China's marine and coastline conservation efforts have not reversed the decline of seagrass meadows.

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*Edited by* **Jennifer Sills**

# Protect seagrass meadows in China's waters

Seagrass meadows are crucial habitats that contribute to biodiversity, food security, and climate mitigation (*1*). China harbors 22 seagrass species, accounting for about 30% of global seagrass plant diversity (*2*). Seagrasses were once common across China's coastlines, but since the 1970s, six seagrass species and more than 80% of the seagrass meadows in China's coastal waters have disappeared (*2*, *3*), compared with a global decline of 29% of known seagrass meadows since 1879 (*4*). The remaining seagrass meadows suffer from sparse coverage and habitat fragmentation (*5*), with negative cascading effects on the species that rely on them. In August 2022, the seagrass mega-herbivore *Dugong dugon* became functionally extinct in Chinese marine waters (*6*), highlighting the urgency of seagrass conservation.

China has taken steps to protect and restore marine and coastal ecosystems, including seagrasses. A seagrass survey from 2015 to 2020 identified about 26,000 ha of remaining seagrasses in China (*3*, *7*). Three protected areas (about 40,953 ha in total) that include seagrasses have been established (*8*), and some seagrasses have been protected through China's recent ecological redline policy (*9*). Seagrass meadows were also listed in the National Plan for Major Conservation and Restoration Projects of Important Ecosystems (2021–2035) (*10*), and some restoration projects of seagrass meadows have been implemented. However, these efforts have not yet been able to effectively reverse the degradation of China's seagrass meadows.

Urgent action is needed to maintain and protect the remaining seagrass meadows in China. Due to incomplete spatial and seasonal coverage of previous surveys, the exact spatial distribution of China's seagrass meadows is still unknown. Hence, long-term and large-scale monitoring of seagrass meadows should be conducted to discover unknown seagrass habitats; otherwise, they could disappear before they have been discovered. In addition, China must improve seagrass protection. The existing protected areas for seagrasses are all located in southern China, and there are no seagrass reserves at all in the temperate waters of northern China (*8*). Finally, human activities such as land reclamation, harbor construction, eutrophication, aquaculture, and overfishing, which pose substantial threats to seagrass meadows in China, should be regulated (*2*, *8*).

The Wuhan Declaration of the Convention on Wetlands, adopted in November 2022, calls for priority conservation and management of vulnerable ecosystems, including seagrass meadows (*11*). The UN Decade on Ecosystem Restoration also encourages the active restoration of billions of hectares of ecosystems worldwide, including seagrasses (*12*). China should respond to these calls by establishing a seagrass conservation and restoration plan with goals and actions at both national and local scales.

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**REFERENCES AND NOTES**

1. R. Unsworth *et al.*, *Science* **377**, 609 (2022).
2. F. Y. Zheng *et al.*, *Biodivers. Sci.* **21**, 517 (2013) [in Chinese].
3. Y. Zhou, "The 'Lung of the Sea' in China must be taken care of," *China Science Daily* (2022); https://news.sciencenet.cn/sbhtmlnews/2022/9/371226.shtm [in Chinese].
4. M. Waycott *et al.*, *Proc. Natl. Acad. U.S.A.* **106**, 12377 (2009).
5. Z. J. Wu *et al.*, *Mar. Environ. Sci.* **40**, 542 (2021) [in Chinese].
6. M. L. Lin *et al.*, *R. Soc. Open. Sci.* **9**, 211994 (2022).
7. S. Yu *et al.*, *Atlas of Seagrass in China* (China Ocean Press, Beijing, 2022) [in Chinese].
8. W. J. Hu *et al.*, *Ecol. Indic.* **129**, 107960 (2021).
9. Y. Bai *et al.*, *Nat. Commun.* **9**, 1 (2018).
10. National Development and Reform Commission and Ministry of Natural Resources, "National Plan for Major Conservation and Restoration Projects of Important Ecosystems (2021-2035)" (2020); https://www.ndrc.gov.cn/xxgk/zcfb/tz/202006/P020200611354032680531.pdf [in Chinese].
11. Ramsar, "Wuhan Declaration" (2022); https://www.ramsar.org/document/wuhan-declaration.
12. UN Decade on Ecosystem Restoration, "Oceans and Coasts" (2021); https://www.decadeonrestoration.org/types-ecosystem-restoration/oceans-and-coasts.

