

## EXECUTIVE SUMMARY

Historically, concentrations of the GHG gases are originated as consequence of the physical changes in the surface of the earth, taken place by the deforestation, the agriculture and the expansion of the human establishments have varied in an acceptable level. However during the last century the antropogénic- activities have increased sustainably. The main causes of the concentrations of these gases in the atmosphere are the development of the global industrialisation, the use of new technologies and the growing consumption of fossil fuels.

Paraguay, worried by the environmental degradation and the increase of the emissions of GHG, caused mainly by changes in soil use, the destruction of forests, the growing urbanization, the increase of the park and in minor quantity the emergence of the industries and the wrong dispositions of the waste, it has signed and ratified the Marco Agreement of the United Nations for the Climate Change, according to Law 251/93 and the Kyoto Protocol according to Law 1447/99.

In that context, the purpose of the First National Communication of the country is. To give to know the national situation with regard to the contribution of the greenhouse effect, as for the possible derived national impacts of the problem.

The First National Communication is the result of the effort of the institution, of the national consultants, of the entities and consultants of the international scientific community under the coordination of the Secretary of the Environment (SEAM).

Equally, the analysis includes the administrations that have been carried out to guarantee the effectiveness of the mitigation measures and adaptation to the proposed climate change in institutional matter.

This denominated document “First National Communication” includes the results of the studies carried out by the Program of Training for the Climate Change CC:TRAIN with the support of the United Nations for the Formation and the Investigation (UNITAR), it

programs created to attend the developing countries to implement the Marco Convention of the United Nations for the Climate Change (UNFCCC) and the results of the execution of the “Project PAR/98/G31” with the support of the United Nations Development Program (UNDP7GEF), which was executed by the Sub-secretary of Natural Resources and Environment (SSERNMA), at the moment Secretary of the Environment (SEAM) created by Law N°1561 July 21 2000.

The present study incorporates the results of the vulnerability studies and adaptation for the sector agriculture, cattle rising, climatic scenarios and the mitigation analysis of the climate change causes and effects and the national strategy of implementation for each sector.

The final report of the vulnerability and adaptation studies of climatic scenarios for the different time horizons have demonstrated interesting results on the possible variations of the precipitations.

International specialists elaborated this document in base to the technical national and international experts consultancy studies and training.

For the studies, the organisms of the climate change suggested the methodologies to be used and they were sustained in the priorities and national necessities.

The First National Communication count with the government's official support through the Secretary of the Environment (SEAM), the focal Point at the Convention. It manifests the interest and national commitment to accompanying international organisms in the search of solutions to the global environmental problems.

### **NATIONAL CIRCUMSTANCES**

#### **Location and geographical characteristic**

Paraguay is a landlocked country, it is located in the center of South America, limits with Argentina (South and West), Brazil (North and East) and Bolivia (North and West). It is located between the parallels 19°18´ and 27°36´ South, and the meridians 54°15´ and 62°38´ West of Greenwich. The tropic of Capricorn passes exactly almost over the half part of the territory. The country has a territorial extension of 406.762 Km<sup>2</sup>. The river Paraguay divides to the country in two natural regions environmentally very different defined as the Oriental Region and the Western Region.

The relief of the Paraguayan territory is determined by the western border with the Brazilian shield and the Chaco plainness. Moreover, the course of the Paraguay river that crosses the country from North to South divides it in two big physiographic regions, those previously mentioned.

#### **Geographical division**

The modern political-administrative classification of Paraguay began in 1906, when a new law divided the Oriental Region and the Western Region in Departments, subdivided in localities or partidos, and designated their capitals. In 1973 the political-administrative map of the national territory was configured by the following Departments: Alto Paraguay, Alto Paraná, Amambay, Boqueron, Caaguazū, Caazapá, Canindeyū, Central, Concepción, Cordillera, Guairá, Itapúa, Misiones, Ñeembucú, Paraguari, Presidents Hayes and San Pedro, besides the Capital District, Asunción.

