

## **Adaptation To Climate Change In Brazil: The Pintadas Pilot Project And Multiplication Of Best Practice Examples Through Dissemination And Communication Networks**

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### **Abstract**

The semi-arid Northeast is already one of the most vulnerable regions to climate variability in Brazil due to a strong seasonal hydrological deficit, low adaptive capacity, and persistent poverty. Long-term climate change scenarios for this region show a progressive increase in temperature and the extension of periods of hydrological deficit, leading to a possible change towards a more arid climate in large areas. Researchers thus agree that urgent adaptation strategies are required for the semi-arid Northeast, particularly for family farmers who will be severely affected as a “hot spot” in terms of climate and social vulnerability. Between 2006 and 2008, a pilot project aimed at strengthening adaptive capacity to these vulnerabilities was implemented in the Northeastern municipality of Pintadas. The project provided a concrete example how community-based adaptation strategies may look like and combined adaptation with poverty alleviation measures by installing efficient irrigation systems. Starting with 2008, a joint ongoing cooperation project between Brazil and Germany is now to assess practices and develop possible implementation strategies to transfer the Pintadas project’s experience to other municipalities and regions, as well as to identify and multiply other successful adaptation projects in Brazil through dissemination and communication networks. This paper presents the preliminary results of the first project phase (2006-2008) and briefly explains how the second project phase (2008-2012) is to proceed. It is hoped that results in 2010 will provide valuable examples and recommendations for Brazilian national adaptation policies as well as transnational activities under the UNFCCC.

### **Keywords**

Climate change, adaptation, rural poverty, Brazil, Semi-arid, Pintadas, Northeast, efficient irrigation, sustainable agriculture, communication networks, climate policy

### **1 Introduction**

Recent scientific evidence confirms that global warming is a reality, and that mitigation alone is insufficient for mankind to cope with the predicted adverse impacts. Longevity of many greenhouse gases (GHG) in the atmosphere implies that today’s emissions will continue to warm the earth for the coming decades (IPCC, 2007). Many researchers thus call for integrated adaptation strategies that decrease vulnerability and raise resilience with regard to these impacts. Such strategies are especially important for the poorest of the poor, as these are expected to suffer hardest from global warming (Pielke et al., 2007, IPCC, 2007).

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In Brazil, only few experiences exist with adaptation strategies and practices, despite the urgency of the problem. It is predicted that one of the most vulnerable regions regarding climate change will be the semi-arid Northeast (Marengo et al, 2007; Governo Federal, 2008). To address these problems, a number of NGO-initiatives now aim to understand what makes local adaptation projects successful. Unfortunately, lack of financial means and support as well as capacity often prohibits development of such projects and/or communication of their results, thus impeding a collective learning for adaptation and adaptive capacity building. In recognition of this, an ongoing joint cooperation project between the German Federal Environment Agency and Centro Clima aims at identifying and multiplying successful adaptation projects in Brazil through dissemination and communication networks. This paper presents the first results of the project.

Accordingly, in section 2 we briefly summarize the main climate and socio-economic vulnerabilities in the semi-arid Northeast, and show that the region is a climate “hotspot” particularly for poor smallholder farmers, thus urgently requiring adaptation strategies. In the following section 3, we begin by (1) presenting a concrete community-based adaptation pilot project that was implemented between 2006 and 2008 in the Northeastern municipality of Pintadas. As we show, the project combines efficient irrigation technologies and poverty reduction as a means for family farmers to adapt to social and climate vulnerabilities. In the following, we (2) briefly discuss the joint ongoing cooperation project between Brazil and Germany which started with the second project phase (2008-2010), and is to assess practices and develop possible implementation strategies to transfer the Pintadas project’s experience to other municipalities and regions, as well as to identify and multiply other successful adaptation projects in Brazil through dissemination and communication networks. Section 4 presents the concluding remarks and recommendations.

## **2 Climate Change and Impacts in the Brazilian Northeast**

Of particular importance in the semi-arid Northeast is the question of water scarcity and access to water (de Carvalho and Egler, 2002; Krol and Bronstert, 2007). Agriculture and livestock raising are already strongly limited due to marginal low sufficiency of rainwater (Krol and Bronstert, 2007). Recent research (Marengo et al, 2007; IPCC, 2007) indicates that this hydrological deficit will increase – either due to declining rainfalls or increased evaporation – if average temperatures in the Northeast rise due to climate change. In particular, the frequency of droughts that affect the region may increase and provoke desertification processes (Marengo et al., 2007). Otherwise, future regional summer average temperatures (i.e. temperatures in the growing season) are found to most likely (> 90% likelihood) exceed the most extreme seasonal temperatures recorded from 1900 to 2006 by end of this century (Battisti and Naylor, 2009).

