

Dams, Poverty and Inequality

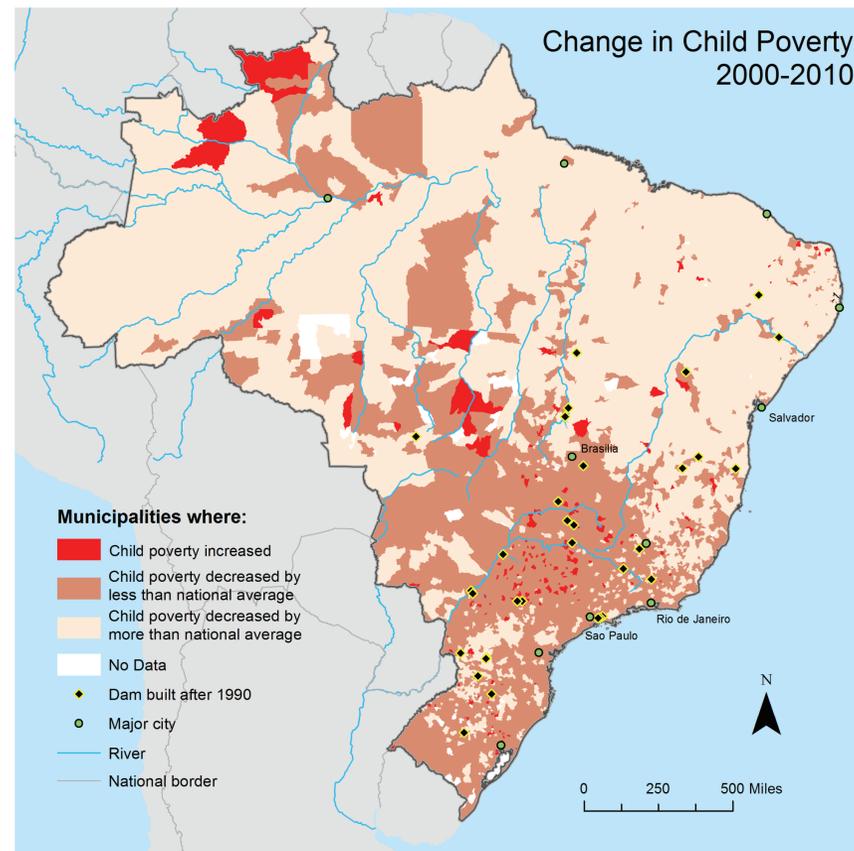
An Analysis of Social Indicators in Dam-Affected Municipalities of Brazil

Purpose

While critical to driving the country's macroeconomic development, Brazilian dams have serious adverse environmental and social consequences for the populations in their immediate vicinity. This project analyzes poverty and inequality indicators in dam-affected municipalities in Brazil, and compares them to regional and national indicators. It finds disparities that suggest a need for policy interventions to better allocate benefits and costs of dams between winners and losers.

Poverty

The poverty analysis focuses on child poverty, using quality of sanitation and parent illiteracy as indicators. The data employed are percentage of children in each municipality who live in households with substandard sanitation and an illiterate head of household. The *Change in Child Poverty* map explores the hypothesis that dam construction is associated with an increase in poverty over time in dam-affected areas. It reveals that large dams tend to be concentrated in areas where child poverty increased, or where it decreased but at a slower rate than the national average. The *Child Poverty* chart below shows that child poverty in dam-affected municipalities improved at about the same rate as in other municipalities in the region, but at a much slower rate than the national average. The *Income* chart indicates that dam-affected municipalities had higher percentages of low-income people than surrounding areas, but lower than Brazil as a whole.



This map displays large dams built since 1990 and changes in a child poverty indicator from 2000 to 2010. Municipalities near dams constructed in the past two decades have poor child poverty indicators compared with other parts of Brazil, supporting the hypothesis that large dams have adverse impacts on local communities over time. The indicator used is percentage of children living in households with inadequate sanitation and an illiterate head of household.