The Oriental region extends along the left riverbank of Paraguay the rivers Paraná and Apa, the mountain ranges of Mbaracayú and Amambay, occupy an area of 159.827 Km<sup>2</sup>, that is equal to the two fifth parts of the national territory. Toward the East is the Paraná plateau. It is the western extension of the Brazilian macizo, it is formed by a crystalline basement that covers a sandy and basaltic substrate of silts of the Secondary, that have given place to red lateritic soils covered by a thick tropical forest. The western edge of this plateau is constituted by an orographic system whose main formations are not more than a range of mountains of small altitude. They are the mountain ranges of Ambambay, Mbaracayú and Caaguazú.

The Western region extends from the right of the Paraguay river toward the West. It occupies a surface of 246.925 Km<sup>2</sup>, equivalent to the fifth three parts of the Paraguayan territory. It is part of the chaco-pampeana great plain, area located between the basin of the Amazons and the Patagonia and among the Brazilian shield and the Andes.

Inside this great physiographic unit, the Western region occupies the called Chaco Boreal, wide plain to the North of the Pilcomayo river. It has scarce demographic density for diverse reasons whose characteristic (sands, loes, loams) they determine the existence of extensive lowlands. Drained by numerous rivers and creeks that flow in the country. In spite of the uniformity, the Western region is divided in three sub-units, the first is the right coast of the Paraguay River characterized by a border that impedes the floods and favours the development of gallery forests. The second is the High Chaco, located to the Northwest where the Departments of Alto Paraguay, Boqueron and Presidente Hayes, that are distinguished to be a dry plain, with sandy dunes and swamp areas. The third is Bajo Chaco that constitutes a fringe from about 80 Km<sup>2</sup> parallel to the Pilcomayo River characterized by the floodable lowlands.

### **Hidrográfico System**

The hidrographic system of the Paraguay belongs entirely to the Rio de la Plata basin, the second more important of the country after the Amazon basin and consists of two springs determined by the Paraná and Paraguay rivers. The last one crosses the country territory from North to South. It delimits the Oriental and West physiographic regions. The hydrographical net of the Paraguay is vertebrate for its homonymous river name and the Paraná. It is characterized by its great complexity. In the Oriental region the system is conformed by watercourses. Some of them of long journey that feeding big rivers, lagoons, lakes, and tidelands formed in the most depressed areas and whose levels and extension vary according to rains.

In the Western region the number of effluents is considerably smaller, but the scarce difference of the Chaco plain gives place to small drainage water courses and big tidelands that cover's it and in the dry season they appear in all its extension like dry waterbeds.

### **Climate and temperature**

As for the climate and temperature, the country is crossed by the tropic of Capricorn. The general climate belongs to the tropical dry, with mean temperatures of 24°C. However, it is necessary to highlight big thermal variations determined by the continentality and the practically plane characteristic of the territory. By this way the sea doesn't allow to feel its moderator effects on the warm climate including the currents of hot and humid or cold and dry air, according to the origin of the winds. The range of mountains, plateaus and valleys located in the East of the country determine a temperate and humid area that contrasts with the warm tropical dry of the Chaco plain that extended to the West.

Paraguay has springs and winters of pleasant temperatures, during which frosts are rarely presented. The values oscillate around the 19°C and torrid summers with a high

percentage of humidity that can reach in some areas,, amongst them Asunción city up to 41°C.

This tropical characteristic of the Paraguayan climate is also verified in the regime and quantity of rain, which present space variations according to temperatures. In general, the precipitations are more abundant in the Southeast region and toward the Northwest area. In the first sector are registered mean precipitations of 1800 mm, although this quantity increases in the mountain areas in the Paraguayan valley. The rains reach the 1300 mm; and in the Northwest end 700 mm, although almost the entirety of them falls in the summer.

### **Precipitations**

The precipitation regime is determined by a rainy season (summer), and a dry season (winter), that lasts hardly one month in the Central region, while in the area of the Chaco it can last until 5 or 6 months. It can be said therefore that the continentality accentuates the dryness as you advance towards the East. Considering one and other, the quantity of annual half rain of the country is of about 1600 mm.

The characteristics of the Paraguayan relief favour the flow of the winds. A circulation of the meridian type dominates them; they run from North to South and of South to North. According to this condition during the summer the area of low-pressure area located in the Argentinean Northeast determines the displacement of a current warm and humid air coming from the centre of Brazil that causes the increase of temperatures, the environmental humidity and the discharge of abundant precipitations.

