

# Climate Change and Children in the Brazilian Amazon Region

UNICEF Brazil, 2009

Contributed to right this document:  
Antônio Carlos Cabral, Child Development Specialist  
Fabio Atanasio de Moraes, EZ Coordinator  
Ida Pietricovsky de Oliveira, Communication Specialist  
Roshni Basu, M&E Specialist

# Table of Contents

## **Chapter 1: Impact of Climate Change and Children in Brazil...05**

- 1.1 Background on the Brazilian Context...05
- 1.2 Key Climate Change Issues in Brazil...06
- 1.3 Key Issues on Climate Change in the Brazilian Amazon...07

## **Chapter 2: Climate Change and Vulnerabilities...08**

- 2.1 Vulnerabilities - How much those costs?...08
- 2.2 Existing Vulnerabilities and Impact of Climate Change on Water Resources...09
- 2.3 Abundance and chaos...10
- 2.4 Changes in Precipitation, Rainfall and Water Security...11

## **Chapter 3: Climate Change: What are the risks?...12**

- 3.1 Impacts of global warming temperature...12
- 3.2 The risks of the deforestation...13
- 3.3 The Risks of Greenhouse Gas Emission...15
- 3.4 Analysis of government position and policies on combating climate change...15
  - 3.4.1 Kyoto Protocol and its control mechanisms...16

## **Chapter 4: Child Population in the Amazon...20**

- 4.1 Socio-Demographic Background...20
- 4.2 Child Poverty in Northern Brazil (Amazon region)...20
- 4.3 Child Survival and Development Indicators...22
- 4.4 Child Malnutrition...22

## **Chapter 5: Impact of Climate Change on Children in the Amazon Region...24**

- 5.1 Impact of Climate Change on Children's Health...24
- 5.2 Diseases Prevalence...24
  - 5.2.1 Malaria Prevalence...25
  - 5.2.2 Dengue Prevalence...27
  - 5.2.3 Leishmaniasis Prevalence...29
  - 5.2.4 Yellow Fever Prevalence...30
  - 5.2.5 Chagas Disease Prevalence...31
  - 5.2.6 Filariasis Prevalence...32
  - 5.2.7 Schistosomiasis Prevalence...32
  - 5.2.8 Onchocerciasis Prevalence...33
- 5.3 Acute Respiratory Infection (ARI)...33

## **Chapter 6: Responses to Climate Change – Protection and Mitigation Efforts...35**

- 6.1 Protecting Children from Impact of Climate Change: What Needs to be Done?...35
- 6.2 Developing the Adaptive Capacity of Communities...36
- 6.3 Role of Children and Adolescents as Agents of Change...37
- 6.4 Social Mobilization: Putting Climate Change on the Social Agenda...39
- 6.5 Child Amazon Agenda...41

## Executive Summary

The production of "Climate Change and Children", in 2007, made UNICEF take the first step to discuss the real impacts that children and adolescents around the world suffer with climate change. These effects are felt also in Brazil, especially in places where children and adolescents are in a situation of greater vulnerability, and, because of that, have larger challenges of environmental issues, and larger issues relating to their rights.

But the goal of this paper is mainly provoke different sectors of Brazilian society to the debate and mobilize to the construction of proposals and strategies, which put the child and the adolescent at the center of this process.

In addition of the reproduction of part of the publication "Climate Change and Children", produced by UNICEF International, in 2007, this document also presents several studies and reports to conclude, finally, that human activity affects global climate change, particularly the emission of gases that generate the greenhouse effect and cause global warming. "Most of the 9.7 million children still die every year are the result of dramatic decisions based on limited views that cause permanent damage to the environment."

"Even now those climate changes gained visibility, water sources are being polluted, forests have been wiped out, species of animals have disappeared and the health of the population has been hampered because of the pollution that we create. Young people in all stages of their education should be informed about the dangers of environmental degradation, abuse of fossil fuels and the possibilities of renewable energy. If nothing is done, climate change could make all the Millennium Development Goals (MDGs) less likely, delaying efforts to eradicate poverty improve health and protect the environment."

This document provides a Brazil profile regarding to the environment. Try to reveal the enormous challenges the country has been facing in recent years and why the Amazon is a central theme in any discussion that is made when it comes to climate change debate.

The rank puts Brazil among the four largest polluters in the world, behind the United States, European Union<sup>1</sup> and China. Brazilian emissions represent about 5% of global emissions. Unlike the other countries, whose main source is the burning of fossil fuels, in Brazil 75% of emissions occurs in land-use activities such as deforestation and burning for agriculture use.

Only the Brazilian Amazon forest per year delivered some 200 million tones of carbon (average for the period 1989 to 1998) of total national annual emissions of approximately 280 million tones of carbon. This analysis strengthens the evidence of the current study where the Brazilian Amazon has a central role in the national and international efforts that are being made for the country's effective contribution to combating global climate change.

---

<sup>1</sup> European Union is considered an only economic block.

Along with the studies and reports, this document also show how Brazilian society and government have been elaborating, in a participative way, proposals for mitigation, education and environmental citizenship, made in local and national conferences that are providing subsidies for the formulation and commitment of National Plan for Climate Change.

Finally, a number of proposals are listed, especially as regarded to the participation of children and adolescents in the construction of another world. In Brazil, an experience and well articulated strategy, developed by the Education Ministry has made possible to thousands of children and adolescents from 16 thousand schools of basic education, to participate and build mitigating proposals on the effects of climate change. For UNICEF in Brazil, this experience is strategic and will be reference to the construction and development of the Amazon Child Agenda, and in particular, UNICEF Seal of Approved Municipality.

UNICEF hopes, therefore, to contribute and built a qualified debate in the country and especially in the Amazon, to place the child and adolescent in the center of the debate on climate change that we all face today.

# Chapter 1: Impact of Climate Change and Children in Brazil

## 1.1 Background on the Brazilian Context

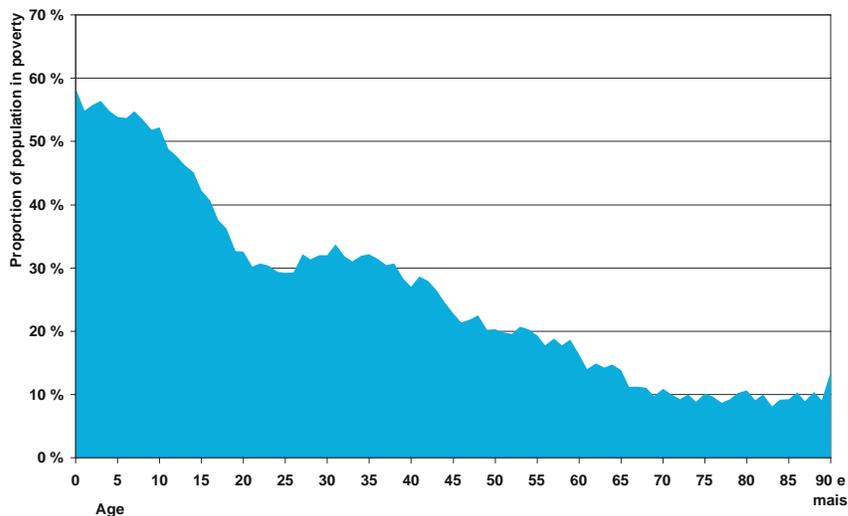
Brazil is classified as a middle income country and has the largest national economy in Latin America, the world's tenth largest economy, and is the ninth largest in purchasing power parity (PPP), according to the 2008 figures stated by the International Monetary Fund and the World Bank. According to the Brazilian Government, the Gross Domestic Product for 2008 was 2.9 trillion Brazilian Reais with a growth rate at 5.1 %.

One of the largest food producers in the world, agribusiness forms a major component of the country's economy. In 2007, it was responsible for 33% of the GDP, 42% of the country exports and employed 37% of the labor force in the country.

According to the Brazilian Institute of Geography and Statistics (IBGE), 190 million people live in Brazil, including 60 million children and adolescents in 5.565 municipalities distributed in 27 states. The population exhibits wide racial, regional and cultural diversity. The Brazilian population under 18 represents almost one third of the entire child and adolescent population of Latin America and the Caribbean. The North and Northeast regions are the most vulnerable regions and have the highest concentration of children and adolescents in the country (around 39.1% and 34.4% of the population, respectively).

IBGE estimates that there are almost 60 million poor people who are living in the country, of which almost 30 million are children, living mainly in the Northeast Region (13 million or 71.6% of all children in the region), and in the Amazon Region (4 million, representing 61.4% of all children living in the Amazon region).

Figure 1: Child Poverty in Brazil



Taking into consideration the nominal value of the minimum salary from 2001 to 2007, poverty in Brazil is stable. However, child poverty has increased in the same period. While these figures are striking, the percentage has fallen by more than half since

1990, indicating that Brazil has a good chance to reach the Millennium Development Goal 1 at the national level, based on national level statistics.

## 1.2 Key Climate Change Issues in Brazil

The rank puts Brazil among the four largest polluters in the world, behind the United States, European Union<sup>2</sup> and China. Brazilian emissions represent about 5% of global emissions. Unlike the other countries, whose main source is the burning of fossil fuels, in Brazil 75% of emissions occurs in land-use activities such as deforestation and burning for agriculture use.

Only the Brazilian Amazon forest per year delivered some 200 million tones of carbon (average for the period 1989 to 1998) of total national annual emissions of approximately 280 million tones of carbon. This analysis strengthens the evidence of the current study where the Brazilian Amazon has a central role in the national and international efforts that are being made for the country's effective contribution to combating global climate change.

In Brazil, especially in places where children and adolescents are in higher socio-economic vulnerability, these effects become more significant, and the largest environmental challenges are also major issues related to rights violations.

In this sense, was urgent to mobilize different sectors of Brazilian society to the debate and the construction of the mitigation proposals which nurture and / or removal of such effects on the lives of children and adolescents, meaning to say that the subject of rights should be at the center this discussion.

Over the last decade, a number of significant scientific findings on the impacts of climate change in Brazil have been revealed, taking into consideration the findings reported in the 2001 IPCC Report. As one of the major fast developing countries, Brazil ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and the Kyoto Protocol in 2002.

However, as a country rich in biodiversities and vast tropical forests, Brazil faces considerable amount of challenge from the impacts of climate changes. One of the biggest threats in Brazil is the high probability of desertification in the semi-arid region of the North East. Severe droughts in this region only aggravates the situation with drying up of major rivers, lack of vegetation, increase in temperatures and its cumulative impact on populations.

Alongside desertification, in the Amazon region, deforestation and forest degradation has also been a cause for concern and debates regarding the exaggerated levels of carbon emission. Researchers have found that deforestation impacts rainfall and climate patterns in the region. Activities such as slashing and burning rainforests release massive amounts of carbon dioxide into the atmosphere. An estimated 75 percent of Brazil's carbon dioxide emission is a result of deforestation. The major causes of deforestation include development of the highway transportation system, settlement programmes, government incentives for agriculture, financing of large-scale projects such as hydro dams, and land speculation.

---

<sup>2</sup> European Union is considered an only economic block.

In contrast, the southern region of Brazil is vulnerable to the impact of changes in the hydrological cycles, which over a long term period could increase the risk of excessive rainfall and changes in atmospheric humidity that influences both southern Brazil as well as the Amazon region. Climatic variability in Brazil has been referred to in the context of the droughts and floods that affected the north eastern region, the Amazon, as well as the southern parts of Brazil over the last ten years.

Other threatened Brazilian ecosystems include the Pantanal wetlands, the world's largest freshwater wetland, and the Brazilian reefs, the only reefs on the South American coast. According to the fourth IPCC report (2007), a 1.7-degree Celsius increase could result in up to 45 percent of the plants in Brazil's Cerrado (central savannas) becoming extinct by 2050. Rising sea levels could also make coastal areas in Brazil more prone to flooding, with researchers speculating that this could even lead to the disappearance of houses and buildings on the seashore, the destruction of ports, and the displacement of large populations. Probabilities of new hurricanes arriving on the coast are among other issues that have raised concerns.

### **1.3 Key Issues on Climate Change in the Brazilian Amazon**

As any other country in the world, Brazil is also considered to be vulnerable to climate change, not least due to its fragile, biologically diverse ecosystems. While the vastness of the country and its diverse geo-physical and climatic environment affects different parts of the country in very different ways, the tropical rain forest in the Amazon and the Pantanal wetland are of particular concern.

