

OPINION ARTICLE

# South–south cooperation for large-scale ecological restoration

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Natural capital degradation worldwide signals the growing need for larger investments in both nature conservation and ecosystem services provision and management. The role of large-scale ecological restoration is a vital part of the work that is needed. One important way to advance the science, practice, and policy on ecological restoration is to develop and promote bilateral and multilateral cooperation among and within countries. In this article, we explore prospects for south–south cooperation for large-scale ecological restoration. Emphasis is given to experience and expertise sharing, cofinancing, and codevelopment of new knowledge and know-how for more effective policy and practice worldwide, especially in developing and newly industrialized countries.

**Key words:** ecological restoration, ecosystem services, natural capital, nature conservation

## Implications for Practice

- To meet national goals and commitments, it is helpful to learn from existing large-scale restoration work in other countries.
- An exchange program is now underway between China and Brazil to increase the effectiveness of large-scale ecological restoration in those two countries and others that may wish to join in.
- South–south networks could allow participants to visit projects in other developing countries that might inspire them or that they might promote, adapt, and implement in their own countries.
- One or two thematic areas should be chosen, as well as the stakeholders that should ideally be involved in the exchange.

## Introduction

In September 2011, world leaders assembled in Bonn, Germany to launch the largest restoration initiative the world has ever seen. Designed as an implementation platform for several existing international commitments, the Bonn Challenge is a global aspiration to have 150 million hectares of degraded and deforested lands under restoration by 2020. The following year, two additional milestones were reached: (1) 168 nations ratified the UN's Convention on Biological Diversity (CBD) Aichi Targets, including Target 15 to restore—or in other words to make significant strides towards restoring—15% of all degraded ecosystems by 2020 (CBD 2012); and (2) the UNCCD (United Nations Convention to Combat Desertification) adopted a new policy to combat land degradation in a much more holistic fashion, including large-scale ecological restoration (UNFCCC 2012).

Then in 2014, the New York Declaration on Forests called for cutting natural forest loss in half by 2020 and striving to end it by 2030 (UN Climate Summit 2014) and added another 200 million hectares to the Bonn Challenge target.

To come close to meeting the above-cited goals, it is crucial to learn from existing and past large-scale restoration experiences and to find new modes for designing, planning, and implementing restoration at the landscape level. Poor lesson learning often leads to similar mistakes being repeated in restoration practice. One way to learn from, replicate, and scale-up existing experiences is through learning exchange visits and formalized collaboration. In this broad context, we argue that south–south cooperation deserves much more attention than it has received to date, especially when the traditional south–north cooperation

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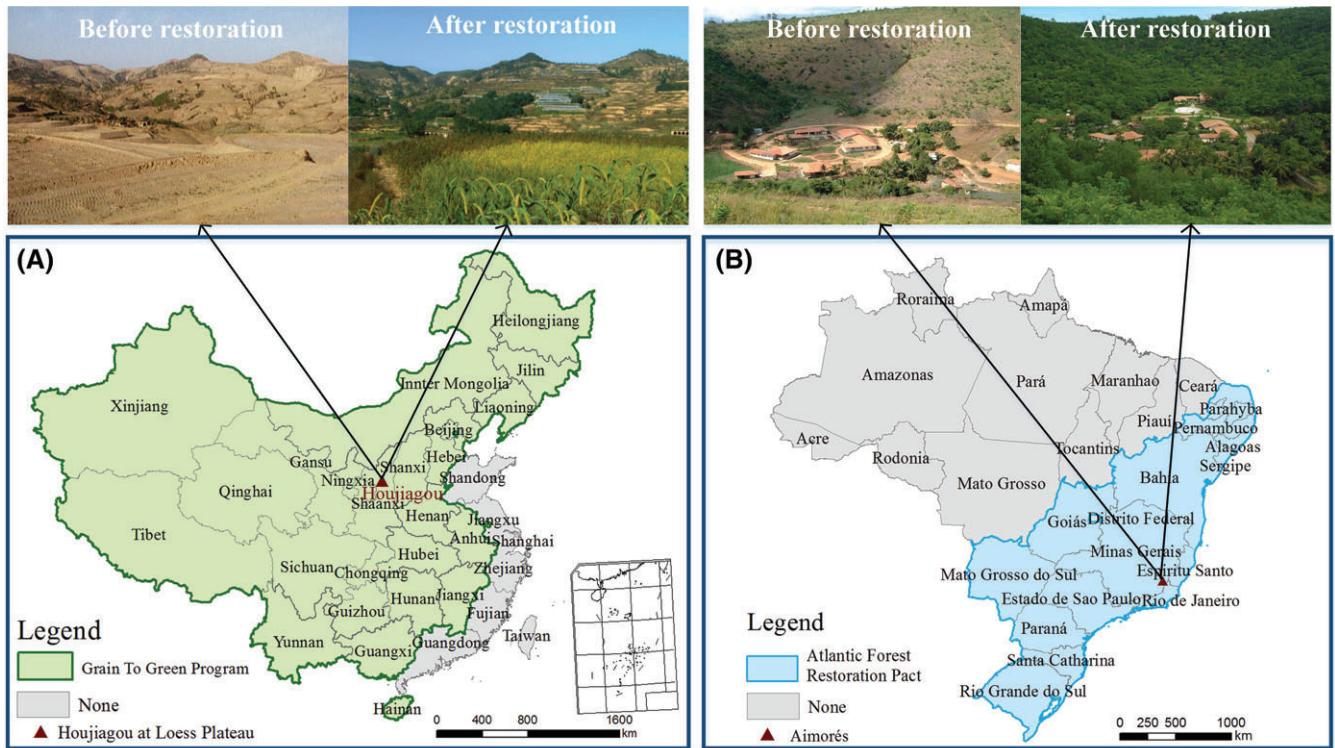


