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Evidence and lessons from Latin America

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

WATER AND CLIMATE CHANGE: IMPROVING ACCESS AND MANAGEMENT IN SEMI-ARID BRAZIL

SUMMARY

Water security is becoming increasingly problematic in semi-arid regions as a result of climate change. In response, Brazil's federal government implemented two large programmes to build water infrastructure and facilitate access. However, the initiatives had a limited focus on water management, a gap that was filled by civil society to help put water to its most productive use. This brief describes these complementary initiatives, focusing on offering useful lessons learned for readers in other regions.

WATER SCARCITY IS GETTING WORSE

Populations living in dry regions already face severe problems of water scarcity, but climate change scenarios show that rainfall will become even more sporadic, making the situation worse. Due to rain variability in semi-arid regions, on average the risk of losing a substantial portion of crops is higher than 70%. Water supply is not the only constraint; using water productively is also a significant challenge.

Brazil has a long experience addressing water scarcity in the *Sertão*, its semi-arid region in the Northeast that is home to 23 million people. This rich experience can be useful to Africans and South Asians as they search for solutions to both water supply and use.

BRAZIL'S FIRST APPROACH: IMPROVING WATER SUPPLY

The first projects to improve water access in rural Northeast Brazil were implemented by missionaries and NGOs, mostly from Europe, who helped to empower civil society by bringing new techniques and technologies to be assimilated and replicated independently. In one telling initiative, NGOs provided funding for municipalities to install water cisterns, so that they could become 100% water independent. It involved projects to engage and teach the community how to best utilise water through practical training with farmers. To scale-up their work, they proposed a national-level public policy to the federal government.

KEY LESSONS LEARNED

Policies and practices focusing on both water supply and use have to be implemented in parallel.

Promoting efficient water use seems to work best when combining community education provided by civil society groups with disseminating simple, cost-effective technology.

Water infrastructure, such as rainwater harvesting dams and wells, when combined with drip irrigation, will help farmers continue to produce as rain-fed agriculture becomes more difficult due to climate change.

As a result of civil society pressure, the Brazilian national programme Water for All (*Agua Para Todos*) came into force, whose goal is to improve water supply for five million isolated rural dwellers in the semi-arid region by 2014 by constructing infrastructure.

The cost-benefit evaluation of various water access strategies showed rainwater harvesting systems to be the most cost-effective solution for supplying water for basic family consumption. As such, the federal government developed a programme, One Million Cisterns (*Um Milhão de Cisternas*), to provide every household with a rainwater collection system. For farming purposes a higher quantity of water is required, so constructing earth dams and wells was commissioned. This strategy has been recently identified as a good practice for climate change adaptation in rural areas.

For domestic use, the rainwater harvesting system of One Million Cisterns consists of a catchment area, a conveyance system, and a collection device (the cistern). During rainfall, water is transported through a simple piping system to a storage tank where it can be stored for several months. The size of the average cistern is standardised to 16 cubic metres (16,000 litres). In less than a decade, the One Million Cisterns programme has provided a household water source to more than 500,000 families in over 1,000 municipalities, and engaged over 10,000 people in their construction.

The installation of the cistern is carried out by specifically trained local organisations in a decentralized manner. Only local labour is used, making the federal government's role purely financial. The federal government subsidises all material and implementation costs; each system is estimated to cost R$2000 (US$1300).

Conversely, the design and implementation of larger water infrastructure, like wells and earth dams, is carried out by the government's National Department for Public Work against Drought (Departamento Nacional de Obras contra a Seca). The costs range from R$5,000 (US$3,200) for the smallest earth dam (açude) or shallowest well, to R$50,000 (US$32,000) or more for a deep well or large açude. As it is centralised, the process is more bureaucratic, less tailored to local needs, and the community is not directly engaged in the planning process, nor sufficiently informed about how to use these resources; this probably accounts for why much new infrastructure remains under-used, as for example only 3% of small-scale dams are used productively.

Finally, in a recent programme launched under the Water for All umbrella, One Land and Two Waters (Uma Terra e Duas Aguas - P1+2), the Brazilian government is disseminating small-scale irrigation systems fed by larger rainwater collection systems of 50,000 litres. These systems cost up to US$4,000 and can supply water for basic irrigation purposes to enable families to grow their own vegetables and fruit year-round and even sell the surplus.

Figure 1: Household Rainwater Cistern
Source: REDEH

Figure 2: Earth Dam
Source: REDEH

WATER USE KNOWLEDGE

In the central government's top-down water infrastructure projects, such as the water dams, it only focused on building the infrastructure, not providing information nor technical assistance to local communities about how to use it. Local civil society organisations, such as the approximately 700 groups that make up Articulation in the Semi-Arid (*Articulação no Semi-Árido ASA*), stepped in to educate people about their right to water access and how to capitalise on water dams, principally using local meetings, workshops and practical training.

The One Million Cisterns programme already had local participation and knowledge dissemination in its plans from inception. It was started as a pilot by NGOs from ASA, and managed to get federal government backing and funding due to its positive results. This programme actively sought out the participation of local citizens, so that they understood the technology that was being installed and felt responsible for it.

Civil society also took the lead in promoting efficient water use for agricultural purposes, including disseminating specific technologies, described below, and employing local technicians to provide both group and one-to-one practical training for farmers on how and why to use the new technologies.

WATER USE TECHNOLOGY

So far government policies have only contributed to increasing water supply, but in the context of climate change, an increasingly limited supply means available water must be put to its most efficient use, especially for agriculture. Currently, there is very little effort from federal programmes to disseminate efficient irrigation technology throughout the semi-arid region, nor to spread knowledge about how to appropriately manage irrigation and use water with different salinity contents. NGOs, such as Adapta Sertão, PAIS and MANDALLA, have stepped in to fill the gap by working to put water to productive agricultural use through irrigation.

Water-efficient irrigation, such as drip irrigation, when combined with access to a water source through water dams and wells, has proven to be an effective way to reduce crop dependence on rainfall, thereby making farmers more resilient to climate change. In drip irrigation, water from dams is supplied at low pressure to the root zone of each plant, drop by drop, through a network of thin pipes.

Figure 3: Drip Irrigation Pipe
Source: REDEH

Key Advantages: Drip Irrigation vs. Conventional Sprinklers

- Water saving: 50-70%
- Labour and energy saving: 60-90%
- Makes good use of low quality water
- Increase in yield: 15-70%
- Saving of nutrients: 30-60% when used in hilly terrain and problem soils
- Payback on investment in one to three years

However, the low population density of Brazil's massive semi-arid region is a major barrier to disseminating drip-irrigation systems, as it is not cost-effective for technology retailers to have a presence in each small, rural community. In addition, irrigation in the semi-arid region can easily cause serious soil salinisation problems that make the soil sterile if the irrigation is not well-managed and too much water is applied. In response, NGOs have taken varying approaches. Some, such as the NGO PAIS, subsidise technology and technical knowledge provision with investments coming from the government and foundations.

Others, such as Adapta Sertão,[1] identify private technology providers and engage with them to expand distribution networks by building local capacity through local cooperatives. They have created local retailers in rural areas who can give instruction, guidance, technical support and long-term maintenance, and this seems to be working well.

Small farmers' associations and cooperatives also offer a way to quickly and easily outreach to hundreds of farmers. These

[1]To learn more about the Adapta Sertão approach, read the ELLA Practice Brief.

organisations are perceived as trustworthy because they are usually created by the farmers themselves. In addition to procuring technology, these associations provide technical assistance and help commercialise the extra produce farmers grow as a result of better irrigation.

Another key challenge to disseminating this technology is that drip irrigation requires fixed capital for installation. The cost depends on the kind of crop, spacing, quantity of water required, type and discharge capacity of the dripper, quality of materials used, and distance between the water source and the field.

Drip irrigation systems for small farmers, including the piping system and installation, can range from US$ 0.2 to US$1 per m^2. Water pumps are typically necessary to transport water from the source to the irrigated area and can range from US$200 to US$500 for an electric pump, and up to US$3,000 for a diesel pump. Solar photovoltaic water pumps are still not commercially viable because of the high initial cost that can exceed US$2,000 for very small flow-rates.

If drip-irrigation technology were to be fully subsidised by the government, it would be costly and time consuming to distribute. To support the market approach for disseminating technology, the Brazilian government set maximum prices for drip irrigation technologies after consultation with industry associations. These maximum prices apply to technologies financed through the government´s micro-credit programme and purchased from registered retailers.

Figure 4: Cost, Potential Production, and Potential Sales of Drip Irrigation Systems for One Hectare of Land

System	Cost range for new material including transport and installation ($USD)	Examples of potential production/year in monocultures (Kg)	Examples of potential production/year in poli-cultures (Kg)	Potential sales (US$/Year)
10,000 m2 (one hectare)	Drippers and pipes: $2,500 to $ 5,000 Water pump: $ 1,000 to $ 3,000 Total: $ 3,000 to $ 8,000	Manioc: 35,000 Kg/Yr Corn: 3,000 Kg/Yr Potato: 20,000 Kg/Yr Beans: 4,000 Kg/Yr Tomato: 10,000 Kg/Yr Onions: 15,000 Kg/Yr Carrots: 15,000 Kg/Yr	Manioc: 6,000 Kg/Yr Corn: 5,500 Kg/Yr Potato: 6,000 Kg/Yr Beans: 1,000 Kg/Yr Tomato: 3,200 Kg/Yr Onions: 4,000 Kg/Yr Carrots: 2,000 Kg/Yr	$4,000 to $12,000

Source: Adapta Sertao

CONTEXTUAL FACTORS

ENABLING THE SUCCESS OF THE BRAZILIAN APPROACH

The *Sertão's* average precipitation is about 650 mm/year, making it one of the most rainy semi-arid areas of the world, so technologies like rainwater harvesting and dams are possible.

NGOs were active in lobbying the government to develop decentralised water policies to meet rural households' needs. Overall, Brazil has a willing and capable civil society sector that was able to step in and complement the central government's supply-side policies, disseminating efficient technology, offering knowledge on how best to use water resources, and building local capacity.

International and national NGOs with good technical capacity provided local civil society organisations with technical solutions. They also developed the local capacity that was able to implement and sustain effective programmes and policies.

International NGOs often had more funding available and freedom to spend compared to local municipalities, who were restricted by tight fiscal controls and budgets. Today, much of the international financial resources that were invested in Brazil are being diverted to Africa and Asia, so the Brazilian government was spurred into self-financing more social programmes.

Political will and support from the federal government put important policies in place. Brazil has a large budget through which it redistributes taxes to a extensive array of social programmes, especially in the northeast where the majority of poverty is concentrated.

LESSONS LEARNED

1. The Brazilian experience demonstrates that increasing water supply in semi-arid regions requires long-term policies and subsidised water infrastructure, but that these work best with a decentralised approach.
2. At the same time, policies promoting both water supply and use need to be developed in parallel. Much water infrastructure commissioned by the government is not used to its full potential because the concept of water use was neglected.
3. In Brazil, a well-organised civil society complemented the government approach by taking on the responsibility for improving water use, which it did through two key strategies: instilling knowledge about water use and disseminating water-efficient technologies.
4. Different technologies worked best for different needs. Rainwater harvesting was an effective tool for supplying rural households' domestic needs. For agriculture, earth dams and wells worked best, though drip irrigation proved important for making efficient use of limited supply, and was effective even in times of scarce rainfall as long as the necessary technology, installation capacity, technical assistance and after-sales care are available.

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FIND OUT MORE FROM ELLA

To learn more about adaptation in Brazil's semi-arid region, read the ELLA Guide, which has a full list of the ELL knowledge materials on this theme. To learn more about other ELLA development issues, browse other ELLA Themes.

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