

POLICY PERSPECTIVE

China's Ecological Conservation Redline policy is a new opportunity to meet post-2020 protected area targets

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Abstract

Designating protected and conserved areas is a critical component of biodiversity conservation. The 10th Convention on Biological Diversity (CBD) in 2010 set global targets for the areal extent of protected areas (PAs) that were met partially in 2020, yet a new, more ambitious target is needed to halt ongoing global biodiversity loss. China recently introduced a national Ecological Conservation Redline policy, which aims to ensure no net change in land cover and no net loss of biodiversity or degradation of ecosystem services within areas that are critical for maintaining ecological safety and functions. Enacting this policy could achieve ancillary conservation outcomes even where conservation is not the primary objective, thus meeting CBD's definition of "other effective area-based conservation measures" (OECM). By comparing the Ecological Conservation Redline boundaries with important coastal waterbird sites in China, we found that three times more sites could be conserved under the new redline policy compared to the national nature reserve system alone. This indicates that considering the redline policy approach as a form of OECM is a promising pathway to expand the areal coverage of PAs and conserve biodiversity outside currently designated PAs, providing a model that could be adopted around the world.

KEYWORDS

Aichi Target, conserved area, convention on biological diversity, ecological conservation redline, other effective area-based conservation measures

1 | INTRODUCTION

Twenty Aichi Targets were formulated during the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity in 2010 to conserve biodiversity and promote sustainable development. Aichi Target 11 aimed to protect at least 17% of the world's terrestrial and

inland water ecosystems, and 10% of coastal waters and ocean by 2020. This target is one of the few Aichi Targets to have been partially met to date (16.64% terrestrial and 7.74% marine ecosystems were recognized as protected in 2020 before further updates; UNEP-WCMC et al., 2020), and was achieved through accelerated establishment of new protected areas (PAs) over the last decade (UNEP-WCMC

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et al., 2020). However, this area-based effort has been criticized for its limited ambition, the relatively low biodiversity values of the new PAs added, and failure to represent the full range of ecosystems (Butchart et al., 2015; Jantke et al., 2018; Li & Pimm, 2020). These critiques have led to calls for an improved target based on conservation outcomes (Dinerstein et al., 2020), or a more achievable PA coverage target in the future (Di Minin & Toivonen, 2015). It has been argued that protection of 50% of earth's lands and waters, an enormous increase from the current Aichi Target, is needed to meaningfully reduce biodiversity loss (Locke, 2013), and there are now widespread calls from the global conservation community to protect and conserve 30% of the planet by 2030 (Convention on Biological Diversity, 2020).

Areas contributing to Aichi Target 11 comprise traditional "PAs" but also "other effective area-based conservation measures" (OECMs). The former has a primary conservation objective, whereas the latter delivers biodiversity conservation outcomes as a by-product of achieving a different objective (IUCN-WCPA Task Force on OECMs, 2019). Although OECMs were always included in Aichi Target 11, improved criteria for OECMs to be considered conserved areas were established only recently (IUCN-WCPA Task Force on OECMs, 2019). In an assessment of potential OECMs applying these clarified criteria, more than three quarters of unprotected Key Biodiversity Areas in 10 countries were found to have potential OECMs present (Donald et al., 2019), meaning these areas would have qualified as conserved areas under Aichi Target 11 if the clarification had been made earlier. In other words, actual global progress toward achieving Aichi Target 11 may be substantially more advanced than currently reported. Inclusion and proper accounting of OECMs provides one pathway through which more ambitious post-2020 targets could be achieved.

2 | CHINA'S ECOLOGICAL CONSERVATION REDLINE—AN EXAMPLE OF OECM

With its vast area and biodiversity, the participation of China is critical to achieving a large and representative network of conserved areas globally. In 2014, China established the Ecological Conservation Redline (ECRL), a policy developed and delineated by the Ministry of Natural Resources and implemented and overseen by the Ministry of Ecology and Environment. Redline policies in China are considered to be of the highest national priority and they have a track record of efficient enforcement by regional and local governments (Bai et al., 2016). Other redline policies with a social and economic development

focus include the Arable Land Redline and Water Resource Redline.