During the winter currents of cold and dry air penetrate, the wind coming from the South of the Argentinean pampas. At margin of these two main currents also blows occasionally temperate and humid winds, coming from the Andean mountain range, that usually cause some strong precipitations, as well as the North-eastern temperate and dry winds that usually moderate the high temperatures of the summer.

### **Government**

Paraguay is an organized sovereign state as a unitary and indivisible Republic whose government according to the Constitution of 1992, is based on a representative system, participative and plural. The proclamation of the country as independent Republic by the congress took place October 12 1813. The national territory is organized in a Capital District and seventeen Departments, with a government in a governor's hands and of a departmental Assembly whose members are chosen directly by their inhabitants. They are divided in turn in Districts and each District in Municipalities.

### **Population**

The Paraguayan population is essentially young, in that way those smaller than 15 years represent more than 40% of the total and the fringe between 15 and 64 year overcomes 55%, what determines the economically active population's high figure (PEA).

One of the aspects that should be kept in mind is the demographic density drop of the country, calculated in about 10 hab/Km<sup>2</sup> and the population's unequal space distribution that determines the Chaco region, almost 60% of the territory has an inferior mean density to 0.5 Hab/Km<sup>2</sup>. In opposition to the Oriental region (17 Hab/Km<sup>2</sup>) and mainly in Asunción where is overcome the 25 Hab/Km<sup>2</sup>.

Similarly, the markedly rural characteristic that has distinguished the Paraguayan population tends to modify towards the urban, whose percentage overcomes 50 %. In the last decades the flow of the migratory current has been increased from the field to the city

where the demand of the social, basic services and employment have created significant infrastructure problems and overcrowding.

**Religion**

Paraguay is a country of great Roman apostolic Catholic tradition, but complete freedom of cults exists. However, the Catholic religion prevails and organizes the country and their congregation in an Archdiocese, a Diocese, two Prelaturas Nulius and two Apostolic Vicarioussness. It is necessary to emphasize that the archbishopric and the bishops should be Paraguayan.

**Language**

Paraguay is the only Spanish American country that possesses two languages of widespread use and both at the moment declared official. Spanish consecrated official language and Guarani consecrated national language and official by the New National Constitution.

**Education**

The national educational system is in charge of the Ministry of Education and Culture. The organization agrees with the educational canon methods of world development and include four levels, Pre-primary, Primary, Secondary and University student.

The primary education is compulsory and free, starting from 1909 according to the corresponding law that establishes it. Since then many efforts have been made thus all the inhabitants complete the primary level and although undeniable processes have been achieved, there are still situations not totally overcome.

**Economy**

The growth of the Paraguayan economy during the decade of 1990 presented some similar values to those registered by the population's growth. Since the average of growth of the Gross Internal Product (GIP) along the period it was 2,9%.

However, this economic growth made little to palliate the levels of poverty that registered in the country.

The cattle rising, the agriculture and the forest exploitation constitute the base of the Paraguayan economy, it represents in the group 27% of the Gross Internal Product in the last years (16,5% for agriculture, 7,8% for cattle raising and 2,7% for forest exploitation), and almost entirely of the exports.

**Agricultural activity**

The agriculture constitutes the fundamental pillar of the Paraguayan economy. The agricultural sector is the main source of the population's employment. Soybean and cotton contributes especially more than 50% of the national exports and most of the inputs for the industrial sector. The agriculture seats in two production types linked to the characteristics of the earth properties.

In areas densely populated of the country where the small properties prevail, subsistence agriculture is developed dedicated to the cultivation of corn, manioc and in smaller measure cotton and tobacco.

In the colonization areas located in the Oriental region, where medium size properties are common industrial cultivations are developed as cotton and soybean that constitute the main export products. The increase of the cultivated surface, moreover the progressive mechanization of the agricultural tasks and the incorporation of modern techniques has

allowed a higher yield of exploitations and a remarkable quality improve of the products of the earth, especially those dedicated to export.

