

Brazilian Community-Based Adaptation (CBA) strategies work to improve farmers' quality of life, earning power and overall resilience to adapt as conditions worsen due to climate change. Brazil's creative and successful approach benefits the 23 million people living in its semi-arid region.



IMPROVING SMALL FARMERS' ADAPTIVE CAPACITY IN SEMI-ARID REGIONS

SUMMARY

In Latin America, as in Africa and Asia, 15–25% of the population lives in semi-arid areas, mostly in small isolated rural communities that are often the most severely affected by, yet least equipped to cope with, the impacts of climate change. Strategies employed to build adaptive capacity in Brazil's semi-arid areas focused on improved water supply, management and use, while at the same time promoting access to technology and improved production techniques, all with a focus on knowledge sharing and multi-level collaboration. The lessons from Brazil's response will be useful for policymakers and community organisations in other semi-arid regions.

THE KEY PROBLEM: SOCIO-ECONOMIC HARDSHIP IN INCREASINGLY DRY AREAS

Drylands cover 41% of the planet's land surface, and are growing. They are home to over two billion people, including the world's most impoverished. About 25% of landmass in Latin America (LA) and Africa, and 38% in South Asia, is semi-arid. Water scarcity and the inability to put limited water to its most productive use are problems that will likely worsen. Food security in dry areas is crucial in the global fight against hunger, as 60% of the world's food insecure population lives in dry lands and over 80% of the rural population in these areas is dependent on crop agriculture and livestock for both food and income.

When temperatures increase and rainfall decreases as a result of climate change, farming on drylands will become increasingly arduous, with potentially disastrous impacts on farmer livelihoods and on food security in rural regions. Experts predict that climate change will affect 40 million poor livestock keepers in mixed systems of Latin America, 130 million in sub-Saharan Africa, and 100 million in Asia by 2055.

KEY LESSONS LEARNED

Brazil's successes were underpinned by integrating government policies and incentives, NGO projects and community participatory development (adaptation across scales).

Improving water access is insufficient without building capacity, introducing technology and providing technical assistance to enable communities to put water to its most productive use.

ADAPTATION ACROSS SCALES: ADAPTATION STRATEGIES THAT INCLUDE ALL SOCIAL LEVELS, FROM NATIONAL GOVERNMENTS TO LOCAL ORGANISATIONS, TAKING INTO ACCOUNT GROUP DYNAMICS DOWN TO INDIVIDUAL BEHAVIOUR CHANGE

The Brazilian semi-arid region (*Sertão*) is LA's most densely populated semi-arid area, with an area of approximately 900,000 km² and a population of 23 million people, 11 million of which are rural dwellers. Governments and civil society in Brazil have a wealth of experience in implementing strategies to improve adaptive capacity in the *Sertão* that may be tailored for use in similar regions in Sub-Saharan Africa and South Asia

COMPREHENSIVE STRATEGIES TO IMPROVE ADAPTIVE CAPACITY

The Brazilian response has been varied. Even if a major focus has been on water, other significant initiatives focused on disseminating technology, diversifying land use, improving productivity, and education and capacity building.

With each of these initiatives, the specific conditions of each locality need to be taken into account. Differences in many variables, such as rainfall patterns, soil composition, available crops for livestock fodder and local pests, have an impact on solutions to improve adaptive capacity. Tailor-made solutions are most likely to achieve maximum benefits.

Access to Water

To improve water access, it is tempting for governments to focus on large, top-down infrastructure projects because of their high visibility and lower cost per unit of water supplied. However, the Brazilian experience has shown that this does not offer the same reach or positive results as bottom-up, small-scale methods, such as providing local communities with earth dams or installing rainwater harvesting systems in households. These numerous small local initiatives have reached millions of people, while the multi-billion dollar project to divert the São Francisco River only reached tens of thousands, or 0.3% of the *Sertão*'s population.

Semi-arid regions may receive significant annual rainfall, but it falls in just a few days, and the majority of the volume leaves the area quickly via ephemeral streams; this means efforts to capture and store this water are key.