Changing rainfall patterns, especially in the drought-affected parts of the country, will mean poorer water resources and reduced water supply. Agriculture would suffer, aggravating the risk of famines. Less rain will also affect the hydropower supply, which, according to the International Energy Association, provides more than 80 per cent of the electricity that Brazil generates. Floods, which are already a serious problem for various regions, including in the Amazon region, may increase. The extent to which climate change will affect agricultural productivity is yet to be understood in greater detail. But possible effects on crops that are particularly important to the country's economy, such as corn, soybean, wheat, coffee and oranges, are a great concern.

Finally, rising temperatures are expected to help organisms that act as vectors for diseases, such as mosquitoes, which transmit dengue fever and malaria, and assassin bugs, which transmit Chagas disease.

The above mentioned situation presents a scenario where if adequate and timely action is not taken, the impact of climate changes on the environment will result in loss of livelihoods for the community, increase the burden of disease on children and adults, and render the already marginalized and poor segments of a society more vulnerable.

Any preventive and proactive action would necessitate a very good understanding of the nature of the impact, its diversity and the extent to which such climate changes would affect the different aspects of the community's life and impede the survival, development and growth of vulnerable groups such as children. This would need to be complemented by a thorough understanding of the social, technical and human infrastructure that exists in the Amazon region and the gaps that must be addressed and the disparities that must be removed in order to ascertain successful and innovative mitigation efforts.

## Chapter 2: Climate Change and Vulnerabilities

### 2.1 Vulnerabilities - How much those costs?

The frequency and severity of natural disasters have been increasing, and experts point to climate change as one of the culprits. While an average of 12 disasters took place per year in the first half of the 20th century, that number reached an astounding 350 in 2004<sup>3</sup>.

The human suffering caused by natural disasters is most profoundly felt in developing countries, particularly poverty-stricken nations that lack the resources to cope with their aftermath. Countries with a low Human Development Index ranking suffer higher mortality rates from disasters<sup>4</sup>.

In addition, catastrophic disasters often result in enormous economic damage, sometimes exceeding the gross domestic product of low-income countries.

While natural disasters are devastating for anyone who experiences them, children are the most vulnerable, due to their small size and relative inability to care for themselves. Children are more likely than adults to perish during natural disasters or succumb to malnutrition, injuries or disease in the aftermath. Natural disasters may force children out of their homes – or even their countries. They may become orphaned or separated from their families, and may be preyed upon by opportunistic adults.

Over recent years, studies related to the impact of climate change on populations in Brazil have agreed that urgent adaptation strategies are required for those regions of the country that may be severely affected in terms of climate and social vulnerability.

While there may be debates on the extent and pace of the effects of change, it is predicted that one of the most vulnerable regions to climate change will be the semi-arid Northeast<sup>5</sup>, due to its 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 that could lead to more arid climate in large areas.

One of the country's principal crops, soy, is particularly sensitive to extreme heat and dry weather conditions which according to scientists, are expected to worsen in the decades ahead. Other economically important crops such as coffee and corn are also susceptible to temperature increases. In the long term, none of Brazil's crops are expected to benefit from global warming and this would have severe repercussions on issues related to food security and nutrition.

Global warming may cause agricultural losses of \$ 7.4 billion in grain crops in Brazil, in 2020. If climate change is severe, the damage doubles and knocking can get to US\$

---

<sup>3</sup> United Nations Children's Fund East Asia and Pacific Regional Office, 'Emergencies: Refugees, IDPs and child soldiers; natural disasters', UNICEF EAPRO, Bangkok, 2005, p. 6.

<sup>4</sup> United Nations Development Programme Bureau for Crisis Prevention and Recovery, *A Global Report: Reducing disaster risk – A challenge for development*, UNDP, New York, 2004, pp. 39-40.

<sup>5</sup> National Climate Change Plan. Public Consultive Version, September 2008, Federal Government, Brasília

14 billion in 2070. And in opposition of the history, the soybean crop appears to be the most affected. It is important to emphasize that in the history of the occupation of the Amazon, two major crops have been responsible for significant losses of primary forest: grass for cattle and soybeans.

Increasing the temperature of the planet associated with the reduction of water availability could turn the Amazon region into a savanna until half of the century. This is what is expected in the second part of the document of Intergovernmental Panel on Climate Change (IPCC) from the United Nations (UN).

Research projections show that such climate vulnerabilities may affect about 2 million rural families of smallholder farmers that currently live in the Northeast<sup>6</sup> under very high levels of poverty. According to the 2007 official data, around 24.2% of families in the Northeast live in acute poverty, with 71.6% of children and adolescents living in poor families<sup>7</sup>. These families and especially children, thus have a low adaptive capacity to cope with impacts such as repeated droughts, floods, heat waves etc. Presently, about 10.2 million children in the Northeast live in households without access to safe water. With lowering water levels, decreased rainfall and temperature increase, the situation of water scarcity can only become worse.

In the Amazon region, which traditionally has an abundance of rivers and adequate fresh water availability, the droughts of 2005 and the floods of 2009 revealed a complex situation, and scientists are yet to find answers to the phenomenon.

On the other hand, the high levels of deforestation, forest fires and carbon emissions also render communities vulnerable due to a combination of factors such as forced migration, violence over land usage, access to natural resources etc. according to WWF reports in 2007, in some states such as Paraná state, in the south region, over the years about 2 million people have been displaced due to soy production.

Studies reveal that continued deforestation and forest fires over a longer term period would result in temperature rise and affect the epidemiological trends in the region. Although direct attributions to climate changes have not yet been suggested, adverse changes contribute to the aggravation of vector infections such as dengue and children are considered to be at a greater risk owing to their less developed immune systems. Over 85.000 cases of dengue fever were reported in southwestern Brazil in early 2007, a 30-percent increase from the previous year.

## 2.2 Existing Vulnerabilities and Impact of Climate Change on Water Resources

Throughout the globe, a decline in global freshwater resources profoundly threatens health and livelihoods. Increasing contamination, over-pumping of aquifers and degradation of freshwater catchments areas is exacerbating an already precarious situation.<sup>8</sup> Fierce competition for a shrinking water supply has resulted in over-extraction for industry and agriculture, falling groundwater levels and failing domestic water sources. At the same time, pollution from industry, agriculture and improper management of human waste threatens previously safe water sources.

---

<sup>6</sup> FAO, 2000

<sup>7</sup> Devinfo Brazil 2008

<sup>8</sup> Bartram, Jamie, and Richard Ballance, eds., *Water Quality Monitoring: A practical guide to the design and implementation of freshwater quality studies and monitoring programmes*, United Nations Environment Programme and World Health Organization, Nairobi and Geneva, 1996, p. 1.

In already dry regions such as North Africa and the Eastern Mediterranean, climate change is expected to exacerbate the decline in water quality and quantity.<sup>9</sup>

Careful management of water and sanitation services is yet the only possible answer to face the risks of water scarcity. New groundwater sources may have to be developed with the anticipated behaviour of aquifers in mind, and new methods and technologies should be developed to safely exploit and protect water resources. Water recycling and reuse may become not only more cost-effective, but imperative.

Protecting and managing the water environment is an enormous task, requiring commitment, effective monitoring, changing practices, and specific interventions at regional, national, intermediate and community levels.

The global consumption of water grew twice as fast as the world population in the last century - and the poorest countries must suffer with it in the coming years. According to the report by Tearfund, the majority of people without water will be forced to leave their homes, causing new waves of immigration. One of the worst effects of water shortage is the food rising price.

On average, 70% of global water is used in agriculture. In a world with less and less water available, the poorest countries will have to choose whether to use water for irrigation or for domestic and industrial. Another factor that increases the concern about the lack of water in the coming years is global warming - some scientists predict an increase in the occurrence of droughts and the emergence of more deserts.<sup>10</sup>

### 2.3 Abundance and chaos

Brazil lives with extremes situations, the permanent shortage of water in semi-arid and a relative abundance in the Amazon region and flooded areas, in the central part of the country called Pantanal.

Brazil has a strategic role in the discussion on the availability of water for human consumption, with 20% of all available fresh water in the world. The whole of the Amazon River basin, which covers several countries other than Brazil, contains 70% of the global availability of fresh water and is comprised of over a thousand rivers. Pollution, siltation and deforestation - sequels of unsustainable economic activities - are today the almost death of once perennial rivers. This is the case of the Xingu (in Mato Grosso State), Negro (in Amazonas State) and Acre (in Acre State) rivers.

The first, however, has been helped. Three years ago, a group of people and NGOs launched the "Y Ikatu Xingu" (clean and good water in the Kamaiurá language). The proposal is to recover the river sources and wood bordering rivers (which borders the watercourses) of the Xingu River. Negro River didn't have the same fate. Remains the deposit of waste and sewage produced by nature in cities located on its banks. In 2005, the situation got more complicated. A strong drought - the largest of the last 103 years - has reached the eastern Amazon, where some rivers reached down six centimeters per day. Millions of dead fish and rotting in the beds of tributaries of the Amazon which once served as source of water, food and transport to coastal communities.

---

<sup>9</sup> Campbell-Lendrum, Diarmid, Carlos Corvalán and Maria Neira, 'Global Climate Change: Implications for international public health policy', *Bulletin of the World Health Organization*, vol. 85, no. 3, March 2007, pp. 235-236.

<sup>10</sup> Source: Amazônia News Agency

Abundance and chaos - Even rich in freshwater, Brazil lives a chaos in the distribution of drinking water for the population. In addition to badly distributing, the country did not properly take care of non-renewable natural resource. The Amazon and the Pantanal are examples.

Entire communities of these regions suffer from health problems caused by contamination, lack of sanitation, presence of mercury used in mines and for the indiscriminate use of pesticides in areas near the springs. All this is because many, despite the need to contain the waste, still believe that water is an unlimited natural resource. Only 59.80% of urban households have a network of water.

The abundance of water in the Amazon, often unfit for human consumption, in contrast to the shortages in other regions. The Northeast, for example, has only 3% of fresh water. In Pernambuco State, there are only 1,320 liters of water per year per inhabitant. The United Nations (UN) recommends a minimum of 2 thousand liters.

## 2.4 Changes in Precipitation, Rainfall and Water Security

The Amazon region has one of the largest single source of freshwater runoff in the world. As such the availability of water resources is critical to the preservation and restructuring of forest and grassland systems. Climatic changes such as temperature rise are known to have increased the likelihood of wildfires and its frequencies, as well as altering plant composition and inducing stress in trees.

It has been estimated that up to 40% of the Amazonian forests could be affected by even slight decreases in precipitation<sup>11</sup>. According to WWF reports, General Circulation Models (GCM) project a regional increase of 2–3°C by the year 2050 and a decrease in precipitation in the Amazon during dry months, leading to widespread drying<sup>12</sup>.

Recent studies have also explained the link between deforestation and precipitation in the Amazon. In 2005, research done by Chagnon and Bras found that deforestation results in dramatic changes in the climatological rainfall occurrence patterns. The high-resolution satellite precipitation measurements revealed significantly more rainfall occurrence over deforested areas. They also found a long-term shift in the seasonality of precipitation that correlates with deforestation, suggesting the two are closely associated. Rainfall accumulations appeared to decrease significantly at the end of the wet season, and increased at the end of the dry season<sup>13</sup>.

Research on river flow patterns in Brazil (Amazon, southern and northeastern Brazil) demonstrate high correlations with the fields of anomalies vis a vis sea surface temperature in the tropical Atlantic and Pacific oceans, suggesting a possible association between river flows and extreme El Niño, or heating in the tropical North Atlantic Ocean<sup>14</sup>.

---

<sup>11</sup> 'Global Review of Forest Fires', Rowell and Moore, 2000

<sup>12</sup> 'Decadal and multidecadal variability of climate in the Amazon basin', Marengo, J., U. Bhatt, and C. Cunningham, *International Journal of Climatology*, 2000

<sup>13</sup> 'Contemporary climate change in the Amazon', Chagnon, FJF and Bras, RL., *Geophysical Research Letters* 32: L13703, 2005

<sup>14</sup> 'Hydro-climatic and ecological behaviour of the drought of Amazonia in 2005', J. A. Marengo, C. A. Nobre1, J. Tomasella1, M. F. Cardoso1 and M. D. Oyama, Feb 2008

## Chapter 3: Climate Change: What are the risks?<sup>15</sup>

### 3.1 Impacts of global warming temperature

Rising sea levels and melting ice caps ... severe weather events ... drought and flooding. With its dramatic and harmful effects on the environment, climate change threatens the basic elements of life for people throughout the world, harming health and the environment and limiting access to water, food and land.

As such, it will potentially make every one of the Millennium Development Goals less achievable, slowing efforts to eradicate poverty, improve health and protect the environment.

