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# THE EMERGENCE OF A CLIMATE ANTHROPOLOGY IN NORTHEAST BRAZIL

By *Donald R. Nelson and Timothy J. Finan*

## A Climate Anthropology Agenda

Climate studies have traditionally fallen within the purview of the natural sciences where cause and predictable pattern are sought for such phenomena as climate change and climate variability. In the past, social scientists had little occasion to cross disciplinary paths with atmospheric or oceanographic scientists. Not that social science has ignored climate, for anthropology and geography claim a rich literature on the impacts of climate variability, particularly drought, on human populations (e.g., Franke and Chasin 1980; Watts 1983; Langworthy and Finan 1997). New theoretical ground, fertilized by an increasing number of empirical studies, now promises to bear the fruit we call climate anthropology. The expanding social science agenda has responded to two relatively recent advances in the natural sciences. The first has been the widening scientific consensus regarding global climate change and its anthropogenic causes. Global change cannot be adequately characterized without understanding the human-environment interactions that have contributed to the phenomenon, forcing social and natural scientists to pursue common research objectives. The second influence on climate anthropology has been the improvement in scientific understanding of oceanic/atmospheric interactions, thus allowing for more refined predictability of climatic events, particularly extreme ones. It is with this advance in climate predictability that climate anthropology is beginning to reap an exceedingly bountiful harvest in both theory and application.

The scientific investment in oceanic and atmospheric data collection has produced increasingly sophisticated



*Donald R. Nelson (left) and Timothy J. Finan in the Field*

models that permit probabilistic predictions of climate phenomena up to a year in advance. It is now known, and generally predictable, that the anomalous warming (or cooling) of sea surface temperatures in the Pacific Ocean will usually result in particular climate patterns elsewhere in the world—the El Niño/La Niña effect. Thus, human populations in Northeast Brazil can “expect” (in probabilistic terms) a below average (El Niño) or above average (La Niña) rainy season, information that could prove critical to a heavily rainfall-dependent population. This enhanced understanding of the natural system encourages an ambitious social science investigation into what funding agencies call “applications.” Climate anthropology is emerging in the context of a real world challenge to understand how climate information is produced, disseminated, and used by proposed beneficiaries, or more widely, how climate information influences a policy-making system. At the same time, the role and the use of Science in policy discourse constitutes a legitimate focus of anthropological inquiry. Furthermore, as scientific climate information becomes part of a public development discourse, climate

anthropology has discovered alternative, perhaps competing, climate knowledge systems which find their public status ennobled by scientific attention. These forays on new research ground are amply demonstrated by our on-going project in Ceará State, Northeast Brazil.

## The Ceará Climate Project

Over the last three years, with financing from the Human Dimensions Program of the National Oceanic and Atmospheric Administration (NOAA), a team of researchers from the University of Arizona has worked with collaborators from the Federal University of Ceará, (UFC) and the Ceará Foundation for Meteorology and Water Resources (FUNCEME) to assess how decision-makers—government officials, farmers, merchants, etc.—can and do utilize climate forecasts to mitigate the negative socioeconomic effects of severe drought in Ceará. In this project, we will document and evaluate the process by which climate information has been integrated into wider government efforts to create a drought policy, thus identifying the parameters of an emergent climate anthropology.

The state of Ceará has a long and marked history of drought as well as documented public sector mitigation strategies going back into the mid to late 1800's. Ceará, located in the semi-arid Northeast region of Brazil, is one of nine states which together comprise the "drought polygon," an area of low and varying rainfall. Ceará, with about 6 million inhabitants and 148,000 km<sup>2</sup> of land, is characterized by the high levels of poverty that afflict the region as a whole. With limited access to land resources, few employment opportunities, and a continued reliance on rainfed agriculture, the rural population accurately reflects the nagging social enigma of non-viable rural livelihoods: increasing rates of out-migration, and an urban infrastructure unable to absorb more people.

Beginning in 1997, our research team conducted a rapid appraisal throughout the state to identify the range of different responses to climate variation in general and drought in particular. The principal organizing concept was that of livelihood vulnerability, which provides a framework for comparing both short and longer term climate impacts upon the rural population. At the same time, key informant interviews were carried out at both the state and local levels with policy-makers and public officials who share responsibility for the "public" response to drought. In early 1998, the team surveyed 484 families in six different *municípios* (local administrative units, roughly comparable to counties), each of which represented important micro-climatic variations in the state. This research activity sought to measure livelihood vulnerability among a random sample of households by documenting levels of production, income streams, and household assets as well as the principal coping strategies that constitute a "private" response to drought. Special attention was attributed to the role of climate information and the local perception of climate forecasting and its value. Since all three project years were in fact drought years, one a severe El Niño-fueled crisis, we returned in early 2000 to conduct an in-depth study of two *municípios*—one

where irrigated agriculture is important and the other where only rainfed agriculture is possible. This phase of the research focused on the recuperative abilities of differentially vulnerable households after successive droughts. Using an innovative research instrument designed to allow the recording of text as well as more quantitative information, the team delved into the nature of decision making under climatic stress as well as the interaction between household strategies and the public sector drought relief measures.