The ECRL is a spatial planning framework that takes both socioeconomic and ecological needs into consideration and was incorporated into Chinese environment protection law in 2014 (Bai et al., 2016). As a policy, it differs from the existing PA system represented by National Nature Reserves (NNR) in its emphasis on not only biodiversity conservation, but also on ecological fragility and ecosystem services such as water provision, natural disaster resilience, soil retention, and desertification control, when considering which areas to include (Bai et al., 2016; Schmidt-Traub et al., 2021). The ultimate goal of the ECRL is to ensure that there is no net change in land cover, and no net loss of biodiversity or degradation of ecosystem services within areas that are critical for maintaining ecological safety and functions, thereby improving environmental quality and promoting the efficient use of resources (Bai et al., 2016; Schmidt-Traub et al., 2021). Many ECRL areas may qualify as "conserved" through OECM, but China has not yet listed a single conserved area under OECM criteria (UNEP-WCMC et al., 2020).

The ECRL areas were selected by the Chinese government in three main steps (Schmidt-Traub et al., 2021). The first was to combine existing PAs that are important to biodiversity with other areas that provide important ecosystem services through remote sensing and ecosystem service modeling (Ouyang et al., 2016). These areas were then adjusted and aligned with other land-use-planning frameworks, as well as with different provinces and ecosystems to ensure continuity and effective management. Finally, the boundaries were revised after consultation with local stakeholders to balance the economic and ecological needs (Ouyang et al., 2016). This process led to more than a quarter of the country's terrestrial area being designated under the ECRL system (Schmidt-Traub et al., 2021). Development is banned in the ECRL, although certain human activities are permitted if those activities do not damage ecological functions. The emphasis on ecosystem services that resulted in large areas being included in the ECRL means there is strong potential for conservation outcomes to be delivered as a by-product (ancillary conservation), which could make a major contribution to meeting Aichi Target 11 and/or post-2020 targets. An example of how ECRL policy works is provided in Box 1.

Few studies to-date have estimated the potential for OECMs not currently counted as conserved areas to meet Aichi Target 11. Here, we start to fill this gap by overlaying China's ECRLs onto important coastal wetlands, an endangered regional ecosystem. We assess how much additional protection the ECRL may afford to important habitat through the mechanism of OECM if implemented effectively.

Box 1. Ecological Conservation Redline policy conserves habitats from development

The failure of a recent dredging proposal in Shenzhen Bay demonstrates that the ECRL policy is already being applied to conserve habitats from development. Shenzhen Bay is located at the Pearl River Estuary in southeast China, and wetlands around the bay provide important wintering and stopover habitats for more than 100,000 migratory waterbirds (Choi et al., 2020). Parts of these important habitats are protected in the Futian National Nature Reserve (NNR; Figure 1). As part of the NNR system, it has the highest administrative rank and receives relatively more funding and support compared to provincial, municipal, and county-level nature reserves (Li & Pimm, 2020). Nonetheless, Futian NNR had no jurisdiction over an area proposed for dredging in 2020 that aimed to create a shipping channel next to the reserve to promote tourism, despite the proposal's potential negative impact on waterbirds in Futian NNR and the bay as a whole (Figure 1). However, the establishment of the Shenzhen Bay important coastal wetland redline boundary outside the Futian NNR where the proposed dredging route was situated provided the legal basis for a strong rebuttal against the proposal, which was eventually withdrawn.

3 | ECRL PROVIDES FURTHER PROTECTION FOR IMPORTANT WATERBIRD SITES

Coastal wetlands in China provide important ecosystem services and critical breeding, stopover, and wintering habitats for millions of waterbirds along the East Asian–Australasian Flyway (Choi et al. 2020). These valuable habitats have been disappearing rapidly, with 51% of coastal wetlands lost in the last 50 years due to coastal development and land reclamation and degradation (An et al., 2007). As a consequence, rapid population decline has been observed in many waterbird species (Choi et al., 2020; Studds et al., 2017; Wang et al., 2018). The identification of important waterbird sites followed by improved management enforcement is critical to halt waterbird population decline along the China coast (Ma et al., 2019).

We compiled a list of important coastal waterbird sites and their geographic locations in mainland China (here-

after important waterbird sites) derived from published sources, all of which document either coastal sites of international importance for waterbird species (i.e., meeting Ramsar Convention listing criterion 6, >1% of the flyway population recorded at the site) or sites of international importance for shorebird species in the East Asian–Australasian Flyway (Table S2). We further updated the list using the latest available data (Table S2). Because our site list was compiled from multiple sources, some sites were duplicated under different names or slightly different locations; we therefore manually removed duplicated sites if any were found located within 4 km of another site, a reasonable distance that shorebirds would not usually commute beyond (Choi et al., 2014).