These climate vulnerabilities may affect about 2 million rural families of smallholder farmer that currently live in the Brazilian Northeast (INCRA and FAO, 2000) under very high levels of poverty (Silveira et al., 2007). Climate change may in fact accentuate or reinforce these existing vulnerabilities and socio-economic inequalities (Adger et al., 2003) so that, taken together, climate and social vulnerabilities hold a tremendous potential to adversely affect poor family farmers in the semi-arid Northeast, especially as these – generally speaking – are assumed to have a low adaptive capacity with regard to such impacts (Adger et al., 2003; Morton, 2007). These considerations make clear that the Brazilian Semi-arid is a “hotspot” for adaptation, where development strategies require a clear focus on increasing adaptive

capacity as well as alleviating poverty of poor family farmers, and efficient water use and/or irrigation plays a crucial part.

### **3 The Pintadas Adaptation Project**

#### **3.1 Project Background**

Based on the findings regarding social and climate vulnerability in the Semi-arid as well as a general lack of experiences in the field of adaptation, Brazilian partners of the network-based NGO SouthSouthNorth (SSN) began in 2006 to identify potential adaptation projects in the region which would combine community-based adaptation with poverty reduction.<sup>2</sup> During this process, 9 projects were identified and appraised using SWOT<sup>3</sup> analysis (SSN, 2008). This assessment showed that the implementation of efficient irrigation technologies in the semi-arid Northeast could provide ample benefits for smallholder farmers, both regarding increased family income (via increased agricultural productivity) and the building of adaptive capacity (regarding hydrological deficit and climate change). Despite decade-long efforts to expand irrigation infrastructure and its use in the semi-arid Northeast, especially for agriculture (de Carvalho and Egler, 2002), most family farmers continue to rely on highly inefficient irrigation techniques such as hand irrigation or water trenches for subsistence crops, thus limiting their agricultural production (both qualitatively and quantitatively) as well as wasting scarce water resources.

It was decided that the pilot project would be implemented in the community of Pintadas, which lies some 300 km West of Salvador. Pintadas falls well into the picture of limited adaptive capacity to climate and social vulnerabilities: the entire municipality displays a strong hydrological deficit and poverty levels are very high. The main economic activity in the region is subsistence farming. Despite this, however, Pintadas is also a privileged case as the community has a history of social mobilization and active leadership that is known well beyond municipality borders. This observation and the fact that from early on the community embraced the idea of the efficient irrigation project supported project implementation in Pintadas.<sup>4</sup>

#### **3.2 First Project Phase (2006-2008): Implementing the Pilot Project**

From the early planning phase the Pintadas efficient irrigation project was designed to expand into other regions of the semi-arid Northeast. Therefore, careful attention was to be given to identify those factors which could turn the pilot stage into a long-term sustainable project. Potentially viable areas in Pintadas were sought for pilot system installation and potential partners were selected based on pre-defined criteria (among other: low income, entrepreneurial spirit, young and female). The exact technical design of each irrigation system was then based on the necessities of each beneficiary. Following this process, a total of 7 efficient irrigation systems were installed in 7 properties, these being in detail:

- 1 drip irrigation system with 1,800 m<sup>2</sup> capacity and regulated beaks, run by a diesel pump;

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<sup>2</sup>Many researchers now highlight that adaptation and sustainable development can be complementary and that such synergies should not go unused (see, for example, Pielke et al., 2007).

<sup>3</sup>SWOT stands for the analysis of Strengths, Weaknesses, Opportunities, and Threats.

<sup>4</sup>Successful expansion of the Pintadas experiences to other municipalities or regions – as aimed by the second project phase (2008-2010) – may require similar social organization. This point will be analyzed by the project team.

- 4 drip irrigation systems with 500 m<sup>2</sup> capacity and automatic dripping. 3 of the systems run with a diesel pump, and 1 with a PV pump;
- 2 organoponic systems<sup>5</sup> run by manual pumping (conventional pumps are not required as only 1,000 l of water per week are required at this system size).<sup>6</sup>

To assess project progress farmers were directed to record information regarding their cultivation, such as cultivated area, types of crops planted, number of irrigation-hours, weather conditions, and productivity and income received. While efforts were made to increase awareness among farmers on the importance of recording production and technical data, participants gradually lost interest to do so because they could not see the practical uses for recording data. Following, initial project assessment could only be based on 5 months of data. Based on this limited information, the results nevertheless show that participating family farmers managed to receive additional monthly incomes ranging from R\$60 to R\$200.<sup>7</sup> Due to these differences, estimated payback times were calculated to vary between 1 to over 6 years.