### **Cattle activities**

The cattle activity although doesn't reach the importance of the agricultural it is also very significant for the economy of the country. An important factor in this sector is the abundance of the natural grasses that occupies 40% of the country surface. The quality of the meat has improved significantly in the last decades, due to crossing of the Criollo race with refined races and to the employment of plants and forages for the feeding. The South of the Chaco and the areas understood among the rivers Ypané and Apa and the Departments of Missions, Paraguari and Ñeembucú, in the southern part of the country; concentrate most of the bovine race. The ovine livestock, whose races have also been improved, has a descending productive line, the same as the goats. On the contrary, the suine presents a clear growth tendency. Most of the livestock is Criollo race, because their exploitation has had, traditionally a secondary character in the agricultural establishments.

Almost half of the national territory it is covered by forests. Forest exploitation has constituted one of the axis of the Paraguayan economy recently. However the indiscriminate pruning and the extension of the agricultural activities have shrunk the productive capacity of the Paraguayan forests considerably. At the present time Paraguay produces hard wood and semi-hardwood mainly those that are largely exported.

### **Industrial activity**

The industrial sector is in Paraguay in an incipient phase, the main industrial items correspond to the transformation of agricultural products. They are cattlemen and forest whose processing plants are concentrated fundamentally in the capital. Among the most developed industry in the country are, textile, tobacco, oily, floury, brewer, sugar, cement, meat and timber.

### **Mining resources**

Paraguay doesn't have large Mining Resources, but it has been able to develop a mining activity in small scale. Among the non metal-bearing minerals it stands out the exploitation of the clay, the feldespató and the mica, in addition salts, talc and plaster, materials with application in the chemical industries, ceramic and of foundry. Among the rocks are the used in the construction. It is necessary to mention sand, lime, marble stone and flagstone.

### **Sources of Energy**

The rivers Acaray and Paraná are two important sources of hydroelectric energy whose exploitation didn't begin to take place until the second half of the XX century, when they were built a series of big dams.

The hydroelectric dam of Acaray on the Acaray River has been built. It allowed Paraguay to export energy for the first time. Also on the Paraná River the Brazilian-Paraguayan dam of Itaipú and Argentinean-Paraguayan of Yacretá-Apipé. The production of these three big central dams has located Paraguay among the biggest exporters in electric power of the planet. At the same time it provides an important flow of resources to promote and activate industrialization in the wide context of the Mercosur. The Itaipú dam, one of the biggest hydroelectric complexes in the world, is built on the Paraná River in the proximities of Foz de Iguazú and Ciudad del Este. Among the populations the great wall of water contention has given place to an artificial lake of 1350 Km<sup>2</sup> it is shared in same parts by Brazil and Paraguay extends.

The great hydroelectric complex of Yacyretá-Apipé, inaugurated in 1994 and worked in 1998, has forming an artificial lake of 1600 Km<sup>2</sup>.

### **Communication and Transport**

The Republic of Paraguay, due to the continentality has had as main via of Communication and Transport the fluvial course of the Paraguay and Paraná Rivers. Where through ships of medium draught access to the Atlantic. In large projects elaborated in the regional context of the Mercosur it is necessary to mention the hidrovía Plata-Paraná-Paraguay. It will allow the fluvial communication among the basins of Plata and the Amazons. It will constitute an extraordinary motor of continental integration and it will have to the Paraguayan territory as an exceptional node of communication.

Paraguay has developed a net of highways which has as main axis of development the Pan-American highway that links Asunción city with Curitiba (Brazil) and Buenos Aires (Argentina). This net counts with approximately 30.000 Km. of highways, where 3000 correspond to paved roads.

### **Trade**

Soybean and cotton are the first official exports products. The main export destinations are the Holland, Brazil and Argentina. According to the figures of the Ministry of Industry and Trade at the end of the 1990's decade, 72 of 1.600 export companies represented 80% of the total sales to the outside. The concentration was even higher in the case of exports; only 14 companies represented 60% of the total of such sales.

The volume of the Paraguayan external trade is inflated by the high volume of reexports, so much legal as illegal to Brazil and Argentina. This way, in the last years the official exports registered by the General Directorate of Customs were in the order of 1.143 million dollars. The total exports registered in the statistics of the scale of payments were of 3.768 millions. A part of the reexports is legal: the purchases that foreign tourists carry out in Ciudad el Este. But the illegal export of a wide range of products form a substantial part of the total of exports. During the nineties decade the public finances began to depend more and more of this triangular trade.