3.1 | PA and ECRL data collection

All PA boundaries were acquired from an open source (National Earth System Science Data Center - National Science & Technology Infrastructure of China, 2016). Only NNRs were included because they are generally better protected than other types of PAs by having the highest conservation priority, strictest management effort, clear delineation of boundaries, and better resource allocation than other types of PAs in mainland China (Li & Pimm, 2020; Ma et al., 2019). Of the 11 coastal provinces/municipalities of mainland China, Guangdong and Guangxi's ECRL were obtained by applying for information disclosure from the provincial government, Fujian's ECRL from Li et al. (2019), and the rest were obtained by direct searching online for publicly available materials. The ECRL boundaries of Hebei, Jiangsu, and Zhejiang provinces and Tianjin and Shanghai municipalities were approved by the State Council (Ministry of Environmental Protection, The People's Republic of China, 2018), whereas the remaining were subject to potential adjustment. These ECRL data were then digitized for further analysis.

To assess overlap between NNRs/ECRLs and important waterbird sites, we mapped all sites in ArcMap (ESRI, 2019). We defined an important waterbird site as protected if its geographic location either fell inside a NNR or was located within 4 km of a NNR boundary. The latter scenario (partial protection) was included because the site data were point data, whereas in reality waterbirds are not stationary and commute between foraging and resting sites regularly; thus, it is likely that some of their range is protected (Choi et al., 2020). We repeated this step using both the NNR and ECRL polygons to determine whether the ECRL provides additional protection to waterbirds. Each important waterbird site was simplified to a point coordinate due to the lack of boundary data reported in most of the accessible records.

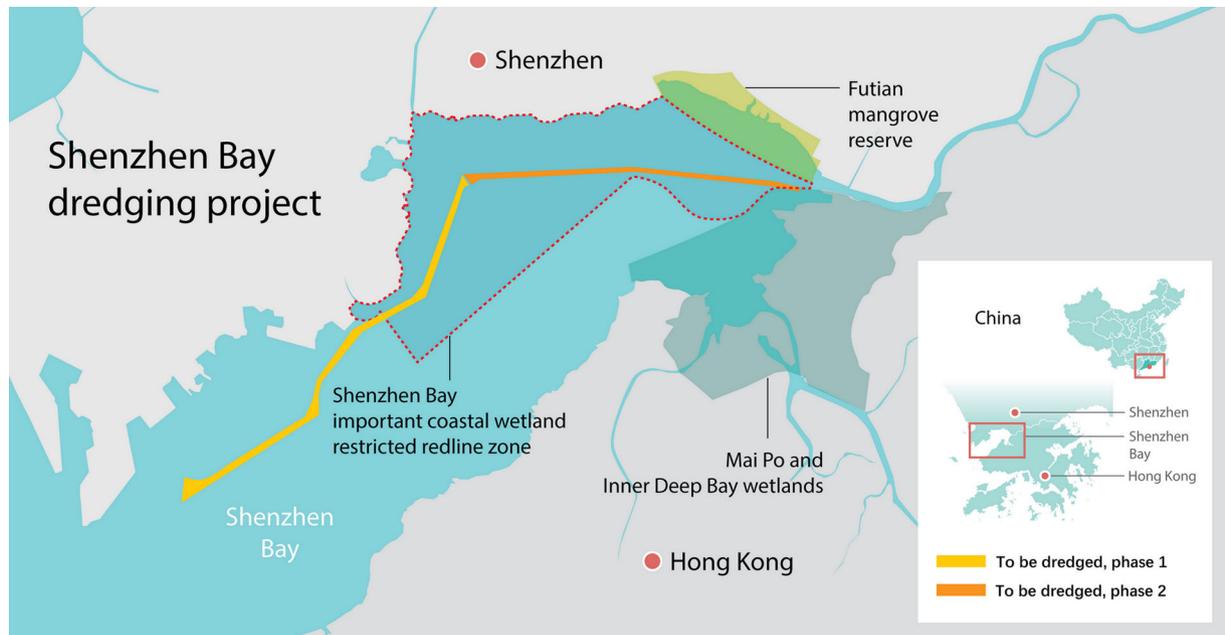


FIGURE 1 The location of Shenzhen Bay, the proposed dredging route in relation to the Ecological Conservation Redline zone (Shenzhen Bay important coastal wetland restricted redline zone), and Futian Mangrove National Nature Reserve (reproduced with permission of China Dialogue)