Evidence is growing that climate change is contributing to the burden of disease. According to the World Health Organization, in 2000, climate change was estimated to be responsible for approximately 2.4 per cent of worldwide diarrhea and 6 per cent of malaria in some middle-income countries<sup>1</sup> – diseases that disproportionately affect young children in developing countries.<sup>2</sup>

As the world warms, people could suffer hunger, water shortages and coastal flooding. As rains fail, crops will wither and livestock will die, exposing children to starvation and diminishing water supplies for drinking and hygiene.

Today's evidence suggests that developing countries – which are mostly located in warmer regions and whose major source of income is agriculture – will be worst hit by changes in rainfall patterns, greater weather extremes and increasing droughts and floods. Change in precipitation patterns is likely to affect the quality and quantity of water supplies, thus compounding the impact of poor water and sanitation, as well as malnutrition. Weather-related physical hazards such as hurricanes and flooding are likely to intensify, resulting in more deaths, injuries and trauma.

Without action today, the costs and risks of a 5°C–6°C warming – which is a real possibility for the next century – will be equivalent to losing at least 5 per cent of global GDP each year, now and into the foreseeable future. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20 per cent of GDP or more<sup>16</sup>.

By 2020, climate change is projected to expose an estimated 75 million people in Africa<sup>17</sup> alone to increased water stress. Towards the end of the 21<sup>st</sup> century, a projected sea-level rise will affect low-lying, heavily populated coastal areas. Adaptation costs could amount to at least 5–10 per cent of GDP. New studies confirm that Africa is particularly vulnerable to climate variability and change due to its multiple stresses and low adaptive capacity.<sup>6</sup>

In general, developing countries – in particular the poorest – depend heavily on agriculture, the most climate-sensitive of all economic sectors, and suffer from inadequate health care and low-quality public services.

---

<sup>15</sup> The same

<sup>16</sup> HM

<sup>17</sup> Some estimate that this number can get up to 250 millions.

As with any complex global phenomenon, the effects of this mounting crisis are far-reaching and interconnected. The droughts that decimate a village's food and water supply create aching hunger, to be sure – but hunger alone is just one facet of this terrible story. A hungry family may not be able to send their children to school or afford health care. Hunger may drive families out of their homes, creating an environment that fosters crime.

Climate change has evolved from an 'environmental' issue into one that requires collective expertise in sustainable development, energy security, and the health and well-being of children.

### 3.2 The risks of the deforestation

"The International Education and Resource Network, Trinidad and Tobago Global Disaster Safety Map Project allows students to learn about disasters and the state of disaster management in their communities. It also empowers them to take measures for mitigation and preparedness. Many factors that exacerbate the impact of natural disasters are easily identifiable and avoidable, including indiscriminate dumping into waterways, improper or illegal land development, and unsustainable agricultural practices.

"Therefore, national reforestation and watershed rehabilitation programmes are aimed at managing surface and groundwater resources and protecting watersheds to maintain an adequate level of water supply. The process is implemented by students, who create maps of their communities with specific measures for mitigation and preparedness. These community disaster safety maps are then joined to form a national safety map, which in turn is combined with other nations' maps to create a global safety map.

This global safety map regards to, among other climate change issues, to deforestation matter.

Deforestation of the Amazon forest may cause losses of US\$ 1 trillion. Data released by experts from United Nations Program for Environment (UNEP) and by 29 research institutions around the world warning that the rains generated in the Brazilian Midwest and in the Southern Cone countries are mostly from the evaporation of water the Amazon region.

Deforestation that commits the evaporation, therefore, would affect the water cycle and the entire agricultural production of the region. "Brazil needs to think about preserving the Amazon as an economic issue that will have direct impact on their exports and agricultural production in the next 50 years," said Pavan Sukhdev, head of the economic division of UNEP and former executive of the Deutsche Bank. "The Brazilian government needs to understand that preserving the forest is not a luxury, it is an economic necessity to be," said Sukhdev. Between 2000 and 2005, 48% loss of forest cover in the world occurred in Brazil and 13% in Indonesia.

A series of studies published by researcher Daniel Nepstad estimated that 55% of the forests of the Brazilian Amazon would be cleared, logged, or damaged by the year 2030, releasing approximately 20 billion tons of carbon to the atmosphere if the trends

of deforestation and drought were to continue<sup>18</sup>. At present about 18 percent of the Brazilian Amazon has been cleared of forests. In 2005, the FAO estimated that the Amazon was deforested at a rate of 4.3 million hectares per year between 2000 and 2005.

Recent studies have shown that the flooding occurred in the south of the country in 2008 is directly related to climate change, in a synergistic relationship with the Amazon forest. The intense deforestation produces effects not yet fully designed. The biggest problem relates to the many meanings of this tragedy for the communities living in the region, with the worsening land disputes, in which whole families are evicted from their land, producing the life precariousness in the region, with particularly negative impacts on children.

In this sense, and pointing out the seriousness of the processes of deforestation and burning that place the country among those that produce more pollution in the world, the Brazilian Amazon Forest has a central role in the national and international efforts that are being made for the country's effective contribution in combating global climate change. Brazil maintains its territory in the largest stretch of rainforest on the planet. Only the Brazilian Amazon Forest stores about 50 billion tons more than its 4 million square kilometers. Three quarters of the country's whole carbon emission is due to deforestation and burning in the region.

The report of the IPCC projected for Amazon region shows the possibility of desertification in large areas in its eastern portion and the impact in coastal wetland, especially on the mangroves. This scenario is caused both by the trend of increasing global temperature, and by deforestation. A recent study<sup>19</sup> suggests that Amazon already has a strong influence of the climate change. With the criteria adopted by the IPCC, this study shows that the states of Pará and Maranhão, the vulnerability in the climate is very high, comparable to the semi-arid region of Brazil, expected to be a more dry than nowadays.

"The report shows that the climate in the region will become increasingly warmer over the century. Already between 2010 and 2040, the temperature should rise 2 degrees Celsius from eastern Pará to Maranhão. From 2041 to 2070, this high-fold, 4 degrees Celsius. The most worrying is that in any of the scenarios, the system of rain must have nearly the same impact: reduction of 10% in the first period and 20% in the second. For the period 2071 to 2100, the conclusion of the report is to further increase of the temperature, with possible raised by 7 degrees in the eastern Amazon region, with alternation of long periods of dry climate, with rainfall concentrated in a few seasons of the year ".<sup>20</sup>

These concerns led the Brazilian government to take up several measures including the creation of 23 million hectares of public forest reserves from January 2004 through December 2006, the development of the "National Pact for Valuing the Amazon forest and Ending Deforestation" and other legislation proposals to establish reduction targets on national deforestation<sup>21</sup>.

---

<sup>18</sup> 'The Costs And Benefits Of Reducing Carbon Emissions From Deforestation And Forest Degradation In The Brazilian Amazon', Nepstad et al. published by The Woods Hole Research Center for the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP), Thirteenth session 3-14 December 2007 Bali, Indonesia

<sup>19</sup> Developed by INPE

<sup>20</sup> Local newspaper of Para, web, DiárioNet, 2008.

<sup>21</sup> 'Smallholders, the Amazon's new conservationists', Campos, M. T., and D. C. Nepstad, *Conservation Biology*, 20(5), 1553-1556, 2006

However, in September 2008, according to national and international press reports, there was a resurfacing of alarms over the destruction of the Brazilian rainforest when it was known that deforestation jumped by 64% over the preceding 12 months, according to the official data released by Brazil's National Institute for Space Research<sup>22</sup>. The controversial news over these rates led the Brazilian government to reveal monthly figures on deforestation which then showed a fall of 25% between the months of May and June. But this fall only happened because it is also a period of heavy rain in the region.

The issues on deforestation were also raised at the Intergovernmental Panel on Climate Change session in 2007 particularly with reference to loss of biodiversity and sustainable management of forests<sup>23</sup>.

### 3.3 The Risks of Greenhouse Gas Emission

Brazil has so far been considered to be clean in terms of energy emissions, being based mostly on hydroelectric power and having a considerable share of biofuels. However, according to environmental research findings, the exaggerated rates of greenhouse gas emissions (70%) from the Amazon rainforest, owing largely to deforestation practices, could eventually result in the extinction of the forest itself.

Despite the Brazilian government's efforts to stop the loss of the Amazon rain forests, deforestation rates continued to be on an increase. From August 2007 to July 2008, Brazil deforested almost 3 million acres. The annual deforestation data gathered by Brazil's space agency revealed a 3.8 percent increase from the 2007 rate, after three successive years of declining deforestation<sup>24</sup>.

Simulations have projected that by 2070, the high climate sensitivity (the global average temperature increase for each unit of additional concentration of CO<sub>2</sub> in the atmosphere) increases the average temperature to as high as 14°C in the Amazon. This implies a peak temperature of 50°C and over, which not only results in the death of the forest but also increases the probabilities of human morbidity and mortality.

The global stock of carbon contained in the soil, as said to be the case for the Amazon region, further gives it the potential to reach the threshold for the runaway greenhouse effect<sup>25</sup>.

### 3.4 Analysis of government position and policies on combating climate change

Over the last decade, growing international research and focus on climate change has meant that Brazil too, recognized the role it played in the international forums on climate change. A series of events has further strengthened the understanding that the country is not immune to the effects of climate change.

On 1 December 2008, the Brazilian government launched the National Plan on Climate Change and the Amazon Fund by president Luiz Inácio Lula da Silva. The event coincided with the first day of COP 14 in Poznan, the country with the largest area of

---

<sup>22</sup> 'Brazil: Deforestation rises sharply as farmers push into Amazon', Tom Phillips, *The Guardian*, 1<sup>st</sup> September 2008

<sup>23</sup> IPCC Climate Change Report:2007

<sup>24</sup> 'Latest Research Shows Increase in Brazil's Deforestation', WWF, Dec 05, 2008

<sup>25</sup> Ibid.

forest in the world announced its climate change plans, which include reducing deforestation but excludes the possibility of trading the carbon stored in its forests.

Brazil's National Plan on Climate Change is based on a very participatory process, according to the Brazilian government authorities. The plan is an important instrument for national climate policy. The two main challenges in achieving the objective of reducing greenhouse gas emissions are emissions from land use, land use change and forestry and to follow a low carbon path of development.

The plan focuses on seven areas:

1. Low carbon development
2. Renewable electricity;
3. Biofuels;
4. Deforestation;
5. Forest cover;
6. Vulnerability and adaptation;
7. Research and development.

Its goals include the following:

- a 10% reduction in Brazil's annual electricity consumption by 2030;
- maintaining the high proportion of electricity generated from renewable sources (currently 89%);
- annual increases of more than 10% in the already widespread use of sugarcane ethanol as a fuel for motor vehicles;
- making it obligatory for all diesel to contain 5% biodiesel from 2010 onwards.

The plan also aims to achieve a 40% reduction in average annual deforestation in 2006-09 in comparison with 1996-2005, followed by two further reductions of 30% in the periods 2010-13 and 2014-17. Achieving these targets, however, will depend on generating the necessary funds – not just domestically, through initiatives such as the Amazon Fund, but also internationally.

Under the plan, deforestation is to be reduced by 70 per cent by 2018, which would avoid 4.8 billion tons of greenhouse gas emissions. Brazil wants "to eliminate net loss of forest cover by 2015"<sup>26</sup>. WWF and Greenpeace have criticized the Amazon Fund, pointing out that even if the fund were to meet its target, it would still result in the deforestation of more than 5,000 square kilometres per year.<sup>27</sup>

### 3.4.1 Kyoto Protocol and its control mechanisms

The Kyoto Protocol establishes a series of control mechanisms. Under the Treaty, countries must meet their targets primarily through national measures. However, the Kyoto Protocol offers them an additional means of meeting their targets by way of three market-based mechanisms.

The Kyoto mechanisms are:

- Emissions trading – known as "the carbon market"
- Clean development mechanism (CDM)
- Joint implementation (JI)

---

<sup>26</sup> <http://www.redd-monitor.org/2009/01/23/brazils-national-plan-on-climate-change-and-the-amazon-fund-%E2%80%9Cthis-plan-does-not-create-any-carbon-credits-or-right-to-emissions%E2%80%9D/>

<sup>27</sup> idem

The mechanisms help stimulate green investment and help Parties meet their emission targets in a cost-effective way.

The Kyoto mechanisms:

- Stimulate sustainable development through technology transfer and investment;
- Help countries with Kyoto commitments to meet their targets by reducing emissions or removing carbon from the atmosphere in other countries in a cost-effective way;
- Encourage the private sector and developing countries to contribute to emission reduction efforts.