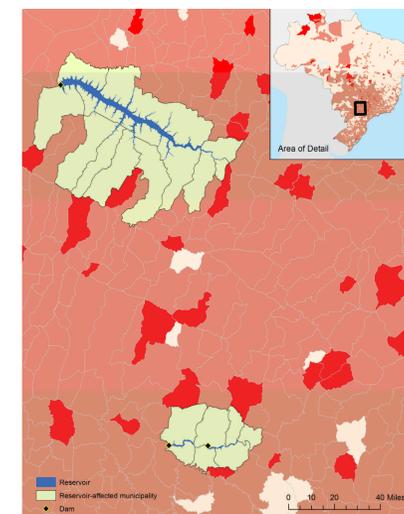
Limitations

- This project explores a temporal relationship between large dams and poverty in Brazil, as well as a contemporaneous relationship between dams and inequality. While yielding compelling evidence of relationships in both cases, these analyses at best demonstrate correlation, and do not show causality.
- The methodology used to identify "dam-affected municipalities" is limited in that it gives equal weight to any municipality intersected by reservoir. Far more detailed data would be required to disaggregate dam-affected municipalities. This method also excludes municipalities not intersected by reservoirs but that may nonetheless be affected the environmental disruptions they cause.
- The averages presented in the charts below are calculated as averages across municipalities, implicitly assigning equal weight to every municipality. A more informative method would assign weights to municipalities proportional to their population sizes.

Method

"Dam-affected municipalities" includes municipalities that contain any segment of a reservoir created by a large dam. (The International Commission on Large Dams defines "large dams" as over 15 meters in height. The average height of dams used in this analysis is 68 m.) Municipalities near reservoirs are affected because villages are destroyed by reservoirs, croplands are flooded or suffer from waterlogging and soil salinity, river flows critical to livelihoods are disrupted, and disease vectors are changed.

"Southern States" includes all municipalities in the states that make up most of Brazil's southern cone, where large dams are concentrated. Comparing dam-affected municipalities against southern states, rather than only comparing against national data, controls for some socio-economic factors that vary by region.



This map depicts selections of municipalities intersected by reservoirs, which are included in the "dam-affected municipalities" layer.

Social Inequality

These maps depict income inequality by municipality for ethnic groups that tend to be socially marginalized in Brazil. National census data is used to determine the difference between mean "white" incomes and mean "black", "brown" and "indigenous" incomes. (Ethnic categories are consistent with the census.)

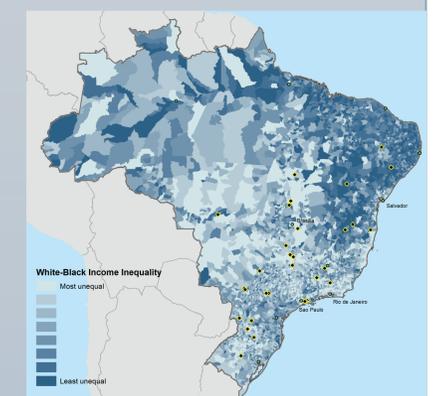
The maps offer a visualization of the relationship between inequality and large dams. The chart below shows that dam-affected municipalities are more unequal than other municipalities in the region and than Brazilian municipalities as a whole.

Implications

There are two probable explanations for these disparities, both of which demand policy interventions:

1. Large dams are constructed in such a way that marginalized groups bear most of the adverse effects.
2. After dams are constructed, marginalized groups receive inadequate compensation for their losses, compared with other ethnic groups.

Both of these explanations imply that socially marginalized groups disproportionately bear the environmental costs of dams because they are unable to influence dam-building policy. Lack of participation in the project-planning and bargaining processes leave them at greater risk than other groups. Policy interventions are needed to ensure that indigenous



and Afrodescendant communities are given a legitimate role in impact assessments and decision-making so that they can defend their interests and exercise control of their own development.

The numbers reported below are the differences in average Brazilian Real (BRL) earned per month between whites and each of three ethnic groups categorized by the Brazilian national census. Income inequality for each group is higher in dam-affected municipalities than for other municipalities in Brazil. 300 BRL = 155 USD.

Child Poverty	Dam-affected Municipalities	Southern States	Brazil
Average Change	+4.7%	+4.5%	+9.8%

Created by Noah Cohen-Cline, Fletcher School of Law and Diplomacy, May 8, 2012
GIS Data Sources: Brazilian Institute of Geography and Statistics (administrative and census data, 2010); Global Reservoir and Dam Database (dam and reservoir data, 2011)

Income	Dam-affected Municipalities	Southern States	Brazil
Less than R\$70/month = approx. USD \$36	5.3%	3.5%	10.9%
Less than R\$255/month = approx. USD 132 = half of minimum wage	37.4%	33.1%	48.1%

Income Inequality	Dam-affected Municipalities	Southern States	Brazil
White-Indigenous	327	277	208
White-Black	385	320	272
White-Brown	348	297	249