10.1126/science.adg2926

# Risks of China's increased forest area

Between 2010 and 2020, China increased its forest area by 193,680 km$^2$ (*1*). The country plans to plant 70 billion more trees before 2030 (*2*). Although the UN's Global Forest Goals regard the increase of forest cover as a primary goal (*3*), the types of trees and locations selected for planting can determine whether increased cover constitutes a conservation success or an environmental threat.

Based on the UN's definition of "forest" (*1*), all types of tree plantations can be classified as forest. Thus, gains in forest cover will not necessarily offset losses of ecosystem services—such as

carbon storage, biodiversity, and water resources—that resulted from native forest loss (*4*). In China, the increase in forest cover primarily took place in the sensitive dryland areas in the north and west (*5*). Future efforts are planned in regions even farther north (*6*), where tree planting can exacerbate water shortages and destroy locally adapted shrubs and grasses (*7*). These harms are not balanced out by benefits; forestation has limited climate change mitigation potential in dryland regions given their reduced ability to reflect sunlight (known as the albedo effect) (*8*).

The absolute power of China's central government makes implementing "land greening" programs at the national scale easier but allows local governments little flexibility, regardless of the suitability of their region. The central government's focus on forest cover (*9*) overlooks key issues such as tree species, forest diversity, bioclimatic location, and planting density. Widespread mortality has been reported in the monocultural forests of world's largest afforestation project, the "Green Great Wall" in northern China (*10*), which is not surprising given that artificial monocultural forests with fast-growing trees and even-aged stands are highly vulnerable to drought, pest, fire, and emerging disturbance interactions. Before proceeding with China's tree planting goals, carbon fixation efficiency, which varies among tree species, needs to be further evaluated in combination with water cycling and tree longevity (*11*).

Relying on forest cover as an evaluation measure may backfire on China's forest biodiversity conservation and natural resource protection. Intact primary forests in the south have been deforested and replaced with plantations that produce rubber, timber, fruits, and other non-wood forest products (*12*). Plantations boost forest cover, but the loss of intact forests, their ecosystem function, and the services they provide cannot be compensated with reforestation activities alone (*4*).

Halting the destruction of native vegetation is far more critical than increasing forest cover. By adhering to a national tree-planting plan without taking proper precautions for the protection of biodiversity, China is increasing ecological and social risks. Policymakers should give more consideration to site-specific, natural reforestation with appropriate tree species. Focusing on reducing industrial emissions will meet environmental goals more effectively than simplistically increasing forest cover.

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#### REFERENCES AND NOTES

1. Food and Agriculture Organization of the United Nations, "Global forest resources assessment 2020: Main report" (2020).
2. The World Economic Forum, "China will aim to plant and conserve 70 billion trees by 2030 as part of the global tree movement" (2022).
3. United Nations, "Global forest goals and targets of the UN strategic plan for forests 2030" (2019).
4. P. Curtis, *et al.*, *Science* **361**, 1108 (2018).
5. C. Gerlein-Safdi *et al.*, *One Earth* **2**, 98 (2020).
6. National Forestry and Grassland Administration, "Timely start to the sixth phase of the 'Great Green Wall'" (2022); www.forestry.gov.cn/sbj/5342/20220801/101831516654000.html [in Chinese].
7. S. Cao, L. Chen, X. Yu, *J. Appl. Ecol.* **46**, 3 (2009).
8. S. Rohatyn *et al.*, *Science* **377**, 1436 (2022).
9. National Forestry and Grassland Administration, "'Forest Chief System Supervision and Assessment Measures' was released" (2022); www.forestry.gov.cn/main/58/20220309/095312966770391.html [in Chinese].
10. Y. Ji *et al.*, *J. Arid Environ.* **174**, 104076 (2020).
11. C. Körner, *Science* **355**, 130 (2017).
12. N. Hoang, K. Kanemoto, *Nat. Ecol. Evol.* **5**, 845 (2021).