Brazil was one of the pioneers in creating procedures for the approval of Clean Development Mechanism (CDM). The country established a national authority, the Inter-ministerial Commission on Climate Change (*Comissão Interministerial de Mudança Global do Clima*) comprising members from some of the most important ministries and also the Brazilian Climate Change Forum, that has the participation of the ministries, private sector, research institutes, universities and NGOs. Brazil has 13% of the total CDM projects under way and has been attracting a great deal of interest from foreign investment funds, together with the private sector, which has been playing a pivotal role in developing the carbon market in Brazil.

Brazil, together with China and India, is one of the key players that are supporting developed countries to attain their carbon reduction targets through the Clean Development Mechanism (CDM) of the Kyoto protocol. Many CDM projects have already been approved in Brazil and subsequently at the UN-CDM Executive Board. The most representative Brazilian CDM projects include the expansion of landfill gas and the use of biomass as an energy source.

And even though Brazil made some improvements on the adoptions of control mechanisms, specially the MDL, many specialists continued to affirm that they weren't enough to guarantee, among others, the Amazon deforestation.

The Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO<sub>2</sub>, which can be counted towards meeting Kyoto targets.<sup>28</sup>

The mechanism is seen by many as a trailblazer. It is the first global, environmental investment and credit scheme of its kind, providing a standardized emissions offset instrument, CERs. A CDM project activity might involve, for example, a rural electrification project using solar panels or the installation of more energy-efficient boilers.

The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets.

---

<sup>28</sup> [http://unfccc.int/kyoto\\_protocol/mechanisms/clean\\_development\\_mechanism/items/2718.php](http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php)

A new mechanism were created, in order to respond to the necessity of different criteria to preserve the forest and give an immediate economic answer. In June 2008 Secretary-General Ban Ki-moon launched the new mechanism: The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD).

According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, the forestry sector accounts for about 17 per cent of global greenhouse emissions, making it the second largest source after the energy sector. The main cause is deforestation.<sup>29</sup>

The UN-REDD Programme is aimed at tipping the economic balance in favor of sustainable management of forests so that their economic, environmental and social goods and services benefit countries, communities and forest users while also contributing to important reductions in greenhouse gas emissions. The aim is to generate the requisite transfer flow of resources to significantly reduce global emissions from deforestation and forest degradation. The immediate goal is to assess whether carefully structured payment structures and capacity support can create the incentives to ensure actual, lasting, achievable, reliable and measurable emission reductions while maintaining and improving the other ecosystem services forests provide.

Despite the concerted efforts being made by the Brazilian government, the year 2008 and 2009 saw an increase in deforestation rates; while natural disasters and emergencies in the southern parts of the country with the floods situation sparked renewed concern on the impact of climate changes on populations.

Thus concerns regarding government policies, climate change and vulnerabilities continue to be raised by some researchers, NGOs and environmental rights groups in Brazil. For instance, the country is presently exploring new oil fields and is interested in expanding its projects on oil extraction. There are doubts as to whether the government will trade off emissions from oil against the emissions saved by reducing the rate of deforestation. Again, while the country has made extensive plans for vast increases in the area of biofuel crops, it is not entirely clear as to whether these plans are really compatible with all the attempts to reduce deforestation. The concern raised by human rights organizations in Brazil is on the question of the rights of vulnerable populations such as those who live in the Northeast and Amazon region. The unfavorable labor conditions in sugar plantations located in the northeast, which cover millions of hectares in Brazil, are among those cited as examples.

Among other persisting doubts, the issue of Brazil's plans of generating energy from new hydropower dams that have been planned for construction between 2007 and 2016 continues to be debated by human rights and environmental activists alike. It has been critiqued that the construction of dams signifies forest flooding, additional greenhouse emission, destruction of natural river flow patterns and forced evictions. The region continues to suffer from severe access and communication problems, with river ways being the principal routes for transport. Severe droughts in that region in the past have presented serious challenges faced by the communities vis a vis access to social infrastructure. The linkage between these challenges and development plans in that region remain unresolved for many and hence remain a pressing concern for the local population.

---

<sup>29</sup> <http://www.un-redd.org/UNREDDProgramme/>

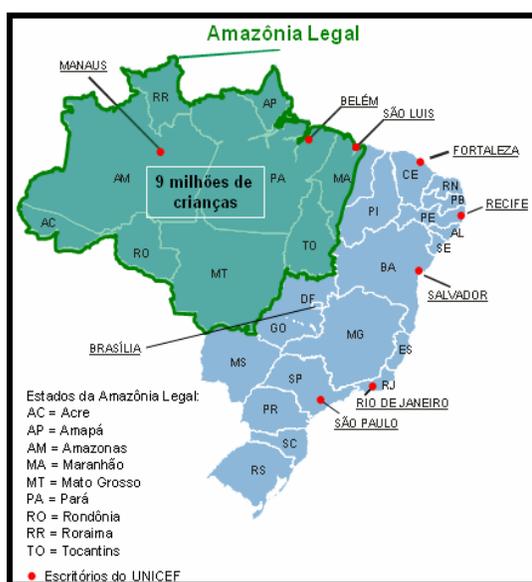
Finally, while the National Plan makes a clear reference to the need for reducing the vulnerabilities of populations, specific focus on marginalized population groups such as children and how they may be affected due to the proposed changes have not been spelt out clearly, thus interrelationships between development plans, poverty reduction, food security, access to basic social services and emergency responses need to be further elaborated.

## Chapter 4: Child Population in the Amazon

### 4.1 Socio-Demographic Background

With 23 million people of which 9.2 million are children, the Brazilian Amazon represents 61% of the Brazilian territory with an area of 5,033,072 km<sup>2</sup>. It hosts one third of all rain forests on the planet, which concentrate about 30% of the world's biological diversity and feature an immense genetic potential of high economic and social interest, and offer high value forest products to the market. About 20% of all non-frozen drinking water on the planet – an increasingly scarce resource – flows through the Amazon river basin, representing 80% of all water available in the Brazilian territory.

Figure 3: Total Child Population, Amazon



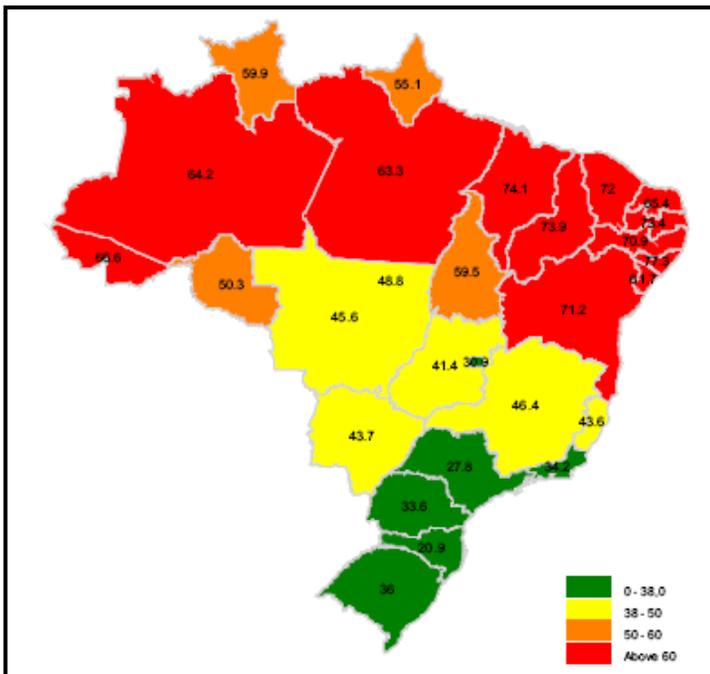
The Amazon region in Brazil accounts for around 23,061,000 people, representing 12.8% of the Brazilian population. The region is populous, young and heterogenous. Around 40% of the population is less than 17 years old, thus comprising 9.2 million children and adolescents.

However, the region itself is sparsely populated when compared to the rest of the country with each square kilometer, covered on average by only 3.3 inhabitants as opposed to other Brazilian regions where the proportion is at 40.5 inhabitants per km<sup>2</sup>.

### 4.2 Child Poverty in Northern Brazil (Amazon region)

In Brazil, while 31.5% of the population is considered poor because they earn less than half the minimum wage per month, this percentage rises to 48.8% for families with children between 0 to 17 years. Besides being concentrated among children, data reveals that between 2001 and 2006 the decline in poverty and extreme poverty levels observed in the country have not benefited all equally. The least benefiting category was the child population where the reduction in poverty was only at 4%, while among adults and elderly this reduction fluctuated between 7% and 18%.

Table 1: Situation of Child Poverty (0-17 years) by Brazilian states and %, 2007				
State	% of Child Poverty		State	% of Child Poverty
ALAGOAS	77,3		AMAPA	55,1
MARANHAO	74,1		RONDONIA	50,3
PIAUI	73,9		MINAS GERAIS	46,4
PARAIBA	73,4		MATO GROSSO	45,6
CEARA	72,0		MATO GROSSO DO SUL	43,7
BAHIA	71,2		ESPIRITO SANTO	43,6
PERNAMBUCO	70,9		GOIAS	41,4
ACRE	66,6		RIO GRANDE DO SUL	36,0
RIO GRANDE DO NORTE	65,4		RIO DE JANEIRO	34,2
AMAZONAS	64,2		PARANA	33,6
PARA	63,3		DISTRITO FEDERAL	30,9
SERGIPE	61,7		SAO PAULO	27,8
RORAIMA	59,9		SANTA CATARINA	20,9
TOCANTINS	59,5		Brazil Average	48,8



The northern region, all of which lies in the Amazon area, has the highest proportion (61.1%) of child and adolescent population living in poverty. In some states such as Maranhão, this figure reaches 74%. The situation of indigenous children and youth is even more serious. According to the IBGE, 71% of indigenous children and young people are poor, living in households with a family income that is barely up to the minimum wage of Brazil.

Looking at poverty from a multidimensional perspective, and taking into account its linkages with health, housing, education, rights protection etc.

the trends on child poverty in the Amazon region presents serious challenges to the child survival and development.

### 4.3 Child Survival and Development Indicators

By altering weather patterns and disturbing ecosystems, climate change has significant implications for human health. Many of the main global killers of children, including malaria, diarrhea and malnutrition, are sensitive to climatic conditions such as flooding.<sup>30</sup>

The effects of global climate change are likely to be most pronounced in those areas bordering current disease transmission zones.<sup>31</sup> Temperate countries including Armenia, Azerbaijan, Tajikistan and Turkmenistan have lately seen evidence of a resurgence of malaria.

In addition, factors that play a role in climate change, such as emissions from vehicles and factories, significantly harm children's health. Deaths from asthma, which is the most common chronic disease among children, are expected to increase by nearly 20 per cent by 2016 unless urgent action is taken.<sup>32</sup>

Since many aspects of the physiology and metabolism of children differ markedly from those of adults, some of the health impacts of climate change are also likely to differ.

In the scenario of increasing average temperature, is also close to the breeding of disease-transmitting insects, increasing the incidence of diseases like dengue, yellow fever and encephalitis.

### 4.4 Child Malnutrition

According to the 2006 figures, the chronic malnutrition rate for Brazil was at 7%. For the Northern region, all of which is forms a part of the Amazon, this rate was at 14.8%<sup>33</sup>. Malnutrition in the region is a good example of how climate change may adversely impact upon the lives of children in the Amazon region. The projected climate change scenarios suggest some shifts in agricultural production and its related health consequences, particularly in regions such as Sub-Saharan Africa, where large numbers of children are already malnourished.

Several studies and research undertaken in the Amazon region reveal prevalence rates for malnutrition, intestinal parasitic infections, anemia, and iron deficiency in under-five children that are way higher than the national figures. In a population based survey conducted in two counties of western Amazon, Assis Brazil and Acrelandia, intestinal parasites were detected in 32.5% children; and anemia and iron deficiency were diagnosed in 30.6% and 43.5% of the children respectively. Evidence of anemia was found in only 47.6% of the children with depleted iron reserves, indicating that hemoglobin measurement alone could severely underestimate the magnitude of iron

---

<sup>30</sup> World Health Organization Regional Office for Europe, *Floods: Climate change and adaptation strategies for human health*, WHO, Copenhagen, 2002, p. 21.

<sup>31</sup> World Health Organization, *Climate Change and Human Health Risks and responses*, Chapter 7, WHO, Geneva, 2003, p. 19.

<sup>32</sup> World Health Organization, *Asthma*, Fact Sheet N 307, August 2006.

<sup>33</sup> Source: Brazil Devinfo, PNAD 2007 data

deficiency in a population<sup>34</sup>. Interestingly, in both towns, anemia and malnutrition were significantly more prevalent among children in the lowest socioeconomic stratum.