### **Health Sector**

The health presents a complex profile of mortality, cohabit with diseases is the characteristic of less development countries combined with other chronic, degenerative and those linked with accidents and violence of diverse type. Emergent, re-emergent, transferable and not transferable illnesses coexist. The deficits of health has as main causes the extreme poverty, the scarce basic sanitation; the inadequate hygienic sanitary and practical education is the lack in the groups of more vulnerability, as well as the low coverage and efficiency of the public services. They remain as serious health problems of the high rates of maternal and infantile mortality. It is evident the necessity of focalise works tending to facilitate the social integration and to overcome the diverse discrimination forms toward vulnerable groups (women, children, young, adults, indigenous and handicap people). Is registered the inefficiency of the reference system and is verified against reference of patients and the use of resources, as well as the scarce resolatory capacity of the urgencies, prevailing an unequal territorial distribution of the resources with high concentration in Asunción and the Central District.

### **Education and culture**

The educational system is characterized by its low coverage, quality problems and justness in it different levels, with scarce diversification of the educational offer and little educational improvement (the third part of the positions is occupied by people with lack

of educational formation). Repetition rates and relatively high desertion are observed and it lowers enrollment rate, retention and general efficiency. The functional illiteracy and the low educational level of a great number of adults are serious. More than half of heads of homes of the urban area have lack of instruction and a third part only has primary education. It is notorious the inequity that affects rural institutions: schools and incomplete schools; late school access; low efficiency; reduced absorption and graduation in half level education; deficits in infrastructure, equipment and educational material. The Educational Reform has not yet consolidated and it will include in the process the half level education and superior level. It is scarce the contribution of the educational system to the consolidation of the national culture, the preservation of the historical and natural patrimony and the development of the democratic values.

### **Tourism**

For the natural and cultural characteristics, Paraguay has big tourist attractiveness, as the Ypacarai and Ypoá lakes, the fluvial courses of its main rivers where also sportive fishing is practiced; the wild Chaco plains and the Jesuit ruins of Trinidad of Paraná and Jesus of the Tavarengue, classified as Patrimony of Humanity by the UNESCO and able to generate an intense cultural tourism. The changes that have been introduced in the hotel infrastructure and the growth of this sector make foresee a notable increment in the flow of visitors.



**TECHNICAL STUDIES FOR THE NATIONAL COMMUNICATION**

**National Inventory of Greenhouse Gases–Base Year 1994**

It is important to mention that according to the National 90's Inventory of Greenhouse Gases, the sector that more contributes with the Greenhouse Gases is the energy with 63.63%, followed by the land use sector with a contribution of 29.2%, followed by agriculture with a contribution of 5.04% and the industry sector with 2%. Taking as reference the gases of more emission are the carbon dioxide (CO<sub>2</sub>) being 87.24% of the total emissions, followed by the carbon monoxide (CO) contributing with 6.75% and in last place the methane (CH<sub>4</sub>) contributing with 4.7% of the total emissions.

The National Inventory of Greenhouse Gases in 1994 indicates that the Agriculture was the sector with more contribution of gases, with a contribution of 73.48% of the total of emissions, the sector change and land use contributes with 22% and the energy sector constitutes 3.64% of the total emissions.

Taking as variable the emitted gases, the major contributor is the carbon monoxide (CO) being its contribution of 62.5% of the total emissions, continued by carbon dioxide (CO<sub>2</sub>) with 26.5% and nitrogen oxide (NO<sub>x</sub>).

Table 1. Inventory National of GHG year 1990

EMISSIONS	CO <sub>2</sub>	CO	NOX	CH <sub>4</sub>	N <sub>2</sub> O	COVDM
Energy	10409,3	0,41	1,69	0,017	0,48	NE
Agriculture	NE	10,26	77,34	642	95,2	NE
Land Use	3530,45	1094,1	31,04	125	0,85	NE
Industry	334,32	0,07	0	0	NE	5,19
Waste	NE	NE	NE	3,26	0,23	NE
<b>Total</b>	<b>14274</b>	<b>1104,8</b>	<b>110,1</b>	<b>770,3</b>	<b>96,7</b>	<b>5,19</b>