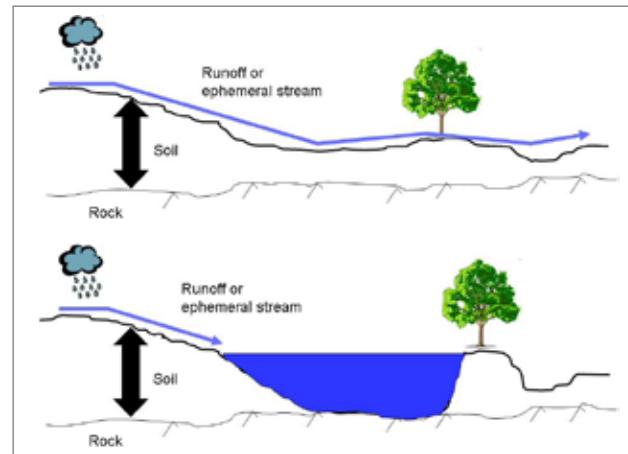


Figure 1: Diagram of an Earth Dam

Source: REDEH

The most all-encompassing programme for assuring access to water for domestic use is the Government's One Million Cisterns (*Um Milhão de Cisterna*) programme, that aims to provide every rural household in semi-arid Brazil with drinking water through a rainwater collection system and a 20m³ cistern. This programme is described in detail in the [ELLA Brief: Water and Climate Change: Improving Access and Management in Semi-Arid Brazil](#)

In terms of water for agriculture, one of the most successful interventions has been the construction of earth dams (*açudes*) (Figures 1 and 2). A thick layer of soil is removed from the ephemeral stream bed until the crystalline basement is reached. The displaced volume is then put perpendicular to the direction of flow to create a small dam, and the crystalline basement prevents water from soaking into the soil. Today,



Figure 2: Artificial Earth Dam (*açude*) in Semi-Arid Brazil

Source: REDEH



there are several thousand *açudes* in semi-arid Brazil.

Finally, alternative water storage practices, such as underground dams, have been put to use. These use runoff water from heavy rains or ephemeral streams to increase an area's water retention potential. A trench, typically 1-4 metres wide, 25-100 metres long, and 4-5 metres deep to reach the crystalline basement, is dug to cross-cut the stream. Then an impermeable layer, such as a thick plastic fabric, is placed inside the trench along its whole length until reaching the crystalline basement. This barrier manages to store enough

Social Cost of Inaction in the Semi-Arid Region

When a farming family migrates because, for example, heavy drought killed their livestock and crops, society has a cost to pay. The government will be responsible for feeding the whole family, creating additional cost for the tax payer. The cost is even greater when farming families move to urban slums due to the lack of sanitation causing diseases, and poor education generating unemployment, crime and pollution. These social costs should be factored into the cost-benefit analysis of large-scale versus small-scale water access projects.

moisture to create an underground water reservoir that can last for several months.

Looking Beyond Water Supply

What seems to set the Brazilian experience apart is its focus not only on increasing water supply, but also on improving water use, while at the same time making farming methods more productive and improving farmers' livelihoods and capacities.

Disseminating Technology

Technological innovations are key to helping farmers adapt to climate change impacts. In areas with limited water availability, access to adequate irrigation technology has been shown to increase crop yields by 70%.

- However, the low population density of Brazil's semi-arid region makes technology dissemination difficult as retailers are not attracted to such small sales volume. Even when retailers are present, they often sell outdated, low-quality and low-efficiency systems that have a large mark-up of 60% to 100% and lack after-sales care and maintenance. This made the market-based technology provision system economically unviable. Interventions have been designed to address this challenge, such as:

- [Adapta Sertão](#): A multi-stakeholder coalition that disseminated technology by setting up rural retail centres, combined with access to micro-finance and capacity building in technology use. This initiative is described further in the [ELLA Brief: An Integrated Approach to Improving Adaptive Capacity: The Adapta Sertão Experience](#).

- [Agencia Mandala](#): An agency that has implemented several rural capacity building projects based on low-cost irrigation technologies, addressing the concerns of people at the bottom of the pyramid. They enter communities, construct pilot projects, and organise one to two week training programmes.