The study further mentions that for some indicators such as iron deficiency the lack of prevalence estimates for anemia in child population make it difficult for researchers to undertake comparative analysis. This population based survey was thus one of the first ones to be undertaken in the Amazon region. A key observation made by the researchers point out that 31.9% of the anemic children had no biochemical evidence of iron deficiency and less than half of them had low hemoglobin rates. This implies that at least within this population, the cause of anemia needs to be examined in relation to the nutritional status, incidence of infection and other such factors.

In another study undertaken amongst the indigenous population in the Amazon, the findings suggested that approximately 25% of Surui children (less than 10 years) suffered from malnutrition. According to the researchers, this high malnutrition rate among the Surui population could be attributed to the low level of sanitation and inadequacy of safe water in the villages. The rate of acute respiratory infections accounted for 58% of the causes of hospitalization for children under 10 years, and this rate was followed by infectious and parasitic diseases (mainly gastroenteritis), accounting for 35% of the causes<sup>35</sup>.

The paper highlights that these indicators have shown substantial improvement when compared with studies undertaken in previous years. The diversification in the income sources of the community has been considered to have played an important role towards the overall improvement in malnutrition figures. However, the anemia prevalence did not reveal commendable reduction trends. And finally, while analyzing the causes of anemia prevalence within this community, the study highlights that despite increase in caloric intake, nutritional deficits continued to exist.

Similar findings have been reported in another study on children from the Pakaanóva community. The frequency of stunting among the Pakaanóva was quite high when compared to national figures for Brazil (50% amongst children between two and five years and 45.8% for children between 2 to 10 years<sup>36</sup>. These conclusions present a worrying nutritional situation for this vulnerable community that continues to suffer due to adverse socio-economic and environmental factors.

The insufficient epidemiological information available on these communities makes it very challenging to link the situation of chronic malnutrition with the high presence of high morbidity and mortality from infectious and parasitic diseases such as diarrhoea, pneumonia, malaria and tuberculosis amongst the community.

The present indicators of child health in several of the Amazonian communities in Brazil are clearly linked to several key issues including overall poverty levels, lack of adequate nutrition, presence of parasitic infections and diseases, inadequate access to clean water and health services. These circumstances already necessitate preventive and corrective action to address the socio-economic and environmental conditions of the region that hinder child survival and growth.

---

<sup>34</sup> 'Child health and nutrition in the Western Brazilian Amazon: population-based surveys in two counties in Acre State', Pascoal Torres Muniz et al, *Cad. Saúde Pública, Rio de Janeiro*, 23(6):1283-1293, June 2007

<sup>35</sup> 'Nutritional status and anemia in Suruí Indian children, Brazilian Amazon', Jesem D. Y. Orellana et al, *Jornal de Pediatria, Vol. 82, Nº5*, 2006

<sup>36</sup> 'Nutrition Evaluation of Pakaanóva (Wari) Indigenous Children, Rondonia, Brazil', Ana Lucia Escobar et al., *Rev. Bras., Saúde Materna Infantil. Recife*, 3(4): 457-461, Oct/Dec 2003

## Chapter 5: Impact of Climate Change on Children in the Amazon Region

### 5.1 Impact of Climate Change on Children's Health

According to the World Health Organization<sup>37</sup> it has been estimated that climate changes would be the cause behind some 150 000 annual deaths, a figure that could double by 2030. Despite these projections, an accurate and direct estimation of the burden of disease due to climate change is difficult. But what is clear is that climate change will have the most severe impact on those countries that have a low capacity to adapt. In the case of Brazil, the country has demonstrated adequate capacity to respond and mitigate – but efforts are not uniform all over the country. For instance, whereas communities in urban area with better access to services, infrastructure, livelihoods etc. may be quicker to respond, in the Amazon region, the existing conditions make this specifically challenging for the local community.

Some projections estimate that in 80 years climate change may double the population living in areas at risk for dengue fever and increase the proportion of people living in malaria risk areas by 2–4%. Researchers studying the impact of climate change in Brazil have also raised concerns over the various indirect health effects that are difficult to quantify as it remains difficult to make a direct causal relationship between a continuing event and the impact it has on increasing the likelihood of negative changes.

For the Amazon, this has a critical meaning as it makes health-sector planning for environmental change a complex challenge. The region presently demonstrates poor social indicators including those of child poverty, suffers from access and communication problems and requires increased and better public health infrastructure, setting up of epidemiological surveillance systems and strengthened capacity to respond to natural calamities and disease.

### 5.2 Diseases Prevalence

The IPCC (Confalonieri & Menna, 2007) recognized three main mechanisms through which climate processes can affect the health of the population:

- Direct effects of extreme weather events. These affect health through influences on human physiology (eg, heat waves), or physical and psychological trauma caused by accidents, such as storms, floods and droughts;
- Effects on the environment, changing determinants over health. Most relevant examples of the impacts of climate over food production, water, air and ecology quality of vectors; and
- Effects of climatic events on the social processes, determining important socioeconomic, cultural and demographic disruptions. One example is the migration of populations, triggered by prolonged droughts, which affect mostly people who depend on subsistence agriculture.

---

<sup>37</sup> Bulletin of the World Health Organization November 2007, 85 (11)

Brazil is considerably vulnerable to the effects of weather, for several reasons, among them:

1. With its vast land extension, has particularly sensitive areas such as semi-arid region, occupying already limited by drought. Any increases in average temperature and / or reduction of rainfall and humidity will make living even more difficult, if not impossible. Biomes relatively well preserved, as the Amazon rainforest and the Pantanal, contain natural focus of infectious diseases, with host animals that may suffer significant changes in its dynamics and distribution.
2. Presents a large population with little access to public policies and services, including health. It is known that the most vulnerable to the effects of climate are those that, for social reasons, are more exposed to climatic hazards, and have less ability to protect and respond to adverse impacts.
3. Existence in its territory of several endemic diseases sensitive to climate. They may have changed their cycles, encouraging both increased and decrease, mostly determined by the changes on temperature and humidity, among other factors. There is also the possibility of redistribution of those endemic diseases as a consequence of the regional demographic phenomena. This was the case of outbreaks of kala azar (visceral leishmaniasis) observed in the capitals of the Northeast, at the beginning of the 1980s and 1990s, consequent to the massive rural-urban migration, driven by prolonged droughts.
4. High concentration of population in urban areas vulnerable to risks from weather, such as floods, landslides and exacerbation of air pollution. Are well known to morbidity and mortality associated with the summer rains in several Brazilian cities, phenomena that can be repeated, in a more dramatically way, because of the global warming.

The strong changes of the environment in natural ecosystems in the Amazon has been contributing to the permanence of tropical diseases and disorders, which refers to diseases that proliferate in hot and humid weather. WHO includes eight diseases that occur exclusively or especially in the tropics.

Those caused by protozoa: malaria, leishmaniasis, Chagas disease and sleeping sickness (this one only happens in the African continent).

Those caused by worms: schistosomiasis, onchocerciasis, filariasis, dengue virus and yellow fever.

### 5.2.1 Malaria Prevalence

The most likely environmental and social factors that affect the transmission of malaria and its permanence are especially related to the intense process of deforestation in the Amazon, but not exclusively. Other reasons are: activities of extractive mineral and plant, projects of agrarian reform settlements, intense and chaotic occupation of peripheral areas of cities, environmental changes that lead to formation of breeding of vectors, climate change, little information on the care of society to prevent is the disease, inadequate actions of government, among others. Making a historical overview of malaria in Brazil, shows that:

The 40's - Malaria was highly prevalent and diverse all over the country, with over half of the cases recorded in the region outside the Amazon. In 1945 the country received the DDT insecticide and with it the expectation of full control of the malaria transmission. Also the introduction of the use of chloroquine in substitution of Atebrina led to the belief that they have the tools now powerful enough to eradicate malaria. This belief was even greater in the case of Brazil by the successful experience with the eradication of *Anopheles gambiae*.

The 60's - With these measures, the end of the decade there was a greater reduction of cases of malaria that have disappeared from the Northeast, Southeast and South. Left the Amazon region, still practically uninhabited.

The 70's and the 80's - New factors hampered the control of malaria. The Amazon region is quite different from the rest of the country, its forced occupation, especially by gold mining, key factors difficult to control the heavy traffic of people within the region and beyond, were both cases of resistance to DDT by anofelinos and for to chloroquine by *Plasmodium falciparum*. This combination of factors led to further increase the incidence of the disease in the country has reached an end point in 1999, with great increase in the number of cases.

The 00's – An Intensification Action Plan for the Control of Malaria in the Amazon Region (PIACM) is created. This plan was implemented between July 2000 and December 2002. At the end of 2001 brazilian government succeeded, decreasing by 40% of cases compared to 1999, decreased by 70% in the number of hospitalizations and consequently reduction of 36.5% in the number of malária deaths. The Plan was more effective in the states of Amazonas and Acre and with less impact in Rondônia and Amapá.

After the start of PNCM, the evaluation of the Health Ministry, in 2005 shows a disappointing situation, and almost a stabilization of the numbers. The incidence of the disease in the Amazon remained high in 2004 (IPA 19.9 / 1,000), damaging the level of population health and socioeconomic development in the region. The concern with malaria is motivated by the "great migration in the Amazon region to other Brazilian states, has led in recent years, the emergence of outbreaks of malaria, as recorded recently in the states of Paraná (south region), Mato Grosso do Sul (east central region), Minas Gerais, Espírito Santo, Rio de Janeiro (south east region), Ceará and Bahia (north east region)."

The development of malaria at capitals periphery and the emergence of new cases in states free of the disease, are the new facts faced by public health services. Despite advances in the 20th century, malaria is still a challenge for public health in Brazil.

In Brazil, 99.8% of transmission is concentrated in the Amazon. In the states of Legal Amazonia<sup>38</sup>, register decrease in cases between the period January 2007 to September 2008, from 324.753 cases to 213.624 respectively.

What is the explanation for high prevalence of malaria in the Amazon?

The population of the Amazon shows a high level of susceptibility because the transmission and endemicity are medium to low intensity in the local population; the migration of populations, without previous contact with malaria to the endemic areas

---

<sup>38</sup> Acre, Amapá, Amazonas, Maranhão. Mato Grosso, Pará, Rondônia, Roraima and Tocantins states.

increases the number of susceptible people; the Plasmodium falciparum resistance to chloroquine and other antimalarial drugs because of inadequate treatment; the diagnosis and treatment delay of simple forms and especially the serious forms and the constant presence of the vector because of breeding and the low effectiveness of insecticides, which have no residual effect after six months of application.

The government's efforts to combat mosquito has resulted in a significant decrease in the number of malaria cases. Potentially viable "because the work of a vector control and environmental management"

### 5.2.2 Dengue Prevalence

Dengue is a major public health problem in the world. The World Health Organization (WHO) estimates that 2.5 billion people - 2/5 of world population - are at risk of contracting dengue fever and annually occurring about 50 million cases. Of this total, about 550 thousand require hospitalization and at least 20 thousand die because of the disease.

In the last two decades, the incidence of dengue in the Americas has shown an upward trend, with more than 30 countries reporting cases of the disease, despite the numerous programs for the eradication or control implemented. The epidemic peaks have been increasing in periods that are repeated every 3-5 years, almost on a regular basis. Between 2001 and 2005, were 2.879.926 reported cases of dengue in the region, with 65.235 of hemorrhagic dengue and 789 deaths. The greatest impact during this period were reported by Brazil, Colombia, Venezuela, Costa Rica and Honduras (82% of total).

Making a historical overview of dengue in Brazil, shows that:

The 80's - the first epidemic documented clinical and laboratory in 1981-1982 occurred in Boa Vista (RR), caused by serotypes 1 and 4. In 1986, epidemics occurred at the Rio de Janeiro and some of the northeast states capital. Since then, dengue has occurred in Brazil and continue, interspersed with the occurrence of epidemics, usually associated with the introduction of new serotypes into areas previously indene and / or amend the predominant serotype. In the epidemic of 1986, the occurrence of the circulation of serotype DENV1 were identified, initially in Rio de Janeiro, spreading, then to six other states until 1990. In this year, were identified the movement of a new serotype, the DENV2, also in Rio de Janeiro.

The 90's - there was a significant increase in incidence, reflecting the wide dispersal of *Aedes aegypti* in the country. The presence of the vector, associated with the mobility of the population, led to the spread of the serotypes DENV1 and DENV2 to 20 of the 27 states of the country. Between the years 1990 and 2000, several epidemics have been reported, especially in major cities of Southeast and Northeast regions of Brazil, responsible for most cases. Mid-West and North regions were later attacked, with epidemics recorded in the second half of the 90s.