### Climate Vulnerability in Rural Ceará

Most of rural Ceará has always been highly vulnerable to climate extremes. Consistent with climatic patterns representative of the semi-arid tropics, rainfall throughout the state is highly variable both spatially and temporally, ranging from about 500 mm annually in the fabled drought-susceptible hinterland, the *sertão*, to about 1000 mm along the coastal strip, the *litoral*. Within any given year, however, rainfall levels may vary greatly even within a *município* and certainly between *municípios* within the same climatic zone. There is a distinct rainy season beginning in December and continuing through May, although most rain occurs in the months of February, March, and April. The distribution of rainfall throughout the agricultural year is critical to the livelihood of local households. Local wisdom states that the rainy season must begin before St. Joseph's Day (March 19) if there is to be good St. John's Day (June 24, the harvest feast day).

The bane of farmers, locally referred to as a *veranico*, is a post-germination pause in the rainy season which lasts long enough to kill most if not all of the planted crops. Because crops, in this case subsistence corn and beans, have moisture demands at particular growth stages, optimum productivity requires rainfall at relatively even intervals, and the *veranico* can produce the dreaded "green drought" effect—a seemingly green landscape but no production (but

too much rain in a short period of time can be as damaging as a *veranico*). Thus for farmers in the region, average yearly amount of rainfall is not as significant an indicator of a good agricultural year as is the spatial and temporal dispersion. While drought has been documented in the Northeast since the arrival of the Portuguese five centuries ago, there is widespread evidence that the frequency of drought is increasing, while overall precipitation levels are decreasing and become more variable. As an example, five drought years have occurred during the last decade.

Drought can be devastating to the state, particularly to the most vulnerable segments of the population. As in the rest of the Northeast, productive resources in Ceará are highly concentrated in the hands of a local elite (increasingly in partnership with international capital). Traditionally, most rural households are either tenant sharecroppers on the large *fazendas*, whose landowners are primarily cattlemen, or are independent smallholders. They grow corn and beans during the rainy season on operational farm units that average less than 5 hectares. The reigning technology is low-input and labor-intensive. Cash crops vary by climatic zone—cashew nut and cassava along the coast and cotton in the *sertão*. Most families have some small livestock. These agricultural activities are critically supplemented by off-farm income sources, such as agricultural day labor, wood-cutting, lime production, commerce, retirement pensions, remittances, etc. During a drought, subsistence production for household consumption is decimated, and off-farm income opportunities also become scarce. The economic wealth invested in livestock is reduced as animals either die or are sold at low market value. At the same time, drought in Ceará generates widespread shortages of water for human consumption. Rural populations depend on water collected in reservoirs (*açudes*) or wells, the stores of which significantly decline and become saline during periods of drought. During the 1998 drought, even the water supplies of

some rural towns were threatened and water had to be hauled in by truck from neighboring *municípios*.

### Drought Impact Assessment

One of our activities that constitutes an emerging climate anthropology is the impact assessment of climate extremes. Frequently, climatic events are seen to impact communities as a whole. While it is true that a physical climatic event may be witnessed over a large area, it is equally true that the impacts are felt differentially throughout the community or region. The data from the household survey provided the basis of a classification of the sample into three vulnerability categories that we use to demonstrate the differential impacts of, and responses to, drought in rural Ceará. In essence, the most vulnerable households were those in the lower quartiles of per capita subsistence production (total production volume of corn, beans, and rice) and in the lower quartiles of income derived from agriculture or livestock. We purposively excluded off-farm income at this point to focus on the more direct forms of climate vulnerability. The least vulnerable households were those with large agricultural income streams (from cash crops or livestock products) and/or large per capita subsistence production. While this classification attempted to define a sense of "core" vulnerability to climate variation, it is admittedly arbitrary in that the categories establish relative rather than absolute levels of household vulnerability. Even many of our least vulnerable households are indeed poor.

The comparison of relative coping strategies of households at different vulnerability levels reveals several patterns. First of all, the least vulnerable populations have the highest levels of education and greatest access to more stable off-farm revenue sources, such as small commerce or government employment. Virtually all the irrigated farmers (15 percent of the sample) are in this category and can actually benefit from drought-related price increases, as long as water sources are not lost. At the

other end, the most vulnerable households generally rely more on unstable (i.e., vulnerable) and seasonal sources of income, such as wood-cutting and day labor. For this category more family members carry out a more diversified range of income-earning activities. The poorer families also rely more heavily on social capital, particularly the monetary and in-kind assistance that is received from migrant children. The most prized gift is the color television and parabolic antenna that adorns many of the homes.