Table 2. Inventory National of GHG year 1994

EMISSIONS	CO <sub>2</sub>	CO	NOX	CH <sub>4</sub>	N <sub>2</sub> O	COVDM	SO <sub>2</sub>
Energy	3068,08	1,286	2,677	0,055	0,63		
Agriculture	NE	51817	0,004	3016			
Land Use	17812,3	640,4	6899	73,19	235		
Industry	733,65	0,082	18,18		0,5	1,82	0,28
Waste	NE			3,67	0,27		
<b>Total</b>	<b>21614</b>	<b>52459</b>	<b>6920</b>	<b>3093</b>	<b>237</b>	<b>1,82</b>	<b>0,28</b>

Source: I Project PAR/98/G31–SEAM/PNUD

### Construction Scenarios

As for the generation of Climatic Scenarios of gas emissions, for our country it was based in the emission scenarios of the Intergovernmental Panel of Climatic Change (IPCC): IS92a, IS92d and IS92c, those that are considered respectively as pessimistic, moderate scenarios and optimists. The projected horizons of time were 2010–2030 –2050 - 2070 and 2100 in base to the climatic series 1961-1990.

For the country study it has been divided in four areas or regions. This division was carried out due the SCENGEN model has a spatial resolution of 5° times 5° of latitude and longitude. For each area or region is considered a homogeneous behaviour of the climate. The delimitations of the areas or regions can be seen in the following table.

**Table 3. Delimitation of the areas or study regions**

AREA	LATITUDE (SOUTH)		LONGITUDE(WEST)	
	FROM	UNTIL	FROM	UNTIL
I	20°	25°	60°	65°
II	20°	25°	55°	60°
III	25°	30°	55°	60°
IV	25°	30°	50°	55°

Source: own Elaboration, Vázquez 2001.

The area I concerns to the West of the western region, it largely includes the Department of Boqueron.

The area II correspond to the center and East of the western region and to the North of the oriental region. It includes the Departments of Alto Paraguay and Presidente Hayes in the western region of the country. It also includes to Concepción Department, Amambay, San Pedro, part of Caaguazú and Canindeyú, all of the oriental region.

The area III, affects the center and South of the Oriental Region, including mainly the Departments of Central, Paraguari, Caazapá, Guairá, Ñeembucu, Missions and Itapúa.

The area IV, reaches the East end of the Oriental Region including the Department of Alto Paraná. The area IV was considered due to the peculiar interest of the health and agriculture in the Alto Paraná region. These areas cover the whole of Paraguay, except some part of the country, where small areas only belong to other cells, in this case it was considered as belonging to the nearest cells.

The four areas or regions obtained from the SCENGEN that covers the Paraguay almost entirely, there have been selected a total of 9 meteorological climatological stations, assisting to the homogeneity of the climatic behavior, to the extension and continuity of the information.

### Evaluation of the Vulnerability and Adaptation Options

The vulnerability studies and adaptation in the Agriculture sector include the yields in the current climate without variation of CO<sub>2</sub> and with an increase in the concentration of CO<sub>2</sub> to double the current concentration, considering the years 2010–2030 - 2050 and 2100 with a sensibility of 4.5°C.

The sector considers diverse agricultural items according to its importance for the country region; there are for each zone studies the results of potential crop yields free of pests and diseases, water necessities and nutrients are satisfied.

The result of the work analysis identifies crop losses, expressed in a yearly average decrease of the yields. Differences exist according to the used method and according to the crop in study defined as potentials, it means free of pests, diseases, water necessities satisfied, denominated potential yields or without water stress or cultivation scenarios denominated " Secano ". According to the analyzed scenarios the considerations in presently work determined the average fall of yields by effect of the climatic changes in Paraguay for the four agricultural items soybean, corn, cotton and sorghum.

The global production loss of soybean varies for the year 2100 between 18.000 tons and 50.000 tons per year. While the global loss of production of corn varies among 16.656 tons up to 66.624 tons per year, the global loss of sorghum production varies among 4.392 tons up to 13.

908 tons per year for the year 2100 and the sorghum loss varies for the year 2100 among 61.360 tons up to 184.060 tons per year.

In the husbandry sector the cattle areas were identified that are sociological economic and ecologically vulnerable to the climatic changes, as well as to evaluate the effect of the climate to the management practices and the ecological processes of the lands, dedicated to the cattle raising. The possible strategies of adaptation are also identified in order to minimize the adverse effects and to optimize the benefits of the climatic changes.