The 00's - The movement of DENV3 virus serotype was identified for the first time in December 2000, also in Rio de Janeiro and at the state of Roraima, in November 2001.

In 2002, were observed the highest incidence of the disease, was confirmed when about 697.000 cases, reflecting the introduction of serotype DENV3. This epidemic has

led to a rapid spread of serotype DENV3 to other states, while in 2004, 23 of the 27 states of the country already had the movement of the serotypes DENV1, DENV2 and DENV3 of dengue virus.

In Brazil, young adults were most affected by the disease since the introduction of the virus. However, from 2006, some states had the recirculation of serotype DENV2 after some years of prevalence of serotype DENV3. This scenario led to an increase in the number of severe cases and hospitalizations of children, especially in the Northeast of the country.

In 2008 were 585.769 reported cases and epidemics caused by new serotype DENV2 occurred in several states of the country, marking the worst scenario of the disease in Brazil, related to the total hospitalizations and deaths so far. Children were at the centre of these epidemics, representing over 50% of hospitalized patients in the largest contingent of municipalities. Even in cities with lower population, more than 25% of patients hospitalized because of the dengue were children, which emphasizes that the whole country is suffering, similarly, those changes in the disease profile.

Until June 2009 (provisional), 361.552 cases of dengue have been reported, which represents a decline of 49.8% on the same period of 2008. In 20 states there was a reduction in the number of cases when compared to same period of 2008. The number of cases among the seven states where there was an increase in the Amazon region were: Acre, Roraima, Amapa, Mato Grosso.

There were 1.021 dengue haemorrhagic fever (DHF) confirmed cases, with 79 deaths, and 7.7% mortality. Were also 1.931 confirmed cases of Dengue with Complication (DCC) with 52 deaths, and 2.7% fatality rate. The fatality rate of all severe cases (DHF + DCC) is 4.4%. In 2008, during the same period, there were 3.487 cases of DHF and 16.413 of DCC, which shows a significant reduction in the number of serious cases in 2009 (85.2%). As the number of deaths, also in 2008, were confirmed in the same period by 201 and 235 DHF by DCC. Compared with this year, there was a reduction by 69.9% in the number of deaths of the total of serious cases.

The current scenario on the reduction of cases demonstrates the ability of Brazilian society and the health sector in fighting the dengue epidemics. The sustainability of this framework requires the continuation of efforts by the three government spheres, besides the involvement of other sectors outside the health area. Conjunction on these efforts can respond appropriately to dengue epidemics.

The conditions of the expansion of dengue in the Americas and Brazil are similar and refer to, in large part, the economic growth model implemented in the region, characterized by disordered growth of urban centers. Brazil concentrates more than 80% of the population in urban areas, with significant gaps in the infrastructure, to ensure regular and continuous supply of water and the collection and appropriate destination of solid waste. Other factors, such as the accelerated expansion of the industry of non-biodegradable materials, and weather conditions, exacerbated by global warming, lead to scene that it is very hard to prevent, in a short period, the action proposal aimed at the eradication of the vector transmitter.

The dengue epidemics produced an important burden on health services and the countries economy. Although there are few studies on this theme, a recent one were conducted in eight Americas and Asia countries, including Brazil. The study showed that the cost of epidemics occurred in these countries was around US\$ 1.8 billion, with

only outpatient costs and hospitals, not including the costs of the activities of surveillance, vector control and mobilization of the population.

The epidemiological picture of the country points out the vulnerability of epidemics occurrences as well as an increase of severe forms, allowing the risk of increased deaths and lethality. Another factor of concern is the increase of cases in younger age groups, including children, situation already observed in other countries.

In Brazil, the dengue epidemic is identified as one of the possible effects of global warming. To Mara Lúcia Carneiro Oliveira<sup>39</sup>, increased temperature and humidity, together with deforestation, promotes the proliferation of the dengue mosquito in urban areas.

The Climate Change Atlas shows that dengue and malaria are still far from disappearing. A survey of the World Health Organization (WHO), made at the end of 2008, also points to the same result. According to the coordinator of the Organization, Shigeru Omi, the extreme heat, drought and flooding affect the health of the population. According to WHO, children are the main victims of the disease. With favorable weather conditions and wet time, rain and heat, the spread of the mosquito *Aedes aegypti* becomes faster, making it difficult to control the disease. Climate change may contribute for the diseases spread. Thus, any situation that leads to increase of rainfall, and hence the breeding of mosquitoes and humidity, together with the heat, may facilitate the spread of vectors and their multiplication.

### 5.2.3 Leishmaniasis Prevalence

#### A) Visceral leishmaniasis (VL)

Given its high incidence and mortality, especially in untreated individuals and malnourished children, is also seen as emerging in individuals infected with the acquired immunodeficiency virus (HIV), becoming one of the most important diseases of today.

The VL has a wide distribution occurring in Asia, Europe, Middle East, Africa and the Americas. In Latin America, the disease has been described in at least 12 countries, with 90% of cases occur in Brazil, especially in the Northeast region. The record of the first case in Brazil occurred in 1913. Since then, the transmission has been described in several municipalities in all regions, except in the South.

The disease has made important changes in the pattern of transmission, initially predominated by the characteristics of rural and suburban environments and, more recently, in urban centers. In Brazil, the LV was initially had a rural character and, more recently, has been expanding into medium and large urban areas.

According to the Health Ministry, in the period between 2001 and 2007 were registered 22.971 cases. Is distributed in 20 states, reaching four of the five regions. Today, the Northeast region accounts for 56% of cases, followed by the Southeast (19%), North (18%) and Central East (7%). It is more frequent in males (60%) and in children under 5 years (45%).

---

<sup>39</sup> She is a Brazilian health researcher.

The epidemiological data of the last ten years show the suburbanization and urbanization of visceral leishmaniasis, especially the outbreaks occurred in Rio de Janeiro (RJ), Belo Horizonte (MG), Araçatuba (SP), Santarém (PA), Corumbá (MS), Teresina (PI), Natal (RN), São Luís (MA), Fortaleza (CE), Camaçari (BA) and more recently the epidemics occurred in the cities of Três Lagoas (MS), Campo Grande (MS) and Palmas (TO).

Despite being known as a disease of a dry climate areas with annual rainfall less than 800 mm, and environmental processes composed of valleys and mountains, the transmission has been presenting different dynamics.

The changes in the environment caused by intense migration process, by economic pressure or social pressure, the consequent impoverishment of distortions in the distribution of income, the process of increasing urbanization, the rural emptying and periodic droughts cause the expansion of endemic areas and the emergence of new outbreaks. Phenomenon that leads to a reduction in the ecological space of the disease, facilitating the occurrence of epidemics.

## **B) American Cutaneous Leishmaniasis (ACL)**

The ATL is one of the most important skin diseases of the Amazon. The region is an endemic area with epidemic outbreaks, presenting 65% of cases in Brazil for the year of 2008, according to provisional data from the Health Ministry. In the period of 2001 to 2007 were 185.037 registered cases in Brazil. It is more frequent in males (72%) and in those with more than 10 years (91.5%). The cutaneous form accounts for 92% of cases. In addition to the deformities that can produce, negatively impacting over human mental aspect, the disease also produces economic influences, preventing the man to do his work.

According to the group of researchers at the Para Federal University, "There are seven leishmania species that cause cutaneous leishmaniasis, identified in the Amazon region. In relation to visceral leishmaniasis, only one species was identified in the Amazon. "The phlebotomy, the disease transmission insect, it is natural in forest areas. Because of the deforestation advance, the insects are migrating to regions inhabited by humans, for broiler houses and going into the homes. The contamination becomes even easier because the dog can serve as host for the disease. These elements are challenge to public health authorities for today leishmaniasis control.

### **5.2.4 Yellow Fever Prevalence**

#### **A) Urban Yellow Fever (UYF)**

In Brazil, the UYF is eradicated since 1942, when it was last registered in the municipality of Sena Madureira, in Acre.

#### **B) Wild Yellow Fever**

It has been occurring in Brazil since 1934, in the North and the Midwest. In these forest areas the disease remains endemic in, but under control, as its annually occurrence happens in a small number of human cases, although there is a growing trend of cases in the period 2005 to 2008. The distribution of cases per month has shown that the disease occurs more frequently in the months January to April, with

highest rainfall period, when the vector density is high, coinciding with a time of increased agricultural activity.

In the period 1989 to 2008 there were 546 cases with 241 deaths, representing a fatality rate of 68%, therefore a disease of high lethality. During the period, the highest number of cases occurred in the states of Goiás, Pará, Amazonas, Mato Grosso and Maranhão, that are within the extensive endemic area of WYF. The great Amazon region is where there is the amarilicus virus movement and also where the disease remains permanently in the woods and animals, affecting a man only in an accidental way.

Report released by the World Health Organization (WHO) indicates the growth not only on the number of cases of yellow fever as well as the number of countries affected by the disease in the last 20 years.

According to José Moraes, there are several diseases facilitators aspects, that make such as jungle yellow fever spread not only in Brazil but also in a number of countries around the world: change the ecosystem, heavy rain, heat, intensive deforestation; disorderly urbanization of rural areas; climate change; displacement for various reasons of persons for the endemic areas; abundance of vectors, often related to meteorological factors; low vaccination coverage of the population living in endemic and transition areas and the presence of primates that, by having high viremia are real amplifiers and disseminators of the virus.

### 5.2.5 Chagas Disease Prevalence

Chagas disease is now considered a antropozoonose from domicile vectors, displaced from their original wild ecotopes, by an entropic action.

In Brazil, currently dominate the chronic cases of Chagas disease from infections acquired in the past. There are about three million individuals infected. However, in recent years, the occurrence of acute Chagas' disease (DCA) has been observed in different states, in different regions (Bahia, Ceará, Piauí, Santa Catarina, São Paulo), with higher frequency of cases and outbreaks recorded in some states of the Brazilian Amazon (Amazonas, Maranhão, Mato Grosso, Amapá, Pará, Tocantins).

In Brazil, two million is the estimated number of chronic patients - 600 thousand of them with digestive or cardiac complications leading to death, ending five thousand people per year. In absolute terms, the number of Brazilians who die from Chagas disease is similar to that the numbers of dying from tuberculosis, and ten times higher than deaths caused by schistosomiasis, malaria, leprosy and leishmaniasis.

Today, the epidemiological profile of the disease presents a new scenario with the occurrence of cases and outbreaks in the Amazon, by oral transmission, vector (home without colonization and extra-home) and isolated cases in other states.

Outbreak of DCA related to the ingestion of contaminated food (sugar cane juice, açai fruit, bacaba fruit, among others), and isolated cases of vector transmission has been occurring in the states of Pará, Amapá, Amazonas, Bahia, Ceará e Santa Catarina. In the period 1997 to 2008, there were 696 cases in Brazil of Chagas disease and 617 (90%) acute oral transmission vector, occurred in the Amazon, and 79.4% in Pará.

The current environmental issues create conditions for the development of diseases, mainly by water. The irregular rainfall with the humans attitudes on the environment

are factors that help in the proliferation of diseases. These actions help the migration of disease, before on in the field areas for the city and its proliferation increases due to changes in climate.

### 5.2.6 Filariasis Prevalence

A chronic parasitic disease, the lymphatic filariasis (LF) is a major global cause of permanent or long-term disability. Estimative of the 1990s pointed to some 100 million people affected by the disease worldwide. Still remains as a serious public health problem, and is considered today as one of the seven possible global diseases to be eradicated. Two main factors determine this eradication: the parasite has a certain biological characteristics and the available strategies of intervention. Taking this perspective, in 1997 the World Health Organization (WHO) launched a plan for elimination of LF by the year 2020.

In certain endemic areas (southern Brazil) was introduced a mass treatment, certainly contributing to the elimination of the disease in those specific areas. It was a prevalent disease in Brazil, but, today, is limited to some persistent outbreaks in the states of Pará, Pernambuco (restricted to the Metropolitan Region of Recife, the state capital), and Alagoas.

### 5.2.7 Schistosomiasis Prevalence

The schistosomiasis is endemic worldwide, occurring in 54 countries and territories, especially in Africa, Eastern Mediterranean, South America and the Caribbean.

In Brazil, an estimated 8 to 10 million people are infected and that approximately 30 million people live in endemic areas and therefore susceptible to the disease. The transmission reaches 19 states, in a continuous area along the coast, from Rio Grande do Norte to Bahia in the Northeast region, reaching the interior of Espírito Santo and Minas Gerais in the Southeast region. In a more concentrated areas, is also present in the states of Ceará, Piauí and Maranhão in the Northeast, Pará, in the north region, Goiás and Distrito Federal, in the Midwest, Sao Paulo and Rio de Janeiro in the Southeast, Paraná, Santa Catarina and Rio Grande do Sul, in the south. Currently, the highest prevalences are found in the states of Alagoas, Pernambuco, Sergipe, Minas Gerais, Bahia, Paraíba and Espírito Santo. Has low mortality and the main causes of death are related to severe clinical forms.