Figure 1. Current distribution and dramatic early results of two major restoration projects underway in China (A) and Brazil (B). In the maps are shown the names of provinces (autonomous regions and municipalities included) and states. The photos above each map illustrate changes in landscapes before and after the initiation of restoration efforts. Photos for the GTGP ©: Kosima Weber Liu (Environmental Education Media Project [EEMP]) and photos for the AFRP ©: Instituto Terra. See text for more information.

and various sources of governmental aid for development have declined dramatically since the 2008 global financial crisis.

Here we report on a cooperation and exchange program that is being implemented with the participation of China and Brazil (Appendix S1, Supporting Information) to increase the effectiveness of large-scale ecological restoration in those two countries and others that may wish to join in. These two countries were chosen to exemplify resource sharing opportunities as well as learning potential in systems not only politically and economically contrasted but also widely separated geographically and culturally. As such, the authors argue that knowledge exchanges as presented in this article offer a solid basis for exploration of efficient institutional reform. Results achieved to date in this program demonstrate that successful south–south cooperation in ecological restoration practice, science, and technology are possible, even at very large spatial scales. However, further exchanges will be necessary to provide opportunities to identify key aspects and barriers for knowledge transfer.

### Large-Scale Restoration in Brazil and China

Both China and Brazil have achieved substantial success in large-scale restoration and conservation programs in recent decades (Appendix S2), but in very different ways. Both are seeking to achieve greater effectiveness and also to meet their commitments to the above-mentioned international treaties.

Both countries are also working to improve laws and policies regarding restoration, biodiversity conservation, and land tenure and stewardship. The Grain to Green Program (GTGP, also known as the Sloping Land Conversion Program or the Farm to Forest Program) was initiated in 1999 in China in order to convert cropland on steep slopes to forest and grassland by providing farmers with grain and cash subsidies (Liu et al. 2008). The bottom-up initiative known as Atlantic Forest Restoration Pact (AFRP) was officially launched in 2009 in Brazil to restore 15 million hectares of the Brazilian Atlantic Forest by 2050 through promoting biodiversity conservation, fostering job creation, and maintaining ecosystem services. In Figure 1, we highlight one restoration project from each of these ambitious programs.

The question that confronts China and Brazil, as well as all other nations, is how to balance economic, social, and ecological interests in a manner that protects natural capital for future generations and improves and creates new job and livelihood opportunities. In order to fulfill the ecological, socioeconomic, and cultural values of natural capital, a much more sophisticated approach than providing limited ecosystem services is required. The two complementary and holistic landscape-scale approaches, namely restoring natural capital (RNC) and forest landscape restoration (FLR), are both becoming more recognized and applied (Clewel & Aronson 2013). These are viable approaches that are comprehensive and nuanced and do not merely seeking to enhance ecosystem service delivery on an

ad hoc basis (Blignaut et al. 2014). The implementation of RNC and FLR requires close collaboration among all stakeholders including governments, scientists, practitioners, and the public. Stakeholders should be fully engaged, informed, and encouraged from the beginning of the process to contribute to the planning and take “ownership” and stewardship of the process. Local stakeholders need to be aware of how they would benefit and depend on natural capital, including the natural, cultural, and more intensive production ecosystems. So far, no nation has a perfect mode to implement RNC and FLR, and bilateral cooperation between countries can help each to learn from the other’s experiences, and to work together to develop effective top-down and bottom-up RNC and FLR models.