The cattle raising will be more rational when this activity suits to the atmospheric events that characterize the locality. In the current state of the science the predictions of climatic change can give us an orientation of the address and sense of the changes with certain probability of certainty in the magnitude of this changes, what can serve as base for a more rational future cattle production.

It should be an incentive to the programs of agricultural investigation to the obtaining of new varieties or long-term races. As well as the probability that the future climatological conditions make more important certain pests and diseases of certain cultivations.

The report of the Health sector in Paraguay indicates that it presents a high vulnerability to the climate and its variations. Still when the evaluations of this vulnerability are scarce and isolated, the presence of a seasonal census is recognized, correlated with the rainy seasons.

In the Departments of Alto Paraná and Canendiyú malaria is an infectious disease transmitted by vectors that is sensitive as much to the variability as to the climatic change. The biggest physic impact observed in the climatic variability is related with the growing tendency that has the malaria in those Departments in correspondence with the tendency also growing of the climatic index IB1.

Malaria will be disease that will suffer a great impact under conditions of climate change. According to the carried out projections, for the year 2010 an important increment should take place in connection with the cases registered before the 90's. With regard to the current conditions, this figure would be even bigger, since the levels of affectation for the diseases are smaller than in the base period.

Given the non consideration of a series of relevant variables for the behaviour of the disease, for different causes will be necessary to undertake new investigations that allow to deepen in the nature of the bonds found in this first study. Emphasizing in the evaluation of the economic cost of the foreseen impacts, as much the variability as the climate change.

### **Socioeconomic evaluation of the Climatic Change Impacts**

As for the Economic Evaluation in the Agricultural and Forestry sector, this analysis includes the physical impliceance of the climatic change in Paraguay on the base of the temperature variation and precipitations, the effects on the decrease of crop yields and cattle production. For the effect technicians involved in the analysis have prepared diverse investigation methods.

The studies of economic evaluation of climate changes consist on quantifying the meaning of the negative effects of the climatic change in monetary terms and with economic indicators.

The effects according to the method applied to quantify the losses of agricultural crops and cattlemen can be considered important in the producer environment because gets lost every year, in concept of yield reduction about 15 million dollars and in the country ambit about 21 million dollars every year. The losses are higher when projecting the population's growth their revenues and their current average consumption of energy.

According to this method the cost of the losses ascends to 50 million dollars per year in the producer environment and 69 million dollars at the country level. These figures would be much higher if there are also considered the effects of the climate change in other sectors like the industries, migrations, health, etc., for what is recommended to include the studies of these costs at some time for the country.

For the present, it is clear that Paraguay should assume costs, at least in the quantity estimated in the present evaluation. That is to say among 15 millions to near 70 millions per year to mitigate the negative effects of the climate change in the agricultural and forestry sector.

For instance with the value of these losses you could compensate with reforestation programs and these costs would reach to reforest, at 500 dollars per hectare the following surface according to analysed methodology:

1. With 15 million dollars they can be reforested every year 30.000 hectares and cumulatively until the year 2100 about 3 million hectares, this would mean a covering of 7% of the total surface of the country in the year 2100.
2. With 21 million dollars can be reforested every year 42.000 hectares and cumulatively until the year 2100 about 4.2 million hectares, this would mean a covering of 10% of the country.
3. With 50 million dollars can be reforested every year 100.000 hectares and cumulatively until the year 2100, about 10 million hectares, what would mean near of the 25% total surface of the country.
4. With 69 million dollars can be reforested every year 138.000 hectares and cumulatively until the year 2100, about 13.8 million hectares what would represent 34% of the total surface of the country.

As environmental service this additional surface easily could represent the fixation and the storage from the following volumes of dioxide of carbon to reason average, estimativo of 30 tons year:

- a- 3 million hectares similar to 90 million tons of dioxide of carbon in the year 2100.

- b- 4.2 million hectares similar to 126 million tons of dioxide of carbon in him year 2100.
- c- 10 million hectares similar to 300 million tons of dioxide of carbon in the year 2100.
- d- 13.8 million hectares similar to 414 million tons of dioxide of carbon for the year 2100.