According to the Health Ministry, for the period of January to August 2008, data is still provisional, 12.506 cases were recorded. In the period 1990 to 2007 there was 9.368 deaths.

The control of the intermediate host of schistosomiasis involves environmental aspects related to injury caused to aquatic flora and fauna, caused by the use of chemical (molluscicidal). Actions of sanitary improvement, although have great effectiveness for permanent changes in the conditions of disease transmission, can cause negative impact on the environment. Among these actions, there are: water and sanitary facilities, landfills for disposal of water that are breeding collections of mollusks, drainage, cleaning and adjustment of margins of streams, canals and construction of small bridges.

### 5.2.8 Onchocerciasis Prevalence

The Onchocerciasis is endemic in Africa, the Arabian Peninsula and the Americas. In tropical Africa, where most of the affected communities lives (over 17 million registered cases), is considered of high morbidity and shows large geographic distribution. In the American continent the disease is focal, affecting some areas in six countries: Mexico, Guatemala, Colombia, Ecuador, Venezuela and Brazil.

In Brazil the outbreak was discovered by Dias and Moraes (1973) and is considered the most isolated of America and is located in the Amazon border with focus in southern Venezuela, forming a bilateral focus area of approximately 192,000 km<sup>2</sup>. In the Brazilian Amazon, the focus covers much of the Yanomami territory in the northwestern state of Roraima and northern edge of the central state of Amazonas. There are about 17 thousand Yanomami, and 10 thousand living in region with risk of infection. These Indigenous People live in approximately 200 communities.

Knowledge of the prevalence and distribution of disease is based on prevalence surveys of infection by parasitological examination of skin samples.

In 1993-1997 surveys were conducted covering 28-pole base and was examined 4.283 individuals (approximately 95% of the Yanomami people), with 1.247 diagnosed as infected.

### 5.3 Acute Respiratory Infection (ARI)

Acute Respiratory Infections are public health problem of great importance, especially among the elderly and children. The ARI on children under five years old are the most prevalent group, accounting about 30 to 50% of outpatient consultations and over 50% of the hospitalizations. In older children, is the leading cause of school absenteeism.

The World Health Organization (WHO) estimates that the actual death of 10 million children under five years of age, over 95% occurred in developing countries; pneumonia is responsible for the 19 to 21% of deaths. In Brazil, depending on the region, the pneumonia is responsible for 11 to 18% of deaths in children under five years of age. The impact of acute respiratory infections in indicators of morbidity and mortality is greater as is the considered age group.

According to the WHO, 50% of chronic respiratory diseases and 60% of acute respiratory diseases are associated with exposure to air pollutants. Most studies comparing the levels of air pollution with health effects have been developed and show the association of morbidity and mortality burden due to respiratory diseases, with an increase of air pollutants. (SALDIVA et al 1994; GOUVEIA et al, 2006).

The effects of air pollution on human health have been widely studied throughout the world. Epidemiological references evidence of increased risk for cardiovascular and respiratory diseases due to overload imposed on their cardiovascular system compromised, since there is a hyper-vascularization in response to an attempt to heat loss to the environment. For the thermo-regulation achievement and ideal maintenance of body temperature, is required from the heart above its normal capacity. There is also the general and specific mortality associated with exposure to pollutants in the atmosphere. (Pope et al., 1995, PAHO, 2005, ANDERSON et al., 1996; Rumel et al., 1993; CIFUENTES et al., 2001).

Therefore, changes in temperature with the heat waves, fires, and a constant alteration in rainfall regime may increase the effects of respiratory diseases as well as the change in the conditions of exposure to air pollutants. Given the evidence of the relationship between certain health effects due to climate change and air pollution levels, such as episodes of inversion conditions, increased levels of pollution and increased respiratory problems, seem inevitable that the long-term climate change may impacts on human health globally. In urban areas some effects of exposure to air pollutants are enhanced when climate changes occur, especially the thermal inversions that concentrate the pollution, giving intrinsic relationship with asthma, allergies, broncho-pulmonary infections and infections of the upper airways (sinusitis), especially more likely in groups that include children under 5 years and individuals older than 65 years of age.

The air temperature increase promotes the concentration of ozone gas in the lower atmosphere, which at concentrations above the normal becomes a pollutant harmful to health and, according to some surveys, may exacerbate the problems of asthma and / or of patients with other lung diseases, by the possibility of damage to lung tissue. People with health in good condition, if exposed to this gas, may also feel pain in the chest, nausea and pulmonary congestion.

## Chapter 6: Responses to Climate Change – Protection and Mitigation Efforts

### 6.1 Protecting Children from Impact of Climate Change: What Needs to be Done?

Considering the prospects and proposals for the Brazilian reality, especially in the Amazon environment, this document puts effort on global debates of various issues related to climate change: global warming, water security, food insecurity, among others.

So the purpose here is to draw a Brazil profile in regard to environmental issues, revealing the enormous challenges that the country has been facing in recent years and why the Amazon is distinguishable in the discussions on climate change.

But any action that seeks to improve the lives of more than 10 million<sup>40</sup> children and adolescents in the Brazilian Amazon requires the establishment of targets, indicators and timelines to monitor national progress, to contribute to:

- ✓ the development and improvement of public policies;
- ✓ economic instruments and financial resources to ensure the development of the proposed actions;
- ✓ institutional arrangements to create the necessary conditions to socio environmental governance.

In addition to the contributions and work done by experts to systematize, the organization of this document considered proposals of different activities in the country, as the National Conference of Environment, the joints of the organizations civil society, and the Amazon Working Group (GTA) and the Forum of the Eastern Amazon (FAOR) and strategic government initiatives such as the Forum of Governors of the Amazon, created in May 2008.

These ideas were discussed with a number of representatives of various institutions, such as Iagua, Cedec Emaus, Unipop, Cultural Foundation Curro Velho, State Secretariats of Environment and Government, UFPA, Goeldi National Museum, in addition consultations by e-mail to at least a dozen institutions and experts that could interact with the proposal and suggest ideas for the second part of this publication.

UNICEF hopes, therefore, contribute to building a qualified debate in the country and especially in the Amazon, to show that without discussing the issues that affect our children and teenagers, we can not find a way that effectively reverses the severe climate changes today faced in Brazil and worldwide.

The Brazilian society, especially its children and adolescents, are inseparable part from the equating of social and environmental issues to face global climate change. This is already happening, which makes Brazil the leader of developing countries in international forums and opens a window of opportunity in the advance of new patterns of development worldwide. Thus, it is necessary to establish targets, indicators and timelines to monitor national progress, to contribute to the progress and improvement of public policies, economic instruments and financial resources for the proposed actions, in addition to the institutional arrangements and appropriate social governance.

---

<sup>40</sup> Brazilian Health Ministry, Datasus, 2007

## 6.2 Developing the Adaptive Capacity of Communities

Children must be the first priority in risk-reduction efforts. Specific risks that exist for children and their caregivers, and the actions that might be taken to counter those risks, should be determined in addition to risk-reduction strategies for populations at large.

Risk-reduction initiatives should be designed to educate families and children about simple and practical actions that can protect life and personal property in the event of natural disaster. Effective awareness programmes in schools, homes and communities can create a culture of prevention and empowerment.

To ensure effective, timely and dependable responses, emergency preparedness measures, oriented specifically to children and women, must be in place. Children, families, communities and basic-service providers must be ready to meet health, nutrition, education and security needs when a disaster occurs.

Since poverty often prevents people from taking preventive measures – and given that it is not the disaster alone but also vulnerability levels that determine the impact of any crisis – the underlying vulnerability of families must be reduced through poverty reduction and other measures.

As disasters have the greatest impact on the vulnerable, their needs must be specifically addressed by response strategies, and vulnerable people should participate in preparing these strategies to ensure their relevance.

### **Strengthening public health systems**

- Strengthening of public health systems is already necessary; climate change makes this need even more critical.
- Enhanced capacity to address public health emergencies saves lives and protects communities.
- Strengthened surveillance and control of infectious disease can protect health from local to global scales.
- Improving the environmental and social determinants of health is critical to protecting populations from climate change.
- The risks of climate change call for more equitable access to public health services.

**Protecting health from climate change - World Health Day 2008, WHO**

One of the development challenges for the Amazon region is the limited social infrastructure such as lack of adequate schools, health care services and water and sanitation systems together with difficulties of access and communication. While at the provider's end there may be inadequacies, it has also been challenging for communities in this region to seek for quality social services, for various reasons including lack of adequate education and access to information, insurance or credit facilities etc. Thus, at present there is little or no institutional framework that is in place to support these vulnerable groups to adapt to climate change.

Planned interventions to reduce the vulnerability of these communities would need to focus on increasing the capacity of the local population to adapt to climate changes. Several adaptation efforts including the enactment of protective policies related to land

usage, development of new agricultural techniques and the use of climate predictions and early warning systems, revival of traditional knowledge and wisdom related to climate, land and related issues must be reinforced. Additionally, increased access to knowledge and education, introduced through school curriculum and non-formal education systems would enable both adults and children to be better aware of their environmental challenges.

### 6.3 Role of Children and Adolescents as Agents of Change

For the World director of UNICEF, Ann M. Veneman, "today's youth is aware of the need to protect the environment. When they are invited to talk about what concerns them most, one of the issues that stand out is climate change".

"They are right to be concerned. While we still have a lot to learn about the consequences of climate change, economic and social development cannot be sustainable unless we deal decisively with this issue. It has the potential to add to the insecurity faced by some of the most vulnerable people in some of the most vulnerable countries."

According to her, "millions of young lives have been saved through the expansion of basic services such as primary health care programs, nutrition and adequate water supply and sanitation, showing that it is possible to improve the lives of children. But the loss of 9.7 million children per year is still unacceptable, and we need to further reduce this number. This task must not be threatened or undermined by short-sighted decisions that cause permanent damage to the environment."

In 2006, child delegates to the 4th World Water Forum in Mexico City challenged leaders and policymakers, saying, "We, the children of the world, are ready to work with you. Are you ready to work with us?" The answer must be a resounding "yes" because what is good for children – reducing pollution, safeguarding education and health, preserving environmental diversity, protecting water supplies, increasing access to proper sanitation – is also good for the planet.

"Comments and letters came from children and young people from all over the world, collected from UNICEF Voices of Youth, child delegates to the 2007 UNEP African Regional Children's Conference for the Environment and the 2007 World Scout Jamboree in cooperation with the United Nations Development Programme."

"Our countries and communities are at risk. Every day we see forests burning and people throwing chemicals into the water and cutting trees. In many countries, children and young people face very poor sanitation, health care and environmental conditions. When we build indiscriminately, dump our garbage into waterways, slash and burn our forests, and practice unsustainable agriculture, these actions lead to floods, soil erosion, landslides and desertification."

Brazilian Youths voices are spreading to every corner of Brazil the need for urgent measures to mitigate the effects of climate change. UNICEF has supported initiatives to strengthen the commitment to improving the indicators of childhood in Brazil, with strong emphasis on building proposals that dialogue with children and adolescents and its enabling role. Many networks of adolescents in different regions of the country are writing their history and, more importantly, are firmly committed to the changes necessary to improve the impacts on the environment.

The Brazilian government is an important partner in this path and has supported the mobilization of youth and adolescents in the construction of commitments, as the result of the II and III National Conference on Child and Youth for the Environment, when adolescents and young people produced a Letter of Responsibilities.

"We are the Brazilian youth... Our quest is to build a fair society, happy and sustainable. This letter carries the collective thoughts of 12 thousand schools and communities throughout the country held their conferences in 2005, with the wishes of 4 million people. We found ways to work global issues, complex and urgent: Climate Change, Biodiversity, Food Security and Nutrition-Racial and Ethnic Diversity. We want to raise awareness and mobilize people to face together the great social challenges that our generation faces."

During the III National Conference on Child and Youth Environment the youths also committed and pledged themselves to:

1. Disclose the information and expansion of knowledge through environmental education;
2. Protect and enhance biodiversity;
3. Transform in areas environmentally healthy, cities, communities and schools;
4. Reduce the production of waste by practicing the 5 Rs: rethink, refuse, reduce, reuse and recycle;
5. Ride to practice solidarity and encourage the use of public transport and bicycles;
6. Prevent deforestation and burning;
7. Respect, understand and recognize cultural diversity;
8. Enhance the production and consumption of natural and organic foods;
9. Promote reeducation of food habits respecting people's habit.