Of the 172 important waterbird sites identified, only about a quarter (42 sites, 24%) are protected in NNRs, including less than half of all sites in each coastal province or municipal city. However, if both NNR and ECRL boundaries are considered, the number of protected sites increases threefold (126 sites, 73%) (Figure 2), leaving only one province (Liaoning) with less than half of its important waterbird sites protected and an additional three with less than three quarters protected (Jiangsu 44.4% unprotected; Hebei 35.7% unprotected; Tianjin 42.9% unprotected; Table 1).

Some of the most critical sites for endangered species that are not protected inside a NNR could be protected through the ECRL, including Rudong Yangkou, Jiangsu for the Spoon-billed Sandpiper (*Calidris pygmaea* [Critically Endangered]; supports 8% of the global population) and Nordmann's Greenshank (*Tringa guttifer* [Endangered]; supports 3% of the global population) (Peng et al., 2017) and the Yingkou coast, Liaoning for the Great Knot (*Calidris tenuirostris* [Endangered]; supports 3% of the global population) (Choi et al., 2020). Across all species, protection within the ECRL network would fill critical gaps in the conservation of migratory waterbirds along the East Asian–Australasian Flyway by protecting critical waterbird habitat along a continuous stretch of the mainland Chinese coast (Xia et al., 2017). Only Liaoning province contains multiple important waterbird sites that are still unprotected within a NNR or the ECRL (Figure 2; Table 1). This could be a result of different priorities when decision

makers tried to balance economic and ecological needs or the ecological importance of these sites was less well-documented. Our findings are in line with a local-scale study in Shanghai that showed the ECRL could substantially increase the areal extent of PA coverage (Bai et al., 2018).

Spatial analysis and planning exercises using prioritization approaches similar to the ECRL have been conducted in other countries, but few have integrated such a large area of land into a national-level policy framework for environmental protection as comprehensively as China has done (Schmidt-Traub et al., 2021). This integration is crucial because support from the state council facilitates unification of different environmental agencies in China, leading to more efficient coordination and implementation (Bai et al., 2016). The ECRL is similar to the “Planetary boundary framework” that advocates the importance of regulating processes that affect ecosystem services to maintain a safe operating space for humanity (Steffen et al., 2015), and ECRL has set an example of how that could be implemented.

Like the traditional PA system, there are some important legal, economic, social, technical, and administrative issues that the ECRL needs to resolve to achieve effective management. These include, but are not limited to, the large investment needed to ensure that adequate and capable personnel and financial resources (e.g., ecological compensation for acquiring land from local authorities) are available to implement the ECRL nationally; the formation



FIGURE 2 Location of 172 important coastal waterbird sites in coastal mainland China. Unprotected sites are shown in white, sites protected as a national nature reserve in blue, and sites protected only under Ecological Conservation Redline policy in orange. Important waterbird sites are considered to be protected if they are located in or within 4 km of an NNR/ECRL boundary. Base image compiled in Esri using data or basemap layers from HERE, Garmin, Esri, and OpenStreetMap

of related rules and laws to facilitate the effective implementation and enforcement of the ECRL; and the clarification of ECRL boundaries through negotiation and discussion with stakeholders to ensure its compatibility and alignment with other spatial planning frameworks such as the Arable Land Redline (Bai et al., 2016; Schmidt-Traub et al., 2021). Thorough assessment is also needed to evaluate ECRL's biodiversity values and the range of ecosystems covered. It has been estimated that 10–15 years are needed

before the ECRL can run smoothly and fulfill its goals (Bai et al., 2016).