#### **Analysis of options of Mitigation**

In the mark of the National Communication it has been carried out analysis of the possible mitigation actions in the energy sector and in the no-energy one, developing climatic scenarios that allow to measure the evolution possible of the socioeconomic system and the identification of options of rational use of energy, contributing in positive form to the global change.

It has also been carried out, the analysis of the possibilities and measures of mitigation of the negative effects of the climatic change in terms of costs and benefits coming from the measures, so much of the private sector as of the public sector.

Next a summary of the list of the most excellent discoveries is presented that are the causing ones direct and indirect of the increase of the concentration of Gases of Effects Hothouse (GEI) and that they contribute to the climatic changes. These causes act of interrelated way and their sumatoria they explain the contribution to the climatic changes of so much current concern.

1. The financial system doesn't incentivate the long term investment so necessary to generate employment, to mitigate the poverty and to incentivate activities with sostenibilidad approaches.
2. The growth of Paraguay is him more low of the region.
3. The rural poverty and the alimentary security not had still been solved in Paraguay.
4. The forest subsector is even very weak in Paraguay.
5. The distribution of the earth is not very appropriate for a better image, more progressive and with vision of I root definitive and sustainable.
6. Markets of products, especially the organic ones are not very well-known for the small producer. Production, productivity and competitiveness with first floor levels.
7. The floors are not being used in function to their true productive potential.
8. The country this losing in great measure their biological diversity.
9. The use of the floor manifests on one hand a scarce production of cultivations vegetable, very little surface with permanent cultivations, and pacas natural reservations.
10. The producers are not organized around the production, commercialization or transformation of the matter prevails agricultural and forest.
11. The derived fuels of the petroleum (diesel, naphtha with or unleaded) they are considerable causing of the increment of Gases of Effect Hothouse.
12. The excessive deforestation and the scarce afforestation and reforestation reduce more and more the reception possibility and storage of dioxide of carbon.
13. It burns it of biomass for the indiscriminate use of the fire, the concentration of Gases of Effect Hothouse increases.
14. The cattle raising and the cultivation of rice are the causing ones main of the emission of the gas methane in the country.
15. The erosion of the floor contributes to the increment of the environmental deterioration and the emission of gases of effect hothouse.

16. For effect of the climatic change it is of waiting important reductions of the agricultural yields.
17. Studies made for Paraguay give bill that there will be increases of temperature and rains in next years because of the increase of the Gases of Effect Hothouse.
18. Paraguay manifests growing consumption of energy, among those which those derived of fossil fuel.
19. The implementation of Programs of afforestation and reforestation will be able to be very useful to mitigate the causes that produce the negative effects of the climatic changes.
20. The population in general not this sufficiently familiarized and conscious on the necessity of a more sustainable handling of the natural resources and the environment.

**Limits of a National Strategy of Implementation of the Convention of Climatic Change**

As for the strategic proposals, he/she was carried out the analysis to achieve the mitigation of the negative impacts originated by the climatic change and mainly an analysis of strategies that allow to achieve a sustainable development for our country and that they could be good to the environmental authority and other public institutions to impel the development.

These main lines of strategies were carried out with base to achieve a quality of satisfactory life for the whole present and future population by means of the preservation, recovery and improvement of the environmental quality and of the natural resources.

Some areas that should be developed to achieve a bigger environmental, economic, social stability and politics that are the following ones:

- To incorporate surface to the natural regeneration of the vegetation, he/she intends a goal of 10% of the total of the country.
- To improve the public services of transport.
- To prohibit the import of used vehicles, besides controlling the state of the vehicles in general.
- To apply technologies with use of alternative fuels as solar energy, biodiesel, alcohol etc.
- To implement a new tax politics with approaches more desarrollista.
- To foment an agroindustrial politics.
- To promote the organic agriculture, the biological and natural control.
- To revalue the traditional technology.

To achieve the full development of the mentioned areas and to have a quality of life improved for the current and future population a bigger artificial security it is required, the one regarding the laws, the definitive exile of the impunity so that investments are achieved in the area of the sustainable production, in the protection of the natural resources and in general the permanent understanding to the population on the necessity of a vision and long term mission that it points to concrete actions of results and benefits.