Furthermore, the China–Brazil bilateral cooperation could lead to improvements in innovations in science, technology, practice and policy, and shared protocols for monitoring large-scale programs. This in turn could lead to evidence-based recommendations for decision-makers and program managers, and stimulate and inspire other south–south collaborations.

#### **Approaches to Strengthen Bilateral Cooperation for Large-Scale Restoration**

China and Brazil can learn and benefit from each other about where, how, when, why, and with whom to conduct large-scale ecological restoration. Additionally, the principles, structure, and basic content of a holistic evaluation and monitoring program could be jointly developed for large-scale programs. The platforms or axes of such work would include not only flora and fauna but also soils, hydrology, and socioeconomic benefits, possibly to be considered in terms of ecosystem services of various kinds. Below we highlight several approaches to sustain and expand cooperation.

#### **Regular Exchange Visits and Dialogues**

Regular exchange visits and dialogues among relevant partners can promote knowledge and experiences exchanges and, hopefully, improvement in restoration policy and practice on both sides. In early 2014, representatives from the International Union for Conservation of Nature (IUCN), the World Resource Institute (WRI), and the Society for Ecological Restoration (SER) worked together to develop a concept note for the “Brazil–China Forest and Landscape Restoration Learning Exchange Program,” which included the main objectives and areas for learning exchange and collaboration. As a result of this process, a steering committee was established with the representatives of the three organizations and countries to select a steering group of Chinese and Brazilian scientists, practitioners, nongovernment organizations, private companies, and policy-makers. Those representatives have agreed to undertake regular exchanges and visits and, insofar as possible, to work together to address common large-scale restoration challenges.

The group’s first learning exchange meeting was held in 2014 in China, allowed 15 Brazilian experts and representatives from government, NGOs, research institutions, and the private sector to visit three restoration sites in China, including the Loess

Plateau. The Brazilian visitors were impressed by the restoration efforts underway in the region, especially in terms of spatial scale, amount of government funding, and willingness of local government agencies to engage in the implementation of a specified restoration target defined by the central government or larger international consortium. It was very clear to the Brazilians that the leadership from the central government in China, together with well-defined, long-term restoration and reforestation programs, is needed to scale-up to the vast scale of intervention needed in the Loess Plateau. However, there were several questions and concerns raised by the experts from Brazil in connection with low productivity in the areas being reforested, and how to measure the success of restoration (Appendix S3).

One of the challenges during the exchange was the language. Because English was the common language of exchange, participants of both sides were not native speakers and therefore there were some misunderstandings and lack of understanding during some of the discussion. This could easily sow misconceptions, especially after participants went back to their own countries and sought to share their experiences with colleagues. While cost may be a constraint to this type of efforts, increasing the number of staff for translation—either bilingual technical experts or interpreters—would at the end improve the communication and exchange.

The learning exchange held in Brazil in September 2015 focused on aspect of biodiversity richness, economic benefits, and cobenefits from forest restoration. This included a new partner (Imazon) and brought together participants from Brazil, China, Guatemala, and Indonesia. Even though the inclusion of participants from two new countries had the potential to add more complexity to the planning and execution of the learning exchange, the great interest of those countries to learn about the experiences of forest restoration in Brazil led the partner-organizations to increase the scope of the exchange. The learning exchange allowed participants to exchange knowledge and experiences about (1) links between restoration and food security; (2) the role of payment for ecosystem services (PES) in cofinancing and engaging landowners on forest restoration; (3) the economic viability of reforestation with native species projects; (4) the role of soil microorganisms in improving the quality and effectiveness of forest restoration; and (5) the influence of gender equality on the success of forest restoration. The participants from China were very surprised and interested in the approach used in Brazil to use economically useful native species as part of the strategy to achieve large-scale restoration and reforestation. Another area that captured the interest of the visitors from China and whetted their appetite to continue the exchange was that of the technology used to reduce the costs and increase the efficiency of forest restoration.