The observations made underline that community-based adaptation is an extremely difficult process. In the case of Pintadas, however, many potential problems and conflicts were avoided by providing information and technical assistance, while simultaneously incorporating local stakeholders and representatives of the municipality into the implementation process.<sup>8</sup> In order to extend the project within the community a mutual credit fund (*fundo rotativo*) is now being installed, an approach that may also be adopted for the second project phase described below.

### **3.3 Second Project Phase (2008-2010): Expansion and Communicating Best Practices**

By installing and implementing 7 efficient irrigation systems in Pintadas a strategic horizon for longer term adaptation has been opened. In addition to testing the proposed technologies, the main advantage of the pilot phase was to prepare an infrastructure and a partnership of local organizations that could support a possible expansion of the project. The objective of the second project phase – which is a joint ongoing cooperation project between Brazil and Germany – is now to assess practices, and strengthen and expand the project's components in the Semi-arid through multiplying and communication of best practices. As next steps, the project is to:

- Consolidate and expand the experiences in Pintadas by installing 15 new systems (5 organoponic and 10 drip irrigation systems);
- Expand project in 2 municipalities near Pintadas (Quixabeira and Baixa Grande) by installing total of 10 systems (4 drip irrigation and 1 organoponic system in each municipality);

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<sup>5</sup>Organoponics is an efficient irrigation system that uses very small amounts of water cultivation without any use of soil. The main difference to hydroponics is that organoponics relies on compost or organic fertilizer.

<sup>6</sup>Both organoponics and drip irrigation are technologically mature systems which can provide for large crop yield increases while requiring far less water than conventional systems (especially the case for organoponics), making both systems extremely attractive for the semi-arid Northeast.

<sup>7</sup>In January 2009, R\$1 is approximately US\$0.40.

<sup>8</sup>This observation is partly evidenced by the fact that the Pintadas pilot project has recently won the SEED award for Entrepreneurship in Sustainable Development, which explicitly praised the implementation process and the adaptation-development focus of the project.

- Expand and/or test other technologies in another municipality in the semi-arid Northeast.<sup>9</sup>

These experiences are to form part of a communication network of municipalities and organizations interested in exchanging successful practices for adaptation to climate change in Brazilian regions particularly vulnerable to climate change impacts. This network is also to incorporate experiences from the Amazon and Mata Atlântica biomes which are currently collected and formalized in another ongoing project. Together, the results are expected to form a general methodology for adaptation project implementation in rural communities and to provide input to the country's national adaptation policies, as targeted by the National Climate Change Policy Plan (Governo Federal, 2008) recently put forward by the President to the Congress. Furthermore, the project outcomes are expected to support international adaptation discussions and platforms.

#### **4 Conclusions**

Adaptation to climate change has become a hotly debated topic throughout the past few years. The poorest of the poor are predicted to carry most hardship of the expected impacts, especially because they are the ones least capable to adapt (Adger et al., 2003; Pielke et al., 2007). We started our analysis by showing that the semi-arid Northeast is a climate "hotspot" where high indices of poverty coincide with large climate vulnerabilities. The Pintadas project presented in the following can be viewed as a concrete example of how to raise adaptive capacity of family farmers by combining efficient irrigation technologies with poverty alleviation measures. In this specific case, sustainability of the Pintadas project will likely be guaranteed only through the creation of local capacity in efficient irrigation. This means that local farmers will need to be trained in efficient irrigation and be supported with adequate capacity and technical assistance.

Adaptation has now become a priority on the Brazilian government agenda, as evidenced by the National Climate Change Policy Plan (Governo Federal, 2008) recently put forward by the President to the Congress. The second phase of the ongoing Pintadas project aims at expanding efficient irrigation systems in Pintadas and other municipalities as well as to identify and implement other potential local adaptation projects in the Northeast. These will consequently be used to form a communication network that will disseminate lessons learned and best practices on local adaptation projects. It is hoped that these results will provide important examples for the current debate on the country's national adaptation policies, as well as for international processes such as the Nairobi Programme of Work on Adaptation under the UN Climate Convention (UNFCCC).

A workshop in Salvador in November 2008 provided the starting point for this second phase. Smallholder farmers from Pintadas and surrounding municipalities, technology providers, NGO staff, government representatives from various agencies and countries, and scientists discussed for two days possible technological solutions, capacity building and technical assistance, and broader socio-environmental implications of adaption projects. These and other results will be published throughout the coming years on the project website (<http://pintadas-solar.org>).

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<sup>9</sup>The number of systems to be installed should be viewed as a minimum number which may still increase.

## **5 Acknowledgments**

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