- Integrated Sustainable Agro-ecological Production (*Produção Agroecológica Integrada Sustentável - PAIS*): Fully subsidised by the Bank of Brazil Foundation, this programme has disseminated 12,000 drip irrigation systems across the country, 30% of those in the semi-arid region. The foundation chooses communities to be beneficiaries, and 100% of the costs of technology, technicians and experts are borne by the Bank of Brazil, with R\$30 million (US\$19 million) invested thus far.

Improving Agricultural Productivity

As part of its efforts to improve farmers' adaptive capacity, Brazil has also focused on strengthening farmers' economic self-sufficiency, especially by improving their productivity. For example, initiatives have introduced multi-cropping, which enables farmers to significantly reduce their vulnerability by spreading the risk of crop failure. Other programmes focus on changing livestock practices, such as providing shade and more nutritious feed, to significantly increase output quality and quantity.

Another type of innovation introduced by [EMBRAPA](#), the Brazilian Agricultural Research Institution, is drought-resistant crop varieties of corn, beans and manioc that can

grow with short production cycles of between 90 and 120 days if seeded right at the beginning of the rainy season. In development since the early 1990s, today these seeds are used in various demonstration areas across the semi-arid region where farmers can compare their production with and without these seed varieties.

Knowledge Transfer

In Brazil, government-led capacity building programmes for farmers seem to have had limited results due to lack of continuity, limited funding and an insufficient number of technicians available compared to the number of farmers, in some cases just 1 technician per 200 to 300 farmers, depending on the region.

At a 1999 Brazilian conference on desertification, a group of civil society organisations came together to form Articulation in the Semi-Arid ([Articulação no Semi-Árido](#) - ASA). Now composed of more than 700 NGOs, ASA works to improve life for rural dwellers in semi-arid Brazil. These NGOs aim to fill the gap between merely providing technology, access to water and new farming techniques, and actually engaging people to put these to productive use. This has included educating people about water scarcity and crop failure rates, demonstrating how *açudes* and dams are used and how to install water harvesting and irrigation systems, and providing one-on-one on-site practical training for farmers. Due to low-levels of education and the time-intensity of farm work,

farmers cannot usually afford to leave their land and attend theoretical workshops. Practical lessons are better received, as tangible results help to eradicate doubts.

Integration of National and Local Government Policies

Another key characteristic of Brazil's CBA approach has been successfully integrating national policies into the local context (adaptation across scales). First, farmers need financing mechanisms to afford to purchase new technologies and productive methods, however, relying on subsidies and donations would cost too much for federal governments. As a response, Brazil successfully integrated CBA into its micro-credit programme, PRONAF, which today has about US\$6 billion per year available to finance small farmers' projects.

For more information, see the [ELLA Brief: Brazil's Public Policy Package for Successful Farmer Adaptation](#).

Second, one significant indicator of adaptive capacity is earning power, because in order to afford new technologies and employ the new techniques that improve productivity and reduce the chances of loss as a result of climatic changes, farmers need to make money. By providing farmers access to markets and setting equitable prices they have more impetus to increase production.

There are several other national-level Brazilian policies that encourage small-holder farmers to grow crops for sales, described in the [ELLA Brief: Brazil's Public Policy Package for Successful Farmer Adaptation](#).



Figure 3: Drip Irrigation Pipe
Source: REDEH

CONTEXTUAL FACTORS

ENABLING BRAZIL'S SUCCESSFUL CBA APPROACH



The success of Brazilian CBA is linked to design features of the approach, including a focus on incentives, access to technology, and integral interventions that move beyond just water access. At the same time, key contextual and enabling factors underpinned the choice of strategy and its success.

First, civil society had an important role to play. International NGOs were key in financing and coordinating projects and influencing local, regional and national strategies. They worked in cooperation with national NGOs and syndicates such as ASA, who helped spread CBA actions throughout small communities in the region.