Another focal point of interest from all the participants from various countries was on the use of PES to cofinance forest restoration and conservation in Brazil. They had the opportunity to visit a 10-year old PES project undertaken at the municipality level and were impressed by the institutional and financial arrangements to mobilize funding and engage farmers in efforts to restore degraded lands on their own properties and also to contribute to the production of clean water for the city of São

Paulo, the largest city in Brazil. From discussions during the site visits, it also became clear that Brazil could learn from China and Indonesia regarding ways to address the role of soilborne microorganisms to improve the effectiveness and reduce the costs of forest ecological restoration. Last but not least, Indonesia can share experience and expertise on the use of agroforestry systems to provide social, economic, and environmental benefits to small landholders. For example, the International Center for Research in Agroforestry (ICRAF) has been working at the district level in Indonesia to integrate agroforestry systems into its midterm development plans (<http://blog.worldagroforestry.org/index.php/2016/05/14/another-local-government-decides-to-support-agroforestry/>; <http://blog.worldagroforestry.org/index.php/2016/06/02/kolaka-timur-district-moves-to-adopt-agroforestry/>).

Noting that the two learning exchanges promoted great value in terms of sharing knowledge among researchers and practitioners, there was keen interest from policymakers to establish a formal collaboration at the government level. For example, Brazil and China can benefit from each other on the development and implementation of government-led PES or ecological compensation programs to finance restoration in critical watersheds that supply water to major cities and millions of people. This can be accomplished by promoting specific learning exchanges between government agencies that are currently implementing these types of programs. Discussions are underway to identify those opportunities and determine how to support a more formal collaboration through a long-term exchange program.

Another important outcome that was not anticipated from the two learning exchanges, but has been a key to strengthen the restoration community in Brazil, was the stronger collaboration in Brazil among the participants from the different sectors (governments, private sector, NGOs, and academia) that participated in the international exchanges. In other words, the spirit of collaboration increased significantly as a result of these exchanges. It seems likely that this same level of collaboration will occur among the participants and sectors from different countries, but for this to happen it is important to have a continuous follow-up with all the participants.

After the two exchanges it became clear that, for this type of learning exchange to be successful, a longer-time (e.g. 5 years) vision and commitment are needed to implement a series of exchanges and follow-up on the results until some formal collaboration is established among the different sectors (Appendix S4).

The next learning exchange is planned for 2017, in Indonesia. In addition to the enlargement of the group to include new countries and participants, the results obtained thus far are sufficiently encouraging to establish a learning exchange platform to serve as a model for other south–south bilateral or multilateral cooperation programs dealing with specific issues or broad topics related to restoration and environmental management. Moreover, the sharing of publications, reports, and Internet-based postings, observations, and ideas emerging from such exchanges through such a platform will contribute to improving restoration policy and practice worldwide. The two exchanges also showed

that having exchanges with a broad set of objectives and range of sectors/stakeholders was key to identify which thematic areas go deeper in the following exchanges; but that a way to generate concrete outcomes would be to subsequently focus on a few thematic areas engagement of a less diverse group of stakeholders. This more focused exchange would not only lead to more concrete results but also require less funding and human resources.

### Links to Education and Training

Training and nurturing a young generation of scholars and practitioners will further strengthen south–south cooperation. Brazil and China have already sent a large number of visiting scholars and students abroad through the China Scholarship Council and through Brazil's Science Without Borders Program, and other funding sources. However, most of those students and visiting scholars have gone to the United States and Western Europe. For example, the China Scholarship Council (<http://www.csc.edu.cn/>) has supported more than 1.6 million visiting scholars and students since 1996, but none of these has gone to Brazil to study ecological restoration, despite the clear need for dialogue and mutual exchange. Among the 83,200 scholarships that the Science Without Borders Program granted since 2011 (ICEF Monitor 2014), not one student has gone to China to study ecological restoration. Many countries, including China and Brazil, should expand opportunities for undergraduate and graduate students and young professionals to study ecological restoration and to exchange knowledge and know-how based on their respective experiences. This would contribute to a much-needed shift in the world of academic exchanges from purely reputation-driven dynamics, to inclusion and setting-up of pragmatic issue- and problem solving-based exchanges in funding programs and curricula. Another initiative that could play an important role in capacity-building for young professionals in forest restoration is the international training program on FLR that was hosted by the U.S. Forest Service, International Union for Conservation of Nature, and WRI, in Oregon in 2015 and 2016 (<http://www.fs.fed.us/about-agency/international-programs/training-seminars#forest-landscape-restoration>). Such initiatives should be replicated among countries with similar biomes using directly applicable study cases. The UN Convention on Biological Diversity is also launching a series of regional workshops in the area of ecological restoration (L. Janashevski 2016, Secretariat of CBD, personal communication).

