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**NATIONAL COMMUNICATIONS FROM PARTIES NOT INCLUDED IN
ANNEX I TO THE CONVENTION**

**CONSIDERATION OF THE FOURTH COMPILATION AND SYNTHESIS OF
INITIAL NATIONAL COMMUNICATIONS**

**Fourth compilation and synthesis of initial national communications from Parties
not included in Annex I to the Convention**

Note by the secretariat*

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* This document is submitted after the due date because all the necessary information was not available on time.

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Explanatory note

The following International Organization for Standardization (ISO) country codes have been used throughout this document:

Antigua and Barbuda	ATG	Mongolia	MNG
Bahamas	BHS	Morocco	MAR
Barbados	BRB	Nicaragua	NIC
Botswana	BWA	Niue	NIU
Burkina Faso	BFA	Panama	PAN
Burundi	BDI	Papua New Guinea	PNG
Chad	TCD	Paraguay	PRY
Colombia	COL	Peru	PER
Congo	COG	Saint Kitts and Nevis	KNA
Cuba	CUB	Saint Lucia	LCA
Dominica	DMA	Swaziland	SWZ
Ethiopia	ETH	Togo	TGO
Guatemala	GTM	Trinidad and Tobago	TTO
Guyana	GUY	Tunisia	TUN
Haiti	HTI	Yemen	YEM
Maldives	MDV		

I. INTRODUCTION

1. Pursuant to Article 4, paragraph 1, and Article 12, paragraph 1, of the Convention, all Parties to the Convention shall communicate information to the Conference of the Parties (COP). This provision applies to Parties that are not included in Annex I to the Convention, referred to as non-Annex I Parties. Article 12, paragraph 5, specifies that each non-Annex I Party shall make its initial communication within three years of the entry into