This collaboration facilitated synergy between local knowledge and the specialised skills, techniques and technologies coming from abroad. French, German and Italian NGOs, for example, provided financial resources and sent specialised technicians to develop and implement technology-based projects. Local NGOs – whose own capacity was key – helped by ensuring that implementation methods took local terrain, education levels, and cultural norms into account.

Second, a strong focus on farmers' training and capacity building underpinned successful CBA experiences. The

Brazilian experience seems to show that theoretical training for farmers does not work. One-on-one technical training in the field has been a major factor behind the success of the various adaptation methods employed. The technicians had to have a strong presence and build up a relationship of trust with the farmers; providing tangible evidence that the new methods were improving yields was significant in convincing farmers of the benefits of investing in new technologies and scaling-up.

As a complement to transferring technical knowledge, NGOs throughout the *Sertão* educated people about climate change and how this weather variability is likely to worsen in time. The response to instruction on how and why to engage in adaptation practices in the *Sertão* has been very positive.

Finally, the successful linking of local-level initiatives with central policy approaches was facilitated by certain characteristics of the central government, like its strong capacity for policy design and implementation, and designation of sufficient budgets to fund initiatives. Political will was also crucial, with influential politicians lobbying for the 'cause' of the *Sertão*.

LESSONS LEARNED

- 1** Lack of access to water, technology and technical assistance all affect coping and adaptation capacity. Furthermore, public policies focused only on water supply are insufficient without adequate technology and capacity building to enable communities to put water to its most productive use. Community-level programmes allow small-scale technology improvement and knowledge transfer over large areas, with extensive reach.
and developed according to the suitability of crops or livestock, skills and local needs.
- 3** Incentives for efficient irrigation technology are essential, but it is also important to have micro-finance schemes that put farmers in a position to pay back loans, giving them a vested interest in implementing and maintaining new technologies.
seems to work best through a direct intervention of farmers' cooperatives instead of relying on government technical assistance programmes. Cooperatives often have a specific focus and a direct economic interest in helping farmers increase their yields and livelihood.
- 5** Integration of government strategies, NGO projects, and community participation give the highest chance of success. CBA efforts need to be integrated into larger policy strategies and contexts in order to gain large-scale impacts. Programmes to improve adaptive capacity should take advantage of existing government policies or incentives, such as in Brazil, with food supply programmes and weather-based insurance for smallholder farmers.
- 2** Overall, a focus on improving livelihoods as an adaptive strategy seems to be working. Access to the market is essential to promote local economies, and institutional markets are successful in this respect. Production systems must be adapted to the specific soil and weather conditions of each locality,
4 Local projects to improve adaptive capacity in semi-arid regions have shown to be successful, both because the government alone cannot do every thing, and because local organisations provide a unique, complementary perspective. In particular, building local technical capacity

CONCLUSION

The Brazilian experience shows that community actions to improve adaptive capacity in remote areas can significantly improve the well-being and resilience of small farmers. For far-reaching results, CBA seems best implemented by simultaneously linking together initiatives to promote farmers' access to water, technology, technical assistance, credit, and markets. Integrating national with local-level initiatives has been key, as has the role of civil society. Especially once taking the underlying contextual factors into account, the lessons learned from Brazil's experience should be useful in guiding CBA approaches in South Asia and Sub-Saharan Africa.

KNOWLEDGE PARTNERS

This is a sample of some of the key organisations involved in Latin America and Brazilian CBA. More detailed information on these and other organisations is contained in the [ELLA Spotlight on CBA Organisations](#).

[CARE International](#) is an international NGO with much experience in adaptation projects, especially those that involve gaining evidence from practical field experience to improve local practices and influence policy.

[Adapta Sertão](#) is an alliance of public, private and non-profit organisations that are working in semi-arid Brazil to improve farming techniques, water supply and use, and energy access.

[Agencia Mandala](#) is a network of organisations that use knowledge and low-cost technology to improve adaptive capacity in semi-arid Brazil (website in Portuguese).

Centre for Popular and Social Education ([Centro de Educação Popular e Formação Social](#)) is a non-profit organisation working in Northeast Brazil to improve sustainable development of rural communities.