The one exception to the pattern is the retirement pension, worth about US \$80 per month, but which nonetheless is the most stable form of income to the poor. Any adult over 50 years of age who can demonstrate an agricultural "profession" is eligible for the pension, and the percentage of families with at least one pensioner member is similar across vulnerability category (about 33 percent of the sample). It is clear that the pension program has provided a cushion of survival for many households whose livelihoods would otherwise be precariously vulnerable to climate extremes.

### Science, Policy, and Politics

A second area of inquiry for climate anthropology is the role of climate forecasting in mitigating the impacts of drought. Let it first be noted that the onset of the rainy season in Ceará is an occasion of great collective angst. The death and suffering caused by past droughts are not only a matter of public record, but have also been etched in the cultural memory and remain vivid in the literary personages and the film stereotypes of the region. To Brazilians throughout the country, the *sertanejo* is a mystical Job-like figure whose hardened will to survive is continually tested in divine trials. In this context, concern about the advent of the annual rains is more than idle newspaper musings, but an essential part of cultural identity. For this reason forecasts have little room for error.

In the 1877-79 drought, 500,000 people in the state perished from

starvation and disease, a fact that drew national attention and precipitated the first organized public acknowledgment of the governmental responsibility in drought relief. Since then, federal and state agencies have continued to struggle with the reality of drought, though their strategies remain mostly reactive rather than proactive. When a drought is declared, which often is not until June, the month in which the harvest normally occurs, emergency aid flows into the region in the form of direct food relief, work front public employment programs, and the delivery of drinking water to centralized storage facilities where people travel to collect their daily consumption requirements. In the past, this reactive approach was often criticized as the "drought industry" because of the siphoning off of drought relief resources by local elites. Public work projects were used to improve private land-holdings; the employment lists were rife with dead and fictitious citizens; and government was invoiced for non-existent water haulers, among other corrupt practices.

In effect, the local power structure turned drought relief into a profitable business. Though changes have been made to eradicate abuse and improve efficiency and equity in government response, drought policy has remained mostly an *post facto* response.

It is true that both the federal and state governments have sought more permanent solutions to the specter of drought, including the stockpiling of water in state reservoirs, the implantation of an irrigation infrastructure in selected watersheds, and improvements in roads and communication. In its attempt to "solve" drought, public policy has placed great faith in the potential of science and technology. In the early 1970s, Ceará created what is today known as FUNCEME, establishing its initial mission as a cloud-seeding agency. Waning enthusiasm over the results of this technology resulted in a wider climate role for FUNCEME, and with a large infusion of federal funds, it developed a widely-respected climate forecasting capacity during the late 1980s. Under prior flamboyant leader-

ship, FUNCEME became an international poster child for the advancement of science applications in the field of climate forecasting. With access to international climate information and models, FUNCEME began to issue state-wide forecasts, in a sense assuring the population that Science would still the psychological anxiety of drought.

In 1992, the government launched an agricultural policy based on the use of the forecasts. FUNCEME used both seasonal forecasting and a soil moisture model to tell farmers when they should plant, the (fallacious) assumption being that farmers did not know when to plant. When it was determined that conditions were appropriate in a given *município*, the Secretary of Agriculture released corn and bean seeds and the local banks began to liberate credit for planting. This program was known as *Hora de Plantar* (Time to Plant). During the agricultural campaign of 1992, FUNCEME forecast below average rains, and the governor is said to have crossed the state promoting the use of drought tolerant seeds to beat the drought. Despite poor rains, grain harvests were only slightly below average... a wonderful testimony to marvels of Science. This now-apocryphal 1992 narrative was been cited repeatedly in international venues (Glantz 1996: 86) as a prototypical example of Science applications, despite the dangers of using state-wide average rainfall data and the fact that this feat was never again repeated. FUNCEME's reputation in international circles made it appear almost as having access to Divine knowledge in the eyes of local populations.

At the time of our survey, FUNCEME had become widely discredited among the rural population. From the years when its president would pronounce to the media that "The miracle of the rains will arrive this year!" FUNCEME saw its star descend as abruptly as the arrival of a *veranico*. In 1997, FUNCEME (under new leadership) announced a forecast of below normal rainfall, and seeds and credit were put on hold, despite several strong rain episodes throughout the state. When seeds were

released under increasing public pressure, the rains had ceased and in fact the overall season was below normal. Nonetheless, the local judgment was that FUNCEME had failed in its attempt to become Divine and that farm households had suffered accordingly. As the locals frequently articulated, "If FUNCEME says it's not going to rain, you'd better get your fields ready to plant."