4 | FROM ECRL TO AICHI TARGETS

Based on the latest official data, mainland China has partially met Aichi Target 11 with 18% of terrestrial and inland water ecosystems, and 5.5% of coastal waters and ocean

TABLE 1 The number of important coastal waterbird sites and their protection status under National Nature Reserve (NNR) or Ecological Conservation Redline (ECRL) boundaries along the coastal provinces and municipal cities in mainland China

Province or municipal city	NNR boundary			Grand total	NNR or ECRL boundary		
	Inside	Within 4 km	Outside		Inside	Within 4 km	Outside
Liaoning	4	1	17 (77.3)	22	5	1	16 (72.7)
Hebei	1	1	12 (85.7)	14	3	6	5 (35.7)
Tianjin	0	1	6 (85.7)	7	1	3	3 (42.9)
Shandong	3	1	12 (75)	16	10	5	1 (6.3)
Jiangsu	3	0	15 (83.3)	18	6	4	8 (44.4)
Shanghai	2	1	3 (50)	6	3	3	0 (0)
Zhejiang	2	0	17 (89.5)	19	7	7	5 (26.3)
Fujian	2	5	25 (78.1)	32	9	18	5 (15.6)
Guangdong	2	5	12 (63.2)	19	10	6	3 (15.8)
Guangxi	2	2	6 (60)	10	5	5	0 (0)
Hainan	0	4	5 (55.6)	9	6	3	0 (0)
Total	21 (12.2)	21 (12.2)	130 (75.6)	172	65 (37.8)	61 (35.5)	46 (26.7)

Note: Number within bracket denotes percentage of total.

area protected (Li & Pimm, 2020; UNEP-WCMC et al., 2020). The inclusion of more coastal waters and ocean area with high biodiversity value, together with effective management, is critical to meet those more ambitious post-2020 targets. The actual figure considered to be protected would have been higher if those PAs without boundary data from listed PAs were rectified in the World Database of Protected Areas (Bingham et al., 2019), and if areas protected through OECMs (rather than formal PAs) were included. As demonstrated above, China's ECRL is a form of OECM and delivers biodiversity conservation outcomes. These newly conserved areas will provide a substantial boost in the percentage of area protected through the inclusion of OECM area, once being managed smoothly.

China's ECRL could deliver significant biodiversity conservation outcomes without further changes to legislation by expanding the areal coverage of PAs and conserving biodiversity outside existing PAs (UNEP-WCMC et al., 2020). In addition to the management challenges listed above, care must be taken to avoid any tendency to inflate conserved areas by including OECM areas that cannot be demonstrated to be achieving positive and sustained biodiversity conservation outcomes (Jonas et al., 2018). To this end, careful assessment is needed to evaluate the actual biodiversity conservation benefits that the ECRL provides. Designating protected and conserved areas is a critical step toward biodiversity conservation, yet a large proportion of PAs, both nationally in China (15%) and globally (33%), also experiences degazettement or extensive human activities that can undermine PAs' role in conserving biodiversity (Jones et al., 2018; Ma et al., 2019). It is therefore paramount to effectively quantify wildlife populations and ecosys-

tem health over time to assess whether the conservation-related objectives of OECM are being met (Visconti et al., 2019). There are many components to doing so, for example, tracking the areal extent of a particular ecosystem (e.g., tidal flats, as done by Murray et al., 2019) and supporting ongoing abundance monitoring of particular threatened biodiversity or groups of threatened species (e.g., waterbirds, as done by the China Coastal Waterbird Census, Choi et al., 2020). Ultimately, establishing a national-level monitoring framework, such as the Biodiversity Assessment Framework established by New Zealand that is based on the concept of ecological integrity (McGlone et al., 2020), is needed to assess the efficacy of the biodiversity protection in China at a national scale. Nonetheless, the substantial increase in the spatial coverage of habitats that have some protection in China through the establishment of the ECRL is an encouraging first step.

Finally, it is also important to note that the objective of the ECRL is not only to safeguard biodiversity, but also ecosystem services. This policy therefore holds significant potential to contribute to the achievement of other Aichi targets about maintaining key ecosystem services (Targets 14–16) and reducing pressures on biodiversity (Targets 6 and 7). With wide enough adoption, national-level frameworks analogous to the ECRL could hold the key to achieving long-term sustainable development goals in China and globally.

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AUTHOR CONTRIBUTIONS

C.-Y.C., X.S., and X.G. conceptualized the paper. X.S., C.W., J.Z., and M.V.J. compiled the data. C.-Y.C. analyzed the data and led the writing of the manuscript with contributions from all other authors.

DATA AVAILABILITY STATEMENT

All data were compiled from published articles and reports, whereas some geospatial data require written application to owners for usage. Full details are available in Table S1 and references listed therein and below.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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