[Associação Caatinga](#) is a non-governmental organisation that works to conserve the *Caatinga Biome* in Northeast Brazil, focusing on conservation and agro-forestry (website in Portuguese).

[Articulação no Semi-Árido Brasileiro](#) (Articulation in the Semi-Arid – ASA) is a group of more than 700 civil society organisations working to improve conditions in semi-arid Brazil (website in Portuguese).

Committee of Entities to Combat Hunger and Improve Life ([COEP - Comitê de Entidades no Combate à Fome e pela Vida](#)) is a network of organisations working with communities in

semi-arid Brazil to combat climate change, poverty, hunger and health problems by improving education, healthcare, environmental awareness and employment.

[Dew Point](#) is a knowledge platform of the UK's Department for International Development (DFID) that provides information on water, environment and climate change issues. Experiences from Latin America, Africa and Asia are incorporated to teach various lessons.

[EMBRAPA](#) is the Brazilian government agency for agricultural research, that includes strategies for the semi-arid region (website in Portuguese).

[International Climate Change Adaptation Initiative](#) of the Australian Government works with developing nations to encourage adaptation policies and implement programmes.

RECOMMENDED READING

This is a sample of some of the key publications related to Latin American and Brazilian CBA. More detailed information on these and other publications is contained in the [ELLA Spotlight on CBA Publications](#) and [ELLA Spotlight on CBA Arguments](#).

Adger, W., Arnell, N., Tomkins, E. 2005. [Successful Adaptation to Climate Change Across Scales](#). *Global Environmental Change* 15 77-86.

Agrawal, A., Perrin, N. 2008. [Climate Adaptation, Local Institutions, and Rural Livelihoods](#). IFPRI Working Paper #W08I-6. University of Michigan, Ann Arbor.

CARE. 2010. [Community-Based Adaptation Toolkit](#).

Eakin, H., Luers, A. 2006. [Assessing the Vulnerability of Social-Environmental Systems](#). Annual Review on Environmental Resources, University of Berkley, California.



Huq, S., Reid, H. 2007. [A Vital Approach to the Threat Climate Change Poses to the Poor](#). *Community Based Adaptation: An IIED Briefing*.

Pielke, R. et al. 2007. [Lifting the Taboo on Adaptation](#). *Nature* 445(8) 597-598.

Ribot, J., Magalhães, A., Panagides, S. (eds). [Climate Variability, Climate Change and Social Vulnerability in the Semi-arid Tropics](#). University Press, Cambridge.

Simões, A. et al. 2010. [Enhancing Adaptive Capacity to Climate Change: The Case of Small-holder Farmers in the Brazilian Semi-Arid Region](#). *Environmental Science Policy* (13) 801-808.

LEARN MORE FROM THE ELLA BRIEFS

More details on the strengths of the Brazilian experience are contained in these ELLA Briefs, focusing on the importance of multi-actor cooperation, water supply and use, the Brazilian policy package, and the specific impacts on a community of farmers.

[An Integrated Approach to Improving Adaptive Capacity: The Adapta Sertão Experience](#)

In Adapta Sertão, small farmers in one of Brazil's semi-arid regions were helped to increase their yields, find markets to sell their crops and access micro-credit to buy productive technology – making them more resilient in the face of a fast-changing climate.

[Water and Climate Change: Improving Access and Management in Semi-Arid Brazil](#)

Climate change is worsening the water scarcity already faced in dry areas. Through the combined action of civil society and the federal government, Brazil has managed to both improve water supply and help farmers put water to its most productive use.

[Brazil's Public Policy Package for Successful Farmer Adaptation](#)

Brazil's policy package for farmers in semi-arid regions demonstrates a successful approach to CBA: market-based strategies, focusing on combining and leverage multiple policies that target a variety of stakeholders, all with an eye to cost-efficiency.

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FIND OUT MORE FROM ELLA

To learn more about Brazilian CBA, read the [ELLA Guide](#), which has a full list of the ELLA knowledge materials on this theme. To learn more about other ELLA development issues, browse other [ELLA Themes](#).

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