From the perspective of an emerging climate anthropology, the FUNCEME example presents questions of the use of scientific information for policy purposes as contrasted with political purposes. In the former case, our anthropological inquiry was able to provide important insights into how climate information is used or not by proposed beneficiaries. In our survey, nearly all the households, regardless of their vulnerability status, knew about FUNCEME and had access to their forecasts. Virtually none of them used this information in their decision-making. This lack of confidence in the information is in part an issue of the packaging of the science product and scale. At the current time, forecasts are expressed in terms of probabilities, i.e., the likelihood that annual rainfall levels will occur in any one of historical precipitation terciles. Until recently, FUNCEME converted the probabilistic statements into categories of normal, above, and below, but now express them in forecasted ranges of expected precipitation. Neither the media nor the farmers tended to understand these statements, giving rise to local interpre-

tations. Thus, below normal becomes the dreaded word—drought—which elicits the expected psychological reaction. More critically, however, our study demonstrates that for the majority of farmers the information cannot be effectively used, because they do not have the alternative technologies to respond to a forecast of less rain or more rain. With little access to land and capital, their decision flexibility is to plant or not plant, which for the most vulnerable is not really an option.

With regard to science politics, anthropological inquiry is rich. Our survey revealed that only about half the sample had ever used *Hora de Plantar* seeds and fewer had ever availed themselves of production credit. In fact, all subsistence producers select their own seed year after year, harvesting for seed the plants that have the desired drought tolerance characteristics. It is doubtful that the government offers a superior seed, although government seed is certainly sought when household supplies are low. From our perspective, the anger displayed over the release of seed and credit is more understandable in terms of a local resistance to government's expropriation of Science to reinforce its power position. In effect, farmers perceived in the forecast a fatal hubris that encroached on the sphere of the Divine... in part because the information was presented in exactly that kind of discourse (e.g., the "miracle of the rains"). This represented another example of unfulfilled promises. It was not by coincidence that beginning in 1997 the traditional "rain prophets"



*Drought Impacts in the Sertao Were Severe*

(*profetas de chuva*) began to occupy public space by presenting an alternative knowledge system based on heavenly and natural signs. These prophets began meeting annually at a local convention prior to the arrival of the rainy season to issue their forecasts. It is indicative of its new-found humility that FUNCEME representatives now participate in these conferences.

### Conclusions: Climate Forecasting and Drought Planning

FUNCEME has changed its approach to forecasting in the last several years, in part taking advantage of the results of this study. The forecasts are no longer tied to the distribution of seeds, nor are the forecasts issued directly from FUNCEME in the form of major press conferences. The agency has become very aware of the need to tailor forecasts to end-users' needs and abilities to understand. In this regard they have instituted a training program of state extension workers who in the past have received weekly weather bulletins, but often understood as little as the farmers they were supposed to share the information with. In each of the last two years FUNCEME has brought in individuals from around the state to give seminars on meteorology and climate forecasting. In this way FUNCEME hopes that forecast information will be passed on to individuals in a more accurate and accessible manner.

Our study argues that the greatest potential stakeholders for climate information are the government agencies involved in drought management and mitigation. As of yet, proactive planning for drought mitigation is not yet established policy, although the idea has captured the attention of some governmental representatives. Here again the role of the climate anthropologist is critical. At the level of the *município*, local government officials often derive power and prestige from emergency drought relief programs that follow ancient patterns of patron-client dependencies, and they perceive no local political incentives for drought

mitigation planning. Climate forecasts, even in their current probabilistic form, provide extremely important information, if the prevention of drought's hardships is the political end. Such political will, however, is still rare in Ceará, and the notion that local and state officials might participate as partners in drought planning rarer still. There is growing recognition that drought is not an anomaly but a reality for both society and its leaders, and as the current president of FUNCEME has stated, we now have to learn how to "*conviver com a seca*" (live with drought). Science, we have learned, cannot "solve" drought, but does provide a tool that makes drought less costly in human and financial terms. Climate anthropology is challenged to develop the ability to move between science product and local reality, and our continued agenda of research in Ceará over the next two years is to help define a realistic strategy of proactive preparedness.

This case study illustrates new pathways for anthropological inquiry, particularly the policy-making areas where anthropology in its professional duty can make concrete contributions. Climate anthropology plays to our unique social science strengths in that it requires an interdisciplinary commitment, yea, even a curiosity to learn more about the natural systems that affect people's lives. At the same time, the climate anthropologist must be able to communicate the social science—local level perceptions, values, constraints and opportunities—to both climate scientists who generate forecasts and to policy-makers who seek to derive benefits from them.

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