10.1126/science.adg0210

# Invest in early-career researchers in Brazil

Luiz Inácio Lula da Silva started his third term as president of Brazil in January. In his November 2022 speech at the United Nations Climate Change Conference (COP27), Lula committed to halt deforestation, stop illegal mining and other environmentally damaging activities, and make the country a global leader in addressing climate change (*1*). He has also declared that Brazil's path to becoming a developed and self-sufficient country depends on science, technology, and innovation (*1*, *2*). His position on these matters has already unlocked international investments for the country, which will likely increase (*3*). To make good on his promises, Lula should invest in Brazil's early-career scientists.

In the past two decades, the number of students graduating with PhDs in Brazil more than doubled, and Brazil's scientific output grew substantially (*4*–*6*). Between 1991 and 1995, Brazil's scientists published 24,039 papers, earning Brazil a world ranking of 23rd based on numbers of papers published; between 2007 and 2011, Brazil's scientists published 147,503 papers, increasing its global ranking to 13th (*5*). In 2011, during Lula's second term, Brazil continued its trend of investing in science by starting the Science without Borders government postgraduate scholarship program, which supported study abroad for science, technology, engineering, and mathematics students (*7*).

Since 2015, however, repeated budget cuts have damaged the country's educational and academic systems (*8*, *9*). As a result, many of Brazil's 100,000 highly trained early-career scientists, including graduates of the Science without Borders program, are currently unemployed or working in jobs outside of science (*7*, *10*). In 2019, they faced unemployment rates 12 times higher than the global average (*6*).

Investing in the expertise of young scientists will help Brazil pursue the environmental goals set by the Paris Accord and the Kunmin-Montreal Global Biodiversity Framework (both ratified by Brazil) (*11*). Early-career scientists can devote their skills to helping Brazil accomplish the 2030 Agenda for Sustainable Development, adopted by the UN General Assembly in 2015 (*12*), and they can contribute to building a green economy based on human capital, technology, and innovations rather than natural resources exploitation. We urge the new government to develop programs to attract and retain researchers who earned their qualifications over the past decade and can now focus on Brazil's development and economic growth.

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#### REFERENCES AND NOTES

1. J. Spring, W. James, "COP 27: Greeted like a rock star Brazil's Lula promise to protect Amazon," *Reuters* (2022).
2. H. B. Nader, *Science* **378**, 931 (2022).
3. M. Murray, R. More, "Germany willing in principle to revive Amazon Fund—development ministry," *Reuters* (2022).
4. C. A. Nobre, *Nature* **574**, 455 (2019).
5. J. Leta, B. Thijs, W. Glänzel, *Encontros Bibli Rev. Eletrôn. Bibliotec. Ciênc. Inform.* **18**, 51 (2013).
6. B. Roscoe, I. Soares, "Desemprego entre mestres e doutores no Brasil chega a 25%," *Correio Braziliense* (2019) [in Portuguese].
7. F. Marques, *Pesquisa FAPESP* **256**, 27 (2017) [in Portuguese].
8. H. Escobar, "Orçamento 2021 condena ciência brasileira a 'estado vegetativo,'" *Jornal da USP* (2020) [in Portuguese].
9. R. O. Andrade, *Nature* **572**, 575 (2019).
10. C. H. L. Silva Júnior *et al.*, *Science* **374**, 948 (2021).
11. S. G. Latoya Abulu, "Nations adopt Kunming-Montreal Global Biodiversity Framework," *Mongabay* (2022).
12. United Nations, "Transforming our world: The 2030 Agenda for Sustainable Development" (2015).

10.1126/science.adg4131