	Ensure inclusive deliberation and engagement	34
	Ensure projects are Indigenous and community led or co-managed	28
	Enact free, prior and informed consent	25
	Actively collaborate with different interest holders	19
	Promote participatory governance models where communities are included in the design, implementation and management of projects	7
	Ensure transparent consultation processes	4
	Ensure gender balanced membership in governance	3
Tenure security	Recognize customary tenure rights and systems	31
	Strengthen local capacity for rights advocacy	10
	Work with governments to formalize tenure, clear legal pathways to secure tenure or management rights, and their right to sell carbon	10
Good governance	Clarify legal frameworks to clarify carbon rights	19
	Develop social safeguards or codes of conduct to protect and enhance community rights, knowledge and leadership	18
	Develop and share clear project agreements	7
	Adopt legal instruments for community sustainable management (that is, use agreements)	2
Context sensitivity	Undertake thorough tenure, rights and cultural assessment (research)	22
	Value traditional ecological knowledge	10
	Consider impacts to those without title	6
	Avoid imposing Western governance models of communities with different land management traditions	1
Benefit sharing	Develop clear benefit sharing mechanisms	37
	Clearly articulate community incentives and benefits	25
Capacity building	Support alternative or improved livelihoods	20
	Strengthen local capacity for resource management	6

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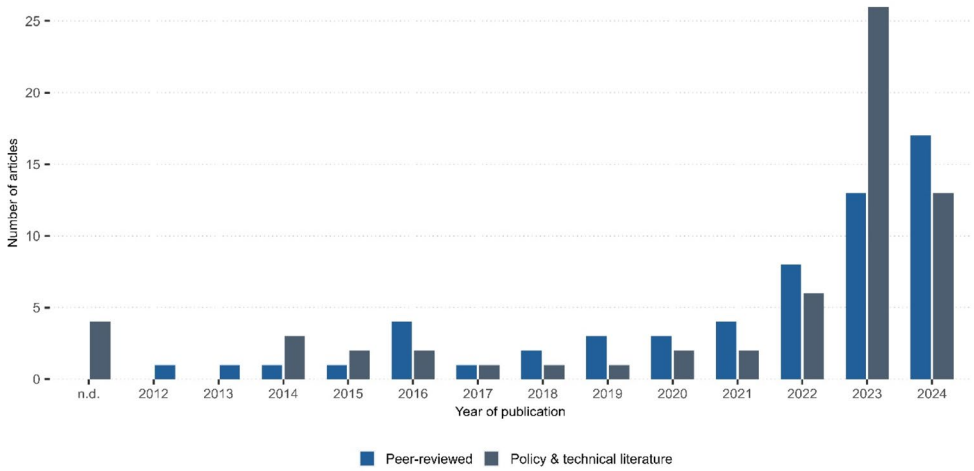

Extended Data Fig. 1 | Blue carbon guidance sample by year of publication. Bars show an overall increase in blue carbon guidance acknowledging tenure over time. The spike in policy and technical literature in 2023 is explained by an increase in news media articles concerned with controversial 'land grab' blue carbon offset projects in Liberia, Africa.