### Collaborative Research

Joint Brazil–China grants programs can help researchers from Brazil and China (and other countries) to conduct long-term collaborative research on ecological restoration (e.g. comparative analysis and synthesis the lessons and experiences in ecological restoration). These joint programs can build on some existing programs. For example, the U.S. National Science Foundation has established joint agreements with the National Natural Science Foundation of China and the State of São Paulo Research Foundation of Brazil. So far, they have funded

a number of U.S.-China Collaborative Projects and U.S.-São Paulo Collaborative Research Projects through the Dimensions of Biodiversity program, but no Brazilian researchers are in the U.S.-China projects and no Chinese researchers are in the U.S.-São Paulo projects as yet. Exclusive focus on bilateral cooperation programs leads to increased administrative and overhead costs while limiting knowledge circulation compared to multilateral platforms. It also hinders the capacity of countries with limited budgets to engage with a wide array of counterparts and maximize synergies.

### Roles of Internal Organizations

International organizations are good facilitators and platforms for Brazil and China (and other countries) to learn from and contribute to global restoration while enhancing restoration in both home countries. The International Union for Conservation of Nature, WRI, and SER jointly sponsored the first visit of the Brazilian participants to China mentioned above. Both Brazilian and Chinese participants also plan to be more actively engaged in global networks such as those of SER, the Ibero-American and Caribbean Society for Ecological Restoration (SIACRE), the Global Partnership of Forest Landscape Restoration (GPFLR), and the Ecological Restoration Alliance of Botanic Gardens, managed by Botanic Gardens Conservation International (BGCI). Sharing the lessons and experiences of FLR and ecological restoration in Brazil and China (e.g. through publications in international journals, presentations in international meetings, and so on) would be beneficial not only to these two countries but also the rest of the world. We argue that positive and optimal outcomes for such exchanges are highly dependent on not only common challenges but also a wider interest to collaborate than the core research participants. While researchers and practitioners can foster idea exchange and accelerate innovation across borders, civil society demands that there also be governmental support—which indeed is a key for success in implementation and long-term programs. The initiative described here, along with efforts for both its continuation and expansion to other countries, represents the first steps towards an integrated and effective collaborative south–south platform. Meanwhile, given that challenges occur both in biophysical characteristics of the various biomes and in available technology, institutional frameworks, and sources of financing, the authors consider independent bilateral exchanges between countries at similar stages of development as potentially high value investments leading to cooperation. A previous transboundary environmental partnership—one that started in 1968 in the Arctic under the International Union for Conservation of Nature initiative and later gave birth to the Arctic Council—set a precedent for an efficient exchange platform for wider international and diplomatic exchanges. We argue that by spurring similar exchanges of experience and knowledge on holistic landscape and river basin restoration efforts, not only can important benefits in cultural, scientific, and technological arenas can be obtained, but also tension between bordering states could be lowered. As

loss and degradation of renewable and cultivated natural capital is a worldwide phenomenon, our capacity to manage and restore it across borders should help reduce pressure on increasingly scarce resources and help foster awareness of the advantages of recognizing codependency between different actors and stakeholders at landscape, national, regional, and international scales.

### Concluding Comments

In comparison with the traditional supportive programs managed by international agencies working with developed countries, a less formal cooperation model that allows developing countries to define specific objectives and outcomes among themselves, and to select the key stakeholders and sectors they prefer to achieve the identified goals seems more flexible and cost-effective. Because large-scale restoration projects depend on the participation and engagement of multiple stakeholders, and given that ecological restoration has now been recognized as a key strategy to address global challenges such as climate change mitigation and adaptation, water security, poverty alleviation, and food security, this type of learning exchange, which allows countries to learn about successful experiences elsewhere, should be promoted, adapted, and implemented in other countries.

The new awareness of Chinese practitioners as to the benefits of stakeholder's engagement should improve the sustainability of the local projects, thereby contributing to the resilience and effectiveness of ongoing and new projects. Conversely, renewed exchanges on successes and obstacles should provide participants with the knowledge and insight required to gradually phase out suboptimal monitoring schemes and management actions and to accelerate their (mainstream) replacement with more current best practices already demonstrated to be effective in partner countries.

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### Supporting Information

The following information may be found in the online version of this article:

**Appendix S1.** A tale of two telecoupled emerging countries.

**Appendix S2.** Large-scale restoration in Brazil and China.

**Appendix S3.** Questions raised by experts from Brazil in their visit in China.

**Appendix S4.** Lessons learned to design and implement south–south exchanges.

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