"We invite you to take care of Brazil!"

The document "Climate Change and Children", produced in 2007, is a contribution of UNICEF to contextualize the discussion on the impacts of climate change on the lives of children and adolescents worldwide. In the document, youth all over the world repeat: We need to do something to save our only Planet Earth!<sup>41</sup>

"Pollution has been a problem for centuries. What are we waiting for? Even since climate change came to light, water sources have been polluted, forests have been wiped out, animal species have disappeared and people's health has been jeopardized because of the pollution we create.

We emphasize the value of education in the context of a sustainable environment and energy supply. Young people at every stage of their education should be informed about the dangers of environmental degradation, overuse of fossil energies and the prospects of renewable energy. Therefore we urge educators to include environment and energy-related topics in the curricula.

The decisions made today will have a significant impact on our lives. We will live the consequences. We will breathe the air and drink the water you leave us. Young people need to be given a greater voice on climate change issues. We need a platform from which we can express our demands. We want to work with governments and

---

<sup>41</sup> Climate Change and Children

communities to help design and influence the policies that will affect our lives, now and into the future.

We would like to move forward with a multigenerational, multidisciplinary vision: Working together, leaders and youth can redesign how society operates. Together we can lobby for a holistic education and climate-change curriculum so that today's youth are not only climate-change literate but are equipped with the tools to act.

We are willing to make a difference."

In various parts of the world Youths are converging for a Planetary Cooperation for Environment. Changes in forms of production, consumption, and learning relationship, must be radical and urgent. These transformations can only be conquered by an intergenerational process of building sustainable societies.

What today we call Youth, is the part of the population born in the 80s and 90s, a period in which the major environmental disasters concentrated, triggering the production of knowledge and communication in scale on environmental issues.

Climate Change Reports show that the social and environmental changes are in course and the hope of mitigation and adaptation will happen in the next 20-30 years. This transforms the current Youth, about 30% of world population, in an absolutely strategic portion of the population to change unsustainable patterns of reproduction and implementation of other forms of being in the world.

This is the population portion with the highest rates of social vulnerability. The process of social and environmental education with these young people should be structured, creating opportunities for learning, work and income generation, social harmony...

#### **6.4 Social Mobilization: Putting Climate Change on the Social Agenda**

While the accelerating deterioration of the global environment has its most profound effect on children and young people, environmentally aware and empowered children and adolescents are potentially the greatest agents of change for the long-term protection and stewardship of the earth.

More than 46 per cent of the world's population is now younger than 25 years old – 3 billion individuals in all.<sup>42</sup> The decisions they make can and will shape the future of our world. The next 10 years are crucial, and they offer an amazing window of opportunity.

Young people's knowledge of water, environment and health is a largely untapped resource. They are the next generation of water users and environmental stewards in households and communities. The capacity of these young people to live in harmony with nature and to manage and maintain local water, air and land resources effectively is absolutely vital.

Community-based monitoring and advocacy activities in selected countries have begun to create opportunities for young people to participate in actions that reduce the incidence of water-related disease and deforestation, as well as clean up degraded community environments and watershed areas to improve living conditions for themselves and their families.

---

<sup>42</sup> United Nations Population Database, 2006.

Children's participation in these activities has succeeded in raising awareness about their role as agents of change. But experience tells us that more must be done to influence the opinion of adults so they regard children as partners in a shared mission.

Based on the premise that what children learn today will shape the world tomorrow, instilling environmental awareness at a young age is an effective way to protect the environment. Programmes that improve the availability and quality of environmental education are key interventions for long-term change. While schools – and especially primary schools – are ideal platforms for increasing children's environmental knowledge, the most effective learning programmes go beyond schools and into local communities.

But increasing children's and young people's environmental awareness is not enough. For them to become effective agents of change, avenues must exist for their knowledge to be translated into advocacy and action. Programmes that promote children's participation in local environmental initiatives that strengthen children's clubs and networks, and that provide a voice for children in local, national and global development processes are all ways to help realize the potential of children to shape their own world.

Protecting the environment while providing for the health and development of children are mutually inclusive goals. Almost any action taken to enhance environmental quality also helps to meet the basic needs and rights of children.

This is the perspective of "Climate Change and Children"<sup>43</sup>, launched by UNICEF in 2007, preceding the meeting of world leaders at the UN Conference on Climate Change in Bali. Based on information and studies already available on the effects of climate change on children's and youth health and development in the world, had aimed to raise awareness among world leaders to adopt measures to adapt in the areas of health, water supply, food security, planting trees and maintaining green cover, energy and governance and participation against climate change.

The same motivation also guides the initiative related to the Brazilian Amazon, where, together with the governors of nine states of the region, was launched in May 2008, the Child Amazon Agenda, which is a broad process of mobilization of actors and resources of governments, civil society and the private sector at the municipal, state and federal to the achievement of the Millennium Development Goals.

As noted previously, the population impoverished and with the worst rates of development are those most vulnerable to climate change, which is intensifying environmental problems related to existing social and economic issues. Especially for those with low response to impacts such as extreme age groups (children, young and old people), sick and disadvantaged population groups and the lower income that usually occupy and live in unstable land in the suburbs and downloading of large cities, but also at the edge of mangroves, for example, river people, fishermen and quilombolas<sup>44</sup>.

The joint challenges of environmental and social equity were emphasized by participants of the III National Conference on the Environment, especially on the

---

<sup>43</sup> UNICEF, 2007.

<sup>44</sup> Black people that once were slave and run away from their owners and created rural communities with unique culture and social way of living.

necessary measures to Brazil's adaptation in combating climate change. Proposals, especially for health, water resources, agriculture, human settlements, natural ecosystems, and specifically for the marine and coastal areas - where population is 6 times higher than the national.

However, the National Plan for Climate Change, prepared by the Brazilian government, incorporates only part of the deliberations indicated the II National Conference and has no program or activity designed specifically for the Amazon region.

The World Social Forum, realized in Belem, in January 2009, enhanced this issues and decisions given by the National Conference on the Environment, emphasizing the importance of active participation of society in the establishment of mechanisms to combat climate change to be faced by national governments for our common future.

In this sense, is mainly important to promote and effective youth participation in the debate on the Eighth Millennium Goals, on the UNDP, which have strong support from Brazil<sup>45</sup>.

The youth knowledge on water, environment and health is still an untapped resource. They are the new generation of users of water and are the protectors of the environment in homes and communities. The ability of these young people to live in harmony with nature and to manage and maintain the local water, air and the resources of the earth is an effective way, absolutely vital.

Activities of control and defense in the communities at the countries selected by UNICEF have started to create opportunities for young people to participate in actions that reduce the incidence of diseases related to water and deforestation, as well as the cleaning of degraded environments in the community and the areas of drinking water to improve living conditions for them and their families. The participation of children in these activities has been able to raise awareness about their role as agents of change. But experience tells us that we must do more to influence the views of adults to help become partners, to join the children in a shared mission. (UNICEF-2007)

The current evidence points out to the importance and impact over important social segments that are most vulnerable to the effects of climate change already underway. By involving children, youth and the community where they live in joint reflection on life quality, sharing ideas, taking on responsibilities and actions, is essential to the process of facing global environmental changes and the future of life on our planet.

## 6.5 Child Amazon Agenda

The construction of Child Amazon Agenda ensures that Brazilian people, specially the ones that live in the Amazon region - indigenous, farmers, fisherman, quilombolas, miners and the urban people -, are empowered to make the necessary changes, in a sustainable way, especially their children and adolescents to participate and be part of this process.

One main strategy is to strength the already on going project: School Commission on Environment and Life Quality – Com-Life (Comissão de Meio Ambiente e Qualidade de Vida na Escola - Com-Vida). This project is developed by the Education Ministry in articulation with all brazilian public fundamental schools. The first proposal to create the Commissions came from the deliberations of I Child and Youth National Conference

---

<sup>45</sup> Brazilian Education Ministry, 2008.

for the Environment, held by the Environment Ministry in partnership with the Education Ministry in 2003, when the students involved suggested the creation of "youth environment councils" in schools in the country.

With that began "Let's Take Care of Brazil With the Schools" Programme, involving 16 thousand schools that participated in the process of construction of the I Conference, which represented hundreds of training seminars for teachers in environmental education. Also participated in these seminars 21 thousand students and delegates elected in all schools. All those people were mobilized by the Environmental Youth Collective – YC (Coletivos Jovens pelo Meio Ambiente - CJ) in all the country to lead the organization of the Com-Life, a permanent and dynamic space for "Taking Care of Brazil".

School Commission on Environment and Life Quality (Com-Life) and Environmental Youth Collective (YC) are articulated and linked in a national network called Youth Network for Environment and Sustainability - REJUMA.

REJUMA is a network of youth-related social issues present in all Brazilian states. Formed in September 2003, has strengthened the local action groups of youth through School Commissions – local action – and Environmental Youth Collective – in a state level – to ensure exchange of information and experiences and promote mutual support at national level.

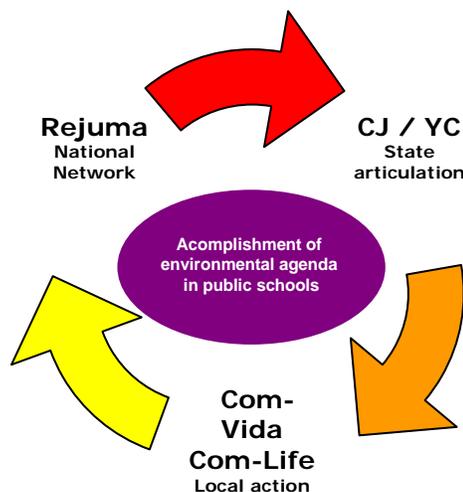
The REJUMA encourages and supports the creation of local networks in a process of dissemination and empowerment of youth to social and environmental action.

Since 2003, when it was created during the National Youth for Environment Meeting, REJUMA is building the identity and autonomy and is present in several areas of discussion, proposals and construction of public policies for youth and environment as the National Conference on Environment, and Inter-institutional Committee for Environmental Education (CIEA's) that meet local, regional and national environmental education and with a seat in the National Council of Youth (CONJUV), coordinate the camera issue of Youth and Life Quality.

The Com-Life is a new form of organization in the school and it is based on the participation of students, teachers, employees, directors and community. Who organizes the Com-Life are the delegate and their substitute of the School Environment Conference, with the support of teachers.

The main role of the Com-Life is to contribute to a participatory, democratic, lively and healthy coexistence at school, promoting exchanges between the school and the community.

The Youth Collective for the Environment is an informal group that gathers young people from 15 to 29 years. They come from organizations or not, youth movements,



schools or universities. With the principles of "young educates young", "Young chooses young" and "One generation learns from another", the group only work in collective way, respecting the cultural and social diversity.

Those three, interrelated articulations are now the only actual proposal that give voice to groups yet to be heard. Even though those networks are functioning since 2003, the local and state authorities still have hard time to deal with adolescents. In some places, there are conflicts; others, the State Secretary put the YC inside its structure; and few schools manage to give real voice and promote a mobilization process that goes beyond the organization and/or participation in conferences and other meetings.

Here is where UNICEF can contribute to strength those networks: promoting and facilitating the dialogue between children, adolescents and youth with the authorities – local, state and federal ones. This will happen through the UNICEF Seal of Approval, in the Social Participation Strategy.

One main change in Seal of Approval for Amazon region is that besides, the so called articulator - a person that is indicated by the Mayor to articulate different local government areas to improve child and adolescent public policies – this new version will also have two other representatives that will work with the articulator:

- A society representative from the Local Child's Right Council;
- An adolescent, indicated by the Com-Lives, in articulation with the YC.

By doing that, it is possible do ensure the dialogue between these different actors and, at the same time, make everybody responsible for the public policies – rethinking some of them, producing new agreements, identifying demands for technical qualification, implementing a real right guarantee system, monitoring. All of this towards child's and adolescent's quality indicators improvement. Even though is a competition, is also a healthy, joyful and participative proposal, with place to everyone's will and respect to each and everyone differences.

In the agenda specifically in the schools, the goals are:

- Develop the Agenda 21 in the schools;
- Promote the environmental education<sup>46</sup> with teachers and students;
- Support the organization of Environmental Conferences in the schools;
- Promote exchange of experiences between the Com-Lives;
- Mobilize communities towards child's rights.

---

<sup>46</sup> When we talk about Environmental Education the reference is the Treaty on Environmental Education for Sustainable Societies and Global Responsibility, approved during Rio-92.