

The following text is the revised version (May 2009) of an article which was first published in:  
**Official Delegate Publication of the 4<sup>th</sup> World Water Forum**  
**Mexico City, March,16 – 22, 2006**

## **Community water action in semi-arid Brazil: Factors for success of rainwater harvesting programs**

**Johann Gnadlinger<sup>1</sup>**

Brazil, with a population of 180 million and a land area of 8.5 million square kilometres, is the world's 5th largest country and has 15% of the world's freshwater: This water is, however, unevenly distributed and about 12% of its territory has a tropical, semi-arid climate, with only 3% of the country's freshwater. Semi-Arid Brazil (SAB) or the so-called "drought stricken polygon" in the north-eastern part of the country, is a region extending over almost one million square kilometres and peopled by about 21 million inhabitants, 9 million of them in the rural areas. Until recent years, the rural population was periodically faced with drought and found itself unable to cope with it. Each year, people tilled the soil and planted corn, hoping for sufficient rainfall. Regular rainfall from year to year and season to season is, of course, the exception rather than the rule in a semi-arid climate and thus a bad harvest seemed to be programmed in advance.

For most politicians, however, from the simple county councillor to congressional representatives, dry years meant a guaranteed election victory. State funds were being manipulated as election bait, and water trucks for thirsty cows caught the votes of whole villages. The so-called "labour front against the drought" and well-digging programmes were being used by big landowners for their own benefit. "In Brazil's northeast there is no lack of water, there is a lack of justice!" was one of the main slogans.

### **RURAL DEVELOPMENT AND WATER MANAGEMENT**

Today, families living in isolated areas with no access to land, water, or an organized community are not able to resist either migration to the cities, or employment as cheap labour in irrigation projects. This situation is changing, though: rural people organized in grass root communities and 'peasant's associations', who know how to live in the semi-arid climate, and who are familiar

---

<sup>1</sup> **Johann Gnadlinger** has been living in Brazil as a rural development worker since 1977 and, since 1991, has been working at IRPAA (the Regional Institute for Appropriate Small Scale Agriculture), one of the most influential NGO's of the Brazilian Semi-Arid Tropics, where he was responsible for the Water and Climate Section from 1991 to 2002. As a member of Horizont3000– the Austrian Organization for Development Co-Operation, he has dedicated the last twelve years to environmental and water management, especially in the Brazilian semi-arid tropics. He is also one of the founders of ABCMAC (The Brazilian Rainwater Catchment and Management Association) and was its President until 2007. He has co-organized six Brazilian Conferences on Rainwater Harvesting, and has also acted as secretary general of the 9<sup>th</sup> International Rainwater Catchment Systems Conference in Brazil, 1999. From 1999 to 2003 he was a vice-president of IRCSA – International Rainwater Catchment Systems Association, gaining practical experience of rainwater harvesting in different parts of the world such as China, Kenya, India, Iran, Israel and Mexico. He is one of the originators and promoters of P1+2 (Programme One Piece of Land and Two Types of Water), relating the water issue to the sustainable development of the Brazilian rural semi-arid region and its population, and has authored publications on this and numerous related issues.  
Email: [johanng@abcmac.org.br](mailto:johanng@abcmac.org.br), [www.abcmac.org.br](http://www.abcmac.org.br)

with production methods appropriate to it, are ready to fight for rainwater catchment systems, as well as for all the other aspects facilitating and enriching life in SAB.

Three main strategies were developed, geared towards ensuring that sustainable living would be possible for people in the Brazilian Semi-Arid Tropics:

**: Living with the climatic conditions and water management:**

Rain is regionally and seasonally very irregular, and groundwater reserves are limited in most of the SAB. Additionally, there is a very high potential evaporation rate, several times higher than the actual evaporation. The consequence of these factors would be an erratic and unreliable water supply, were it not for preventive measures, such as the establishment of rainwater harvesting in order to accumulate reserves for the dry periods.

**: Animal husbandry:** The provision of facilities for keeping small animals, especially sheep and goats, that are adapted to the semi-arid climate and the storing of water and fodder for the dry months.

**: Water harvesting for agriculture:** With less than 4 % of the land of SAB suitable for irrigation, it is essential to collect run-off to sustain crops in years with poor rainfall, implement soil and water management, plant drought resistant annual crops, and plant forage crops and trees well suited to a semi-arid climate.

Over time, the communities have discovered how to resolve the water supply problem in SAB. It has to be managed in a number of different ways, using all the available sources of water: ground, surface, soil, and rainwater.<sup>2</sup>

**A. Providing safe drinking water for every household.** The campaign with ‘No Family without Drinking Water’ as its slogan was part of the effort to ensure the supply of domestic drinking water of a recognised safety standard using cisterns, shallow wells, and other means.

*Several of the more widely available tank designs are well known and used in the SAB. The two designs most efficient in terms of cost are the **semi-surface cistern made of pre-cast segments**, preferred by users, and the **wire-mesh concrete cistern**, better in terms of sustainability. Diversion of the first rain after a dry spell, and extraction of water from the tank through a hand pump, help to ensure that it is safe to drink.*

**B. Supplying community water** for washing, bathing, and for animals. This is sourced from ponds, ground catchment rockcisterns, riverbed-cisterns, shallow wells, etc., and necessitates a community organization for planning, construction, and maintenance. **Hand-dug rock cisterns**, over 4 metres deep, with a small surface area to minimise loss by evaporation, are a traditional way to harvest water for the dry season. Even in years of drought, these reservoirs provide water for humans, animals and a small vegetable garden.

**C. Assuring blue and green water for agriculture**<sup>3</sup>. This is supplied by sub-surface reservoirs, supplemental irrigation, road catchments for irrigation of fruit trees, contour ploughing, minimum tillage, use of furrows for storing rainwater *in situ* (i.e. inter-row water harvesting),

---

<sup>2</sup> Gnadlinger, Johann, P 1+2: Rainwater Harvesting Programme for Livestock and Agriculture in the Brazilian Semi-Arid Tropics, 12<sup>th</sup> International Conference of Rainwater Catchment Systems, New Delhi, India, 2005.

<sup>3</sup> Falkenmark, M, Rockström, J. & Savenije, H. G., Feeding Eight Billion People, Time to Get Out of Past Misconceptions, SIWI, Stockholm, Sweden, 2002.

using manure and mulching to retain water for plants, planting crops adapted to dry climate conditions (sorghum, pigeon pea, green gram, sesame, etc.). *Sub-surface reservoirs, appropriate in crystalline subsoil, store rainwater run-off for later application: a shallow transverse barrier is dug below the ground level (normally 1 to 3 metres deep) to create an intermittent flow towards the impervious subsoil. Then earth or rock-filled sub-surface dams are built with a PVC sheet on the downstream face to avoid seepage. When finished, it is possible to plant many varieties of vegetables, corn, rice, beans or fruit trees, on the run-off watered upstream soil. In addition, it is almost always possible to dig a shallow well for water for animals or irrigation. Sometimes even in the months after the rainy season has ended, a second crop is possible*<sup>4</sup>.

**D. Supplying emergency water for drought years.** This can be achieved by using deep wells and smaller, strategically placed, dams, but it remains a transitory solution as long as the potential of the methods described in points a, b and c are not fully exploited. The communal water truck must be replaced, since it is not only the most expensive type of water supply, but also bad quality water, and a means of supply that has been misused to make communities dependent on politicians.

**E. Managing water for the environment**<sup>5</sup>. This is based on the watershed, protection of springs and riparian vegetation, pollution prevention, wastewater treatment, and reuse and recycling of water.

Following these methods, decentralized and participatory means of supplying water are developed by communities, districts, and municipalities within SAB. The technologies for utilization of water for drinking, agriculture, and the rearing of animals are considered ‘social technologies’. The communities themselves experiment with, and evaluate, the various methods, with the technicians’ knowledge and abilities complementing communities’ efforts in making the technologies viable. In this way the technical and social viability of a programme can be more definitely assured.

## **Scale-up through institutional and political arrangements**<sup>6</sup>

The NGO IRPAA (the Regional Institute for Appropriate Small Scale Agriculture) has been focusing on the methods described above since 1990, as has EMBRAPA (the Governmental Agricultural Research Agency), and later ABCMAC (the Brazilian Rainwater Catchment and Management Association). It was necessary to create an institutional base to synthesise the different and isolated experiences in the SAB into a political programme. In 1999, organizations

---

<sup>4</sup> Porto, E. R., Silva, A. S., Dos Anjos, J. B., Brito, T. de L, Lopes, P. L. C., Small-Scale Water Management in Farming Systems in the Brazilian Arid Zones: What is Being Done and How to Improve its Application, 9<sup>th</sup> International Conference of Rainwater Catchment Systems, Petrolina, Brazil, 1999.

<sup>5</sup> Garciadiego, Raul F. & Guerra, Gisela H., Water Forever Programme, 5<sup>th</sup> Brazilian Rainwater Catchment and Management Symposium, Teresina, Brazil, 2005.

<sup>6</sup> Gnadlinger, Johann, Rainwater Catchment And Sustainable Development In The Brazilian Semi-Arid Tropics (BSATs) – An Integrated Approach, 11<sup>th</sup> International Conference of Rainwater Catchment Systems, Mexico City, Mexico, 2003.

working in SAB came together to found the ASA Network, which is today made up of almost 1,000 grass root organizations, among them NGO's, farmers' unions, associations, and cooperatives. ASA launched a campaign with the slogan 'No Family without Safe Drinking Water', and developed the 'Programme of 1 Million Cisterns' (P1MC), to be carried out by civil society on a decentralized basis at the community, municipal, micro-region, state, and regional levels. The programme received funding from both governmental organizations and the private sector. The goal of the programme is to supply safe and 'drought secure' drinking water for 1 million rural households, comprising five million people. On May 2009, more than 255,000 cisterns had been constructed<sup>7</sup>, and in some SAB municipalities every rural household had its cistern. P1MC was the starting point for the sustainable development of SAB, but other aspects such as food production, health, education, infrastructure, political organization, environmental protection, etc. should be considered equally important. In the agricultural sector, therefore, P1MC is now complemented by the programme 'One Piece of Land and Two Types of Water' (P1+2). P1+2 signifies that every rural family should own one piece of land which is, firstly, large enough to produce food and allow a sustainable living to be made and, secondly have access to two types of water supply, one for human consumption and the other for food production. After putting the 'droughtproof' drinking water program for one million households on the way, there still remains the task of ensuring water security for raising livestock and agriculture. Besides the use of green water conserving technologies, such as contour tillage, vegetative soil protection, and the use of manure, other techniques are employed to provide water supply for agriculture, such as cisterns for supplemental irrigation of vegetable gardens, for poultry raising and beekeeping, shallow wells, rock cisterns for water for livestock, subsurface dams, and rainwater catchments diverted from roads. P1MC and P1+2 will help different governmental programmes to get closer to the people, involving the population of SAB directly, using the funds for the well-being of the communities rather than against the interests of the population. The Bank of Brazil Foundation and the Brazilian petrol company, Petrobras financed the demonstration phase of P1+2 during 2007. In 2007 and 2008, 1500 rainwater catchment systems, mostly underground cisterns for protective irrigation, rock cisterns and subsurface dams, have been constructed by the P1+2, and the implementation of another 1500 systems is underway in 2009. These systems are supported by the Ministry of Social Development and CODEVASF (the Development Agency of the São Francisco Valley). It is hoped that P1+2 can also join the Ministry of the Environment's "Programme Combating Desertification", provide an orientation for the development of the Ministry of Agrarian Development's "Appropriate Land Reform Plan for SAB".

## **Rainwater catchment and women**

Solving the problems of water supply during the dry season makes women's daily lives much easier, and the cisterns are liberating women from the daily drudgery of water carrying. It is therefore understandable that there are groups of women who construct cisterns for themselves, or for other poor women who are not usually given due consideration in projects managed by men. Other women now have time to plant vegetables on subsurface reservoirs, or to produce and sell jam and juice made from native fruits. By resolving families' water supply problems in this way, and creating a proper income, women gain strength and are empowered to escape poverty and play a strategic role in the sustainable development of the SAB.

---

<sup>7</sup> Homepage of ASA, Access at 30-05-2009: <http://www.asabrasil.org.br>

## Rainwater catchment and education

Teachers in rural communities of SAB became aware that schoolbooks should be changed to suit the needs of the rural population. Children should not be educated for city life, but on the basis of the reality of SAB, so they would be prepared for life in the country. The teachers founded RESAB – the Union of Schools of SAB, which mobilizes the different social actors living in the region to renew the political and teaching programmes for schools of SAB. In the teaching of mathematics, children no longer take examples from the urban environment: instead, they calculate the amount of rainwater falling on a roof and are asked to figure out if it will be enough to supply their families with water for the dry season, given a specific water consumption.

## OUTLOOK

Community water initiatives leading to programmes like P1MC and P1+2 would not have been possible without a new vision for SAB, based on “living in harmony with the semi-arid climate”, similar to the Vision of Water for Food and Rural Development of the 2<sup>nd</sup> WWF<sup>8</sup>, which describes the life of rural communities in the year 2025 as a world of healthy people, with adequate nutrition and secure livelihoods, where following three principles dominate:

: **Access to land and water**, acknowledging that all the people have fundamental rights to land, drinking water, hygiene and the means to produce food.

: **Sustainability of the production system** in the use of and water, the technologies, and the market.

: **Democracy in the process of implementation and production**: both men and women should have a voice in the making of decisions that affect them, including those related to soil and water management.

The rural communities in SAB are working hard to make their vision a reality, and the hope is that the Brazilian government will continue to finance P1MC, and commit to the inclusion of P1+2 in its development projects. Semi-Arid Brazil should exchange its experiences in “Mainstreaming Rainwater Harvesting” with similar programmes in other countries around the world, especially those with semi-arid regions, in the context of both the policy and practice of integrated water management.

---

<sup>8</sup> 2nd World Water Forum, A Vision of Water for Food and Rural Development, The Hague, The Netherlands, 2000.