


Dams, Chinese investments, and EIAs: A race to the bottom in South America?

Andrea K. Gerlak , Marcelo Saguier, Megan Mills-Novoa, Philip M. Fearnside, Tamee R. Albrecht

Received: 14 September 2018 / Revised: 18 December 2018 / Accepted: 29 December 2018

Abstract The political economy of dam development in South America is changing as a result of a resurgence in water infrastructure investments. The arrival of Chinese-funded projects in the region has altered a context traditionally dominated by multilateral development banks. Tensions are escalating around new dam projects and the environmental impact assessment process is increasingly the site of politicization around water in the region. In this perspective, we examine the most recent surge in dam development in South America, the resulting environmental and social impacts, and the mobilization of civil society and environmental groups that have developed in response to these projects. In the absence of regionally shared standards for environmental assessment and regional mechanisms to mitigate the emerging conflicts—primarily occurring between companies, states, and civil society—we argue there is a risk of a race to the bottom to finance infrastructure projects with laxer environmental and social standards.

Keywords China · Conflict · Dams · EIAs · Hydropower · Regionalism

INTRODUCTION

An unprecedented boom in the construction of hydropower dams is underway in many parts of South America. Across Peru, Ecuador, Brazil, Argentina, and Uruguay, governments facilitate dam development as part of their enduring “hydraulic mission” or the state-building ideology of constructing dams and canals to prevent water from being “wasted” by flowing to the ocean (Molle et al. 2009). National governments remain key, alongside the private sector, in propelling dam projects forward despite

environmental, social, and financial challenges (Mills-Novoa and Hermoza 2017; Warner et al. 2017). Many of these projects, including some 300 + dams proposed in the Amazon basin, are highly controversial (da Silva Soita and Freitas 2011; Fearnside 2015a, 2016a; Latrubesse et al. 2017). Many other dams—more than 300—are also being proposed or being constructed in transboundary river basins, or rivers that extend cross national borders, in South America (De Stefano et al. 2017). While the hydraulic mission has been a motivating force across the continent, many South American nations now justify hydropower development as both an alternative to fossil fuel-based energy production and as a mechanism for buffering climate change exacerbated flooding and drought (Crow-Miller et al. 2017; Warner et al. 2017).

Dam development has often been viewed through the lens of national hydropolitics, but increasing regionalism through electrical connections has reshaped the nature of energy production and dam development (Saguier 2018). Bilateral hydropower interconnections within South America are increasingly common as the region moves towards enhanced electrical integration. In 2009, the government of Peru signed a contract with Brazil to construct six new dams in order to export electricity with financing from the Brazilian Economic and Social Development Bank (Gobierno de la República del Perú and Gobierno de la República Federativa do Brasil 2009). Brazil has already connected its grid to Paraguay, Argentina, Uruguay, and Venezuela, and plans to connect to Guyana. This highlights how hydroelectricity production in the region is increasingly integrated with opportunities for nations to export and import energy (da Silva Soita and Freitas 2011). These binational hydroelectric connections can also be leveraged to increase the connectivity of trade routes between countries. For example, construction of the Salto Grande

hydroelectric project on the border of Uruguay and Argentina back in the 1970s has spurred the dredging and expansion of the Uruguay River to enhance navigability and enable connections between the countries of the La Plata River basin (Custudio 2017).

Yet, this patchwork of hydroelectrical and infrastructural connections has not been accompanied by integrated regional policy frameworks and international cooperation that might ensure that common socio-environmental considerations are taken-into-account (Saguier 2018). Environmental impact assessments (EIAs) are emerging as a pivotal arena of political contestation and demands for democratic legitimization. These assessments, which have become widely recognized as important decision-making tools for identifying and evaluating potential environmental impacts of proposed development projects, are increasingly under threat, as economic stimulus initiatives that favor dam development have gained traction within national debates (Zomer 2009).

In this perspective, we examine how the political economy of dam development in South America is changing as a result of a resurgence in investments, fueled increasingly by private investment and bilateral financing from China and Brazilian Development Banks (McDonald et al. 2009; Muggah and Abdenur 2017; Mora 2018). The subsequent controversy generated by the socio-environmental impacts of dam infrastructure is a source of both intense debate and social advocacy around issues of sustainable development, energy production, and socio-ecological sustainability. We trace the changing landscape of infrastructure financing and the construction of dams and EIA process based on the best available scholarship and media reporting, along with insights based on our collective experiences and observations studying the economics, politics, and policies associated with water governance in the region (Figs. 1, 2 and Table 1).

We argue that the changes in the international political economy of infrastructure financing in the region, coupled with an absence of effective regionally shared standards for environmental assessment and regional mechanisms to mitigate the emerging conflicts between actors, is resulting in a race to the bottom to finance infrastructure projects with laxer environmental and social standards. Existing regional organizations like Southern Common Market (MERCOSUR) and Union of South American Nations (UNASUR) do not provide the necessary normative and policy cooperation frameworks to offset the risks of a race to the bottom with respect the environmental assessment practices and governance. This situation could exacerbate existing governance gaps for environmental safeguards (Saguier 2018).

THE CHANGING LANDSCAPE OF INFRASTRUCTURE FINANCING IN SOUTH AMERICA

Due to the myriad controversies surrounding hydropower development, there has been a significant shift in the role of the private sector, international financing organizations, and states in financing hydropower. Multilateral funders, such as the Inter-American Development Bank, World Bank, and Development Bank of Latin America, have become increasingly reluctant to finance large infrastructure projects over the past decades (Silber-Coats 2017). Instead, central governments in South America are investing their own funds as well as turning to the private sector and the development banks of emerging economies, notably Brazil and China to support new dams (McDonald et al. 2009; Muggah and Abdenur 2017; Mora 2018).

The changing landscape of hydropower financing in the region reflects the broader development models of both the countries receiving the financing as well as the national development banks providing that funding (Reuters 2017). The direct financing of dams via the development banks of both Brazil and China highlights the globalization occurring across the region and the demand of these emerging economies for raw materials (Nathanson 2017; McDonald et al. 2009). The environmental and social policies of Brazil's National Bank of Economic and Social Development (BNDES) and the China Export-Import Bank (China Eximbank), as important financiers of infrastructure, energy, and mining projects in Latin America, are far laxer than those of multilateral development banks (McDonald et al. 2009; Warner et al. 2017). Additionally, hydropower engineering and construction firms such as the private Brazilian conglomerate Odebrecht (which is mired in corruption scandals across South America) and the Chinese state-owned business SinoHydro have been central in undertaking large-scale hydropower businesses across the region.

South America is an area of increasing geopolitical importance for China due to its growing appetite for raw natural resources. Chinese development banks and state-owned enterprises are often financing projects in return for guarantees of state-owned fossil fuel resources or other important primary products (Gallagher and Porzecanski 2010; Warner et al. 2017). Relatedly, Brazil is also looking to neighboring countries to expand regional electricity generation via hydropower in order to fuel the expansion of the Brazilian mining and industrial sector.

Chinese companies including state corporations such as SinoHydro and banks such as the China Eximbank have funded 308 dams in 70 countries since 1999 (International Rivers 2012). China uses both loans and infrastructure investments as key instruments in a broader framework of

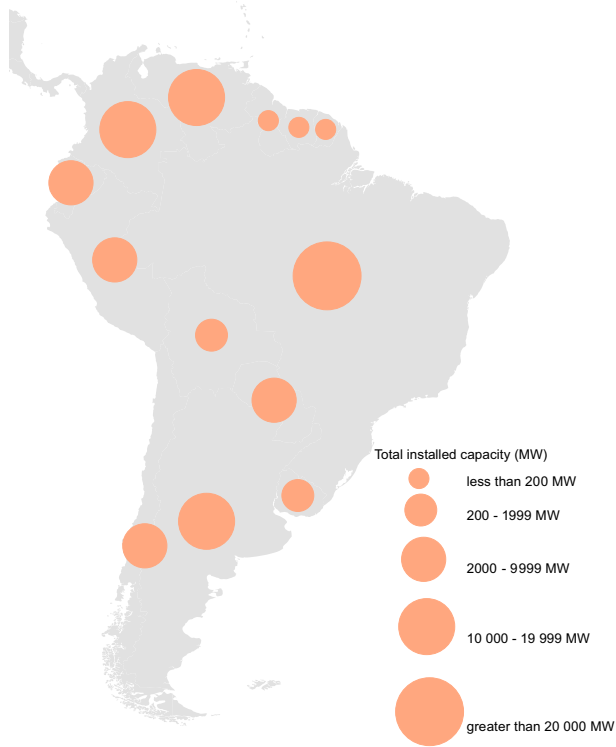


Fig. 1 Installed capacity in South America (including pumped storage). *Source of data* International Hydropower Association (2018)

international engagement through south–south cooperation mechanisms (Mora 2018). In China, public–private corporations blur the line between the private sector and state intervention. Therefore, this bilateral support for hydropower comes in the form of loans from national development banks such as China’s Eximbank and engineering/construction support from public to private corporations and private construction firms. In the case of Ecuador, the administration of Rafael Correa secured loans from the Chinese government to develop eight new dams,

Table 1 Hydropower capacity added by country. *Source* International Hydropower Association. Annual reports 2015–2018. Hydropower Status Report: *Hydropower Status Report: Sector Trends and Insights*. London: IHA

Country	Capacity added (including pumped storage) in MW			
	2017	2016	2015	2014
Brazil	3376	6365	2457	3312
Peru	200	1040	370	199
Chile	181	239	25	316
Bolivia	120	–	–	–
Columbia	119	106	599	875
Argentina	72	52	65	nd

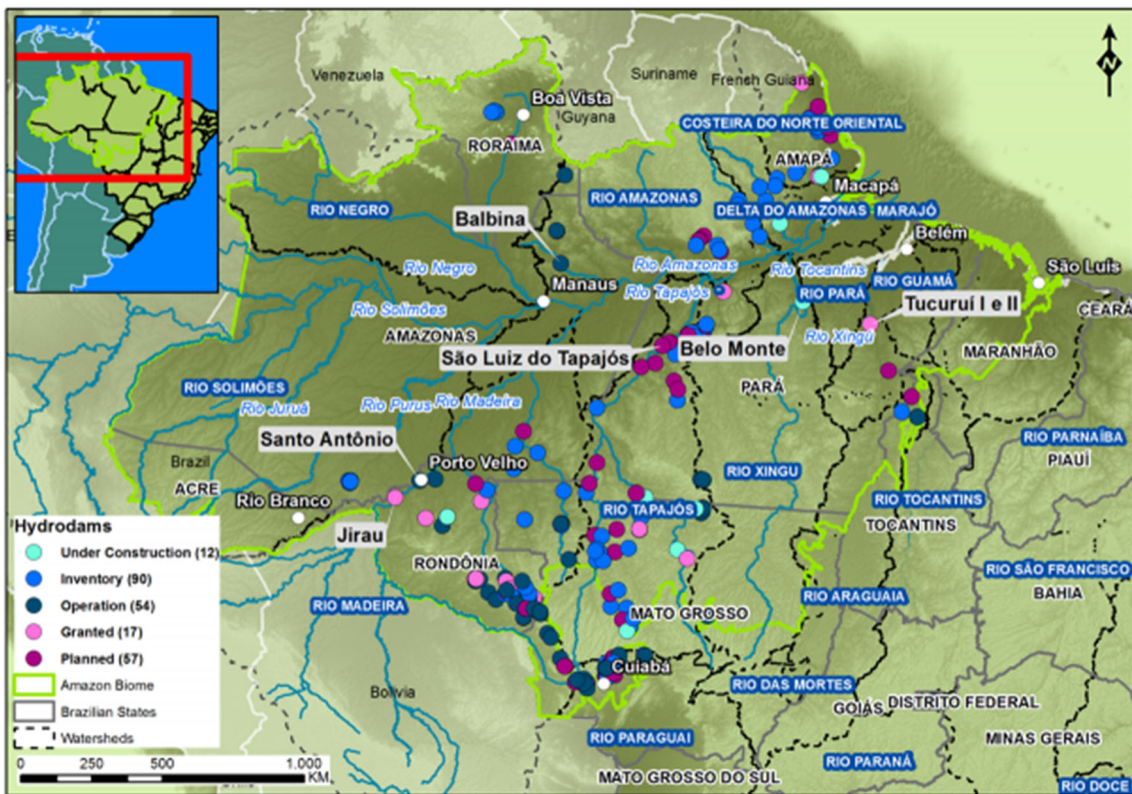


Fig. 2 Existing and planned dams in Amazon region. *Source* Greenpeace <https://infoamazonia.org/en/2016/04/bndes-a-bank-loans-billions-to-tame-south-americas-wild-watersers/>

in return promising that some construction contracts would be awarded to Chinese state firms and that a large proportion of the nation's oil sales would go to Petro China (Warner et al. 2017). The Lenin Moreno administration, which succeeded Correa in 2017, has not yet signaled if it will continue this relationship with China, but media reports indicate that the Moreno government is seeking ways to diversify away from Chinese investment (Nathanson 2017).

In the eastern Amazon Basin, Chinese investment has substantially influenced water infrastructure development in Brazil. However, it was not until Michel Temer's presidency in 2016, following the controversial impeachment of former president Dilma Rousseff, that Brazilian water infrastructure development became unprecedentedly reliant on Chinese investment. A 2017 \$20 billion investment matching agreement between China and Brazil opened the door for Chinese public companies—mainly State Grid and China Three Gorges—and private companies to increase their assets in Brazil and increase control in strategic sectors such as hydropower (EFE EPA 2017; Reuters 2017). A series of Chinese purchases of Brazilian dams includes not only recently built dams in Amazonia but also older dams in the rest of the country (Alvarenga 2017). Brazil utilized a dual strategy for promoting hydropower development internally and regionally, the BNDES funds hydropower in neighboring countries to increase regional generation capacity to support Brazilian economic development as well as welcoming Chinese investment in hydropower development.

These investments raise concerns about potential environmental impacts, questionable adherence to labor and human-rights standards, negative wage pressure in Brazil's manufacturing sector, and other considerations. China has yet to accept international standards for mitigating the social and environment impacts of large dam construction (McDonald et al. 2009). Therefore, compared to other western industrial powers or multilateral development banks, China and other emerging countries offer lower-cost investment options to developing countries with fewer social and environmental safeguards that are often seen by borrowers as time-consuming, expensive, and limiting what national governments perceive as their right to cause social and environmental impacts as they please. The lax environmental and social safeguards in Chinese-funded projects in Ecuador, Peru, and Chile have led to ecosystem damage, social tensions, and popular backlash (Muggah and Abdenur 2017).

Chinese investments in dam projects in Brazil are particularly illustrative. In Brazil, China has either invested or is negotiating to invest in dam projects that are among the most notorious in terms of their negative social and environmental impacts and licensing irregularities (Fearnside

2018a). In 2014, China Three Gorges bought a 33% interest in the São Manoel Dam, which is located only 700 meters from the Kayabí Indigenous Land. During the licensing process, indigenous residents were not consulted as required by Brazilian law (Decree 5051) and the International Labor Organization Convention 169 (Macauhub 2014). Technical staff of Brazil's environmental agency (IBAMA) sought to block the licensing of the São Manoel dam but were overruled (Fearnside 2017a, 2018b). Currently, China is in negotiations to purchase part of the Belo Monte Dam (*Correio Braziliense* 2017), which has a long record of human-rights violations, environmental impacts, and corruption (Fearnside 2017b).

The October 2018 election of Jair Bolsonaro, who will take office as Brazil's president on January 1, 2019, signals significant downgrading of protections both for the environment and for human rights (Fearnside 2018c). Mr. Bolsonaro's statement during the campaign that he would withdraw Brazil from the United Nations because "It is a gathering of communists, of people who have no commitment to South America" was later clarified as only referring to the UN Commission on Human Rights (*BBC-Brasil* 2018). His campaign attacks on environmental restrictions included frequent promises to strip the federal environmental agency of its licensing power and distribute this authority to the ministries in each subject area, such as the Ministry of Mines and Energy in the case of dams. Neutralizing environmental restrictions by putting a "fox in charge of the henhouse" has also begun by offering the post of environment minister to a "ruralist" aligned with agribusiness interests. Legislative proposals recently introduced by Bolsonaro supporters include making indigenous peoples "partners" in hydroelectric projects by offering tribal leaders royalties in exchange for supporting dams in their territories. All of these developments would speed the construction of Brazil's planned Amazonian dams.

ENVIRONMENTAL AND SOCIAL IMPACTS OF DAMS

Large dams have many recognized impacts on environmental systems. Some 47% of the 151 proposed dams in the Andean Amazon—primarily in mountainous areas of Peru and Ecuador that drain to the Amazon River—are expected to cause significant environmental impacts including degraded aquatic habitat, increased siltation in large shallow reservoirs, and fragmentation of the river system that connects the Andean headwaters to the lowland Amazon (Finer and Jenkins 2012). Even if only a fraction of the dams planned in the Amazon are ultimately built, scientists expect major hydro-physical and biotic

disturbances of the floodplain, estuary, and its marine sediment plume (Winemiller et al. 2016; Latrubesse et al. 2017, p. 363). Sediment retention by these dams is expected to impact fish populations over the full length of the Amazon River (Forsberg et al. 2017). Thus, Brazil's funding of dams in Peru and Bolivia is ironically poised to impact Brazil's own fisheries (Forsberg et al. 2017). There are also substantial risks associated with breakdown or failure of dam infrastructure, as exemplified by the devastating effects of the 2015 collapse of the Samarco mine-tailings retention dam in Mariana, Minas Gerais, one of Brazil's worst environmental disasters. This dam collapse resulted in 20 deaths and the persistent pollution of one of Brazil's major rivers and a 7000 km² area in the Atlantic Ocean (Garcia et al. 2017).

In addition to environmental impacts, large dams can have widespread and long-lasting impacts on social structures and community well-being. In South America, construction of mega dams like Venezuela's Guri Dam and the Brazilian–Paraguayan Itaipú Dam in the 1970s and 1980s permanently flooded large tracts of land and displaced thousands. But social impacts of dams often extend beyond displacement areas and the ensuing challenge of resettlement, prompting various secondary effects on livelihoods, economic structures and employment options, social and community cohesion, cultural heritage, health and well-being, indigenous rights and access to resources (e.g., Brown et al. 2009). Consider the planned Garabí–Panambí binational hydroelectrical project, a complex of two dams along the Uruguay River to be built on the border of Argentina and Brazil. This project is expected to inundate native forests, grasslands, and protected natural reserves, negatively affecting agricultural and forestry production, destroying archaeological sites, and displacing more than 10 000 urban and rural dwellers (Saguier 2018). Clearly some communities pay a high price while others benefit from hydropower development, and considering the political economy of water-energy futures in South America is needed to better understand the trade-offs and potential inequities (Gerlak and Saguier 2015).

GROWING SOCIAL RESISTANCE TO DAMS

The expansion of dams across South America, however, has not been met without resistance. This resistance has taken many forms from national social movements to more local forms of mobilization by affected communities. Chile's emblematic “Patagonia sin Represas” or “Patagonia without Dams” social movement escalated from local resistance to the HidroAysén dam project to the country's largest environmental social movement. This decade-long movement, which was ultimately successful in halting the

proposed dam and its 2000-km transmission line, shifted the narrative away from traditional environmental framings towards social justice and democracy in order to build key alliances and spark mass protests in 2011 (Borgias and Braun 2017).

In other places, such as the site of the El Quimbo dam in Colombia, locally affected communities have banded together as the “Association of Affected Peoples of Quimbo Hydroelectric Project.” Opposition to this dam, which displaced 450 families without consultation, has galvanized a larger national conversation about the social and environment impacts of other large hydroelectric projects such as the proposed dam on Colombia's iconic Magdalena River (International Rivers 2015).

These forms of resistance are present and growing across the continent. Presently, communities in both Argentina and Brazil oppose the planned Garabí–Panambí binational hydroelectrical project because of the unequal distribution of benefits and burdensome environmental and socio-economic costs of proposed dams. Opponents also challenge the predominant view of rivers as opportunities for energy maximization, which abstracts rivers from the ecological and socio-productive systems in which they are embedded (Saguier 2018).

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTS

Environmental impact assessments (EIAs) are the main tool for mitigating potential negative impacts of dams and are required by governments for large development projects in both industrialized and developing countries. In most (but not all) of South America, EIAs became mandatory in the 1990s. How they are conducted, however, varies significantly by country and by what agency initiates or manages the EIA. Since their institution, EIAs have become increasingly under threat in many countries as economic stimulus initiatives in favor of dam development have gained increased traction within national debates (Zomer 2009).

Despite many years of worldwide use, the EIA process continues to have widely variable influence. Institutional capacity to implement or enforce assessments is often low, technical guidelines limited, stakeholder participation inadequate, and social impacts ignored (Bragagnolo et al. 2017, p. 87). In Chile, EIAs have been difficult to integrate with other environmental and sectoral policies and transparency regarding their execution is limited (Agostini et al. 2017). Similarly, in Columbia, EIAs have little influence on dam licensing decisions due to insufficient legal and administrative mechanisms, inadequate public participation, and limited guidelines and monitoring for how EIAs

are conducted and implemented (Toro and Requena 2010). EIAs conducted in Brazil can lack adequate technical information (Ritter et al. 2017) and are often conducted in a way that favors streamlining the project over careful consideration of potential impacts. EIAs in Brazil are typically completed *after* the decision to undertake a development project has been made, are conducted by consultants hired by developers, and frequently vetted by politicians before reports are finalized (Fearnside 2015b). The risks of flawed impact assessment studies are evident, as exemplified in the case of the 2014 flooding of the Madeira River in Bolivia immediately upstream of Brazil's Jirau reservoir (Fearnside 2014a). The risk of Bolivian territory was known before the recording breaking 2014 Madeira River flood but this potential impact was omitted from the Brazilian environmental impact study of the Jirau dam, revealing irregularities in the licensing of Brazil's Madeira River dams (Fearnside 2014b).

Inconsistencies in EIA implementation will likely persist, or worsen, given recent reforms in global EIA guidance. While the World Bank's 2016 revised Environmental and Social Framework (ESF) creates shared standards for countries receiving loans or direct investment from the World Bank, it also increases reliance on national regulatory frameworks to enforce these standards. Unfortunately, national frameworks often do not have the capacity for effective and consistent implementation and enforcement. Because of this, the ESF has been met with controversy. While the World Bank (2016) claims that the reforms will improve development outcomes and increase ownership of borrowers, civil society organizations counter that the reforms will weaken environmental protection (Chavkin 2016) and fail to address the needs of indigenous peoples and overall human rights (Human Rights Watch 2017).

In Brazil, the recent economic and political crisis has catalyzed a legislative effort backed by the powerful agribusiness lobby to dismantle the current licensing process in favor of a streamlined and less rigorous project review process. A proposed constitutional amendment would grant automatic authorization to any submitted environmental impact study, while two proposed laws would reduce the approval process from three steps to only one and set a timeline for government review that is one-seventh the normal approval time (Fearnside 2016b). These changes, if approved, will signify an acceleration in hydropower infrastructure in the Amazon basin and across Brazil with major implications for indigenous groups and ecosystems (Finer and Jenkins 2012).

Advocates for these changes to the environmental licensing process argue that it will stimulate crucial

economic growth in rural areas, cut high levels of rural employment, and attract investment. However, such economic justifications for dam-building lose credibility due to rampant cost overruns and delays (Ansar et al. 2014) as well as unrealistic projections of electricity demand (Prado et al. 2016). Often in Brazil, electricity from dams is used by industries such as aluminum smelting while providing little local employment or other social benefits (Fearnside 2016a). Civil society organizations in the region call for better standards, more transparency, and heightened participation—aspects not adequately enforced by Brazil's National Bank of Economic and Social Development—afforded to indigenous populations.

Despite the challenges of EIAs, actors in South America continue to advocate for national legislation to support the EIA process, seeing it as a venue for dialog about trade-offs, the relative costs and benefits of dams, and the social and environmental implications of such projects. In Argentina, the Chinese-financed Kirchner-Cepernic dam complex has been a contentious project that underscores the politicization of the EIA process (Mora 2018). This \$4.6 billion project is sited on the Santa Cruz River, one of the last free-flowing rivers in Argentina, with its headwaters located in the UNESCO heritage site of Los Glaciares National Park (Koop 2017). In December of 2016, the Argentine Supreme Court suspended the construction of the project, citing the inadequacy of the EIA and the potential impact of the dam complex on Patagonian glaciers. Environmental groups lauded this decision, celebrating judicial support for a robust EIA process, while dam developers countered by highlighting the loss of 1500 jobs and the outstanding debt obligation to Chinese banks, which are funding 85% of the project and had already disbursed the first installment of funds (*Buenos Aires Herald* 2016).

Despite the early victories of environmentalists in fighting the Kirchner-Cepernic dams, the project is now set to reinstate since a new EIA and required public hearings have been completed. The hearing, however, was held at the last minute restricting its potential as a means for different stakeholders to voice their concerns (Mora 2018). While the new EIA has also been criticized because it does not consider the environmental impact of power lines, there is mounting pressure on the Argentinean government to move forward with the project (Koop 2017). The EIA process, which was viewed by the environmental coalition as a key mechanism for contesting this project, has become overshadowed by the government's concerns about securing a strategic alliance with China, the existing debt associated with the project, labor implications, and desire for a diversified energy matrix.

CONCLUSION

Environmental impact assessment processes in South America represent an emerging arena of political contestation and public demands for democratic legitimization. Following more global trends, there is increased interest in hydropower infrastructure investments from Chinese to private sector actors in South America. We have examined the rise of dam development, associated environmental and social impacts, the mobilization of civil society and environmental groups, and the role of the EIA process in addressing the effects of this boom.

There is a worrying gap between increased foreign direct investment in dam development and an absence of regionally shared standards for EIA processes which has led to a race to the bottom to finance dam projects with laxer environmental and social standards. There is a risk that the increased role of the private sector and emerging economies as bilateral funders of hydroelectric projects in South America can exacerbate the insufficiency of current institutional and normative frameworks to prevent, mitigate, and remedy detrimental consequences of dams on the environment and communities.

In March 2018, 24 Latin American and Caribbean countries adopted the first legally binding regional agreement to protect the rights of access to information, public participation, and justice in environmental matters (Principle 10 of the Rio Declaration). Though yet to be ratified, this agreement introduces elements of equal access and environmental sustainability of development projects that could be leveraged to create shared standards for EIA governance practices in national contexts through cooperative frameworks (see <https://www.unenvironment.org/news-and-stories/story/bid-strengthen-environmental-democracy-latin-america-and-caribbean>). This is especially relevant in the case of transboundary waters in South America. National and subnational levels of governance alone are insufficient to tackle the problems associated with infrastructure and water issues in transboundary basins.

Regional and basin-level governance are needed to ensure that large hydropower projects do not jeopardize socio-ecological sustainability. Historically frail governance of transboundary basins in South America is an impediment to the much-needed harmonization of standards and norms to deal with EIAs in international waters. Stronger regional governance mechanisms around transboundary waters are needed, especially at a time when a proliferation of public and private dam infrastructure financiers threatens to undermine national EIA processes and civil society efforts to address the negative social and environmental impacts of large dams. The time is ripe for a broad dialog on the role of hydropower in the national energy mix in South America.

REFERENCES

- Agostini, C.A., C. Silva, and S. Nasirov. 2017. Failure of energy mega-projects in Chile: A critical review from sustainability perspectives. *Sustainability* 9: 1073.
- Alvarenga, B. 2017. A energia da China. *Veja*, 27 December 2017, 85.
- Ansar, A., B. Flyvbjerg, A. Budzier, and D. Lunn. 2014. Should we build more large dams? The actual costs of hydropower megaproject development. *Energy Policy* 69: 43–56.
- BBC-Brasil. 2018. Bolsonaro presidente: As propostas com as quais Jair Bolsonaro se elegeu presidente do Brasil. *BBC-Brasil*, 28 October 2018. Retrieved November 23, 2018, from <https://www.bbc.com/portuguese/brasil-46012309>.
- Borgias, S.L., and Y.A. Braun. 2017. From dams to democracy: Framing processes and political opportunities in Chile's Patagonia Without Dams movement. *Interface: A Journal on Social Movements* 9: 300–328.
- Bragagnolo, C., C. Carvalho, R.J. Ladle, and A. Pellin. 2017. Streamlining or sidestepping? Political pressure to revise environmental licensing and EIA in Brazil. *Environmental Impact Assessment Review* 65: 86–90.
- Brown, P.H., D. Tullios, B. Tilt, D. Magee, and A.T. Wolf. 2009. Modeling the costs and benefits of dam construction from a multidisciplinary perspective. *Journal of Environmental Management* 90: S303–S311.
- Buenos Aires Herald. 2016. Companies defend Santa Cruz dams project. *Buenos Aires Herald*. 2 January 2016. Retrieved February 6, 2018, from <http://www.buenosairesherald.com/article/205937/companies-defend-santa-cruz-dams-project>.
- Chavkin, S. 2016. Debate surrounds World Bank's proposed new safeguards rules. *International Consortium of Investigative Journalists*. (2 August 2016). Retrieved January 28, 2018, from <https://www.icij.org/blog/2016/08/debate-surrounds-world-banks-proposed-new-safeguards-rules/>.
- Correio Braziliense. 2017. Chinese want to buy Belo Monte Power Plant in Pará. *Correio Braziliense*, 31 January 2017. Retrieved July 1, 2018, from http://www.correio braziliense.com.br/app/noticia/economia/2017/01/31/internas_economia,569460/chineses-querem-comprar-a-usina-eletrica-de-belo-monte-no-para.shtml.
- Crow-Miller, B., M. Webber, and F. Molle. 2017. The (Re)turn of infrastructure for water management? *Water Alternatives* 10: 195–207.
- Custodio, L. 2017. El dragado potenciará el sistema de puertos de la hidrovía del Río Uruguay. *Economía y Mercado*. 2017. Retrieved 1 July, 2017, <http://www.elpais.com.uy/economia-y-mercado/dragado-potenciara-sistema-puertos-hidrovia-rio-uruguay.html>.
- da Silva Soito, J.L., and M.A.V. Freitas. 2011. Amazon and the expansion of hydropower in Brazil: Vulnerability, impacts, and possibilities for adaptation to global climate change. *Renewable and Sustainable Energy Reviews* 15: 3165–3177.
- De Stefano, L., J.D. Petersen-Perlman, E.A. Sproles, J. Eynard, and A. Wolf. 2017. Assessment of transboundary river basins for potential hydro-political tensions. *Global Environmental Change* 45: 35–46.
- EFE EPA. 2017. Brazil attracts Chinese investment for big infrastructure projects. September 1st. Retrieved July 1, 2018, from <https://www.efe.com/efe/english/business/brazil-attracts-chinese-investment-for-big-infrastructure-projects/50000265-3367830>.
- Fearnside, P.M. 2014a. As barragens e as inundações no rio Madeira. *Ciência Hoje* 53: 56–57.
- Fearnside, P.M. 2014b. Impacts of Brazil's Madeira River dams: Unlearned lessons for hydroelectric development in Amazonia. *Environmental Science & Policy* 38: 164–172.

- Fearnside, P.M. 2015a. Amazon dams and waterways: Brazil's Tapajós Basin plans. *Ambio* 44: 426–439.
- Fearnside, P.M. 2015b. Brazil's São Luiz do Tapajós Dam: The art of cosmetic environmental impact assessments. *Water Alternatives* 8: 373–396.
- Fearnside, P.M. 2016a. Environmental and social impacts of hydroelectric dams in Brazilian Amazonia: Implications for the aluminum industry. *World Development* 77: 48–65.
- Fearnside, P.M. 2016b. Brazilian politics threaten environmental policies. *Science* 353: 746–748.
- Fearnside, P. M. 2017a. Amazon dam defeats Brazil's environment agency. *Mongabay*, 20 September 2017. Retrieved July 1, 2018, from <https://news.mongabay.com/2017/09/amazon-dam-defeats-Brazils-environment-agency-commentary/>.
- Fearnside, P.M. 2017b. Belo Monte: Actors and arguments in the struggle over Brazil's most controversial Amazonian dam. *Die Erde* 148: 14–26.
- Fearnside, P. M. 2018a. Environmental justice and Brazil's Amazonian dams. In *Landscapes of Inequity: The Quest for Environmental Justice in the Andes/Amazon Region*. eds. N. A. Robins and B. Fraser, Lincoln: University of Nebraska Press. (in press).
- Fearnside, P.M. 2018b. Challenges for sustainable development in Brazilian Amazonia. *Sustainable Development* 26: 141–149.
- Fearnside, P. M. 2018c. Why Brazil's new president poses an unprecedented threat to the Amazon. *Yale Environment* 360, 8 November 2018. Retrieved November 23, 2018, from <https://e360.yale.edu/features/why-brazils-new-president-poses-an-unprecedented-threat-to-the-amazon>.
- Finer, M., and C.N. Jenkins. 2012. Proliferation of hydroelectric dams in the Andean Amazon and implications for Andes-Amazon connectivity. *PLoS ONE* 7: e35126.
- Forsberg, B.R., J.M. Melack, T. Dunne, R.B. Barthem, M. Goulding, R.C.D. Paiva, M.V. Sorribas, and U.L. Silva Jr. 2017. The potential impact of new Andean dams on Amazon fluvial ecosystems. *PLoS ONE* 12: 0182254.
- Gallagher, K., and R. Porzecanski. 2010. *The dragon in the room: China and the future of Latin American Industrialization*. Stanford, CA: Stanford University Press.
- Garcia, L.C., D.B. Ribeiro, F.O. Roque, J.M.O. Quintero, and W.F. Laurance. 2017. Brazil's worst mining disaster: Corporations must be compelled to pay the actual environmental costs. *Ecological Applications* 27: 5–9. <https://doi.org/10.1002/eap.1461>.
- Gerlak, A.K., and M. Saguier. 2015. Interdisciplinary knowledge frameworks for transboundary river basins. *International Journal of Water Resources Development* 4: 790–794.
- Gobierno de la República del Perú and Gobierno de la República Federativa de Brasil. 2009. Acuerdo entre el gobierno de la República Federativa del Brasil y el gobierno de la República del Perú para el suministro de electricidad al Perú y exportación de excedentes al Brasil. https://www.internationalrivers.org/sites/default/files/attached-files/acuerdoenergetico_peru_brazil_0.pdf.
- Human Rights Watch. 2017. *Letter to the World Bank on the Environmental and Social Standards Guidance Notes*. 4 December 2017. Retrieved January 28, 2018, from <https://www.hrw.org/news/2017/12/04/letter-world-bank-environmental-and-social-standards-guidance-notes>.
- International Hydropower Association. 2018. *Hydropower Status Report: Sector Trends and Insights*. London: IHA.
- International Rivers. 2012. *The New Great Walls: A guide to China's overseas dam industry*. Berkeley Foundation: International Rivers, https://www.internationalrivers.org/sites/default/files/attached-files/intrivers_newgreatwalls_2012_2.pdf.
- International Rivers. 2015. *The many faults of El Quimbo Dam*. Berkeley Foundation: International Rivers. Retrieved January 29, 2018, from <https://www.internationalrivers.org/blogs/436/the-many-faults-of-el-quimbo-dam>.
- Koop, F. 2017. Argentina under pressure to revive dams in Patagonia. *Diálogo Chino*. 31 July 2017. Retrieved February 6, 2018, from <http://dialogochino.net/argentina-under-pressure-to-revive-dams-in-patagonia/>.
- Latrubesse, E.M., E.Y. Arima, T. Dunne, E. Park, V.R. Baker, F.M. d'Horta, C. Wight, F. Wittmann, et al. 2017. Damming the rivers of the Amazon basin. *Nature* 546: 363–369.
- Macauhub. 2014. Energias de Portugal vende activos no Brasil à China Three Gorges. <https://macauhub.com.mo/pt/2014/11/12/energias-de-portugal-sells-assets-in-brazil-to-china-three-gorges/>.
- McDonald, K., P. Bosshard, and N. Brewer. 2009. Exporting dams: China's hydropower industry goes global. *Journal of Environmental Management* 90: S294–S302.
- Mills-Novoa, M., and R.T. Hermoza. 2017. Coexistence and conflict: IWRM and large-scale water infrastructure development in Piura, Peru. *Water Alternatives* 10: 370–394.
- Molle, F., P.P. Mollinga, and P. Wester. 2009. Hydraulic bureaucracies and the hydraulic mission: Flows of water, flows of power. *Water Alternatives* 2: 328–349.
- Mora, S. 2018. Resistencias sociales a la cooperación de China en infraestructura: Las represas Kirchner-Cepernic en Argentina. *Colombia Internacional* 94: 53–81. <https://doi.org/10.7440/colombiaint94.2018.03>.
- Muggah, R., and A. Abdenur. 2017. China's strategic play in Brazil. *America's Quarterly*, 27 September 2017. <http://www.americasquarterly.org/content/chinas-strategic-play-brazil>.
- Nathanson, M. 2017. Damming or damning the Amazon: Assessing Ecuador/China cooperation. *Mongabay*, 22 November 2017. <https://news.mongabay.com/2017/11/damming-or-damning-the-amazon-assessing-ecuador-china-cooperation/>.
- Prado, A.P., S. Athayde, J. Mossa, S. Bohlman, F. Leite, and A. Oliver-Smith. 2016. How much is enough? An integrated examination of energy security, economic growth and climate change related to hydropower expansion in Brazil. *Renewable and Sustainable Energy Reviews* 53: 1132–1136.
- Reuters. 2017. Brazil, China open \$20 billion fund for infrastructure, tech projects. Thompson Reuters. 26 June 2017. Retrieved April 5, 2018, from <https://www.reuters.com/article/us-brazil-china-infrastructure/brazil-china-open-20-billion-fund-for-infrastructure-tech-projects-idUSKBN19H2NP>.
- Ritter, C.D., G. McCrate, R.H. Nilsson, P.M. Fearnside, U. Palme, and A. Antonelli. 2017. Environmental impact assessment in Brazilian Amazonia: Challenges and prospects to assess biodiversity. *Biological Conservation* 206: 161–168.
- Saguier, M. 2018. Transboundary water governance in South America. In *Handbook of South American Governance*, ed. Pia Riggiozzi and Christopher Wylde, 373–384. London: Routledge.
- Silber-Coats, N. 2017. Clean energy and water conflicts: Contested narratives of small hydropower in Mexico's Sierra Madre Oriental. *Water Alternatives* 10: 578–601.
- Toro, J., and I. Requena. 2010. Environmental impact assessment in Colombia: Critical analysis and proposals for improvement. *Environmental Impact Assessment Review* 30: 247–261.
- Warner, J., J. Hoogesteger, and J.P. Hidalgo. 2017. Old wine in new bottles: The adaptive capacity of the hydraulic mission in Ecuador. *Water Alternatives* 10: 322–340.
- Winemiller, K.O., P.B. McIntyre, L. Castello, E. Fluet-Chouinard, T. Giarrizzo, S. Nam, I.G. Baird, W. Darwall, et al. 2016. Balancing hydropower and biodiversity in the Amazon, Congo, and Mekong: Basin-scale planning is needed to minimize impacts in mega-diverse rivers. *Science* 351: 128–129.
- World Bank. 2016. *World Bank Board Approves New Environmental and Social Framework*. The World Bank. 4 August 2016.

Retrieved January 28, 2018, from <http://www.worldbank.org/en/news/press-release/2016/08/04/world-bank-board-approves-new-environmental-and-social-framework>.

Zomer, A. 2009. *Tracking environmental impact assessment rollbacks*. World Resources Institute. Blog Post. Washington, DC. 4 June 2009. <http://www.wri.org/blog/2009/06/tracking-environmental-impact-assessment-rollbacks>.

AUTHOR BIOGRAPHIES

Andrea K. Gerlak (✉) is an Associate Professor in the School of Geography and Development and an Associate Research Professor with the Udall Center for the Studies of Public Policy at the University of Arizona in Tucson, Arizona, U.S. Her work examines the role of institutions in water governance and policy.

Address: School of Geography and Development, University of Arizona, 1064 E. Lowell Street, Tucson, AZ 85719, USA.
e-mail: agerlak@email.arizona.edu

Marcelo Saguier is a Research Fellow at the Argentine National Scientific and Technical Research Council (CONICET) and the Director of the International Relations Program at the School of Politics and Government, National University of San Martín (UNSAM). His research interests include international political ecology, environmental governance, socio-environmental conflicts, globalization as extractivism.

Address: School of Politics and Government, National University of San Martín (UNSAM), San Martín, Buenos Aires, Argentina.
e-mail: marsaguier@gmail.com; msaguier@unsam.edu.ar

Megan Mills-Novoa is a PhD Candidate in the School of Geography and Development at the University of Arizona in Tucson, Arizona, U.S. Her work examines the governance of climate change adaptation in the water sector across the Andes.

Address: School of Geography and Development, University of Arizona, 1064 E. Lowell Street, Tucson, AZ 85719, USA.
e-mail: mmillsnovoa@email.arizona.edu

Philip M. Fearnside is a Research Professor at the National Institute for Research in the Amazon (INPA) in Manaus, Amazonas, Brazil since 1978. His work has been organized around the objective of converting the environmental services of Amazonian forests into a basis for sustainable development for the rural population of the region, taking the place of the current pattern of forest destruction. He has studied the environmental impacts of more than ten hydroelectric dams, as well as the decision-making and licensing processes for these and other infrastructure projects in Amazonia (see <http://philip.inpa.gov.br>).

Address: Coordenação de Dinâmica Ambiental (CDAM), Instituto Nacional de Pesquisas da Amazônia, Av. André Araújo 2936, Manaus, AM 69067-375, Brazil.
e-mail: philip.fearnside@gmail.com

Tamee R. Albrecht is a PhD student in the School of Geography and Development and a Graduate Research Associate with the Udall Center for the Studies of Public Policy at the University of Arizona in Tucson, Arizona, U.S. Her work focuses on water governance and interactions among water, energy, and food resources.

Address: School of Geography and Development, University of Arizona, 1064 E. Lowell Street, Tucson, AZ 85719, USA.
e-mail: talbrecht@email.arizona.edu; tamee.albrecht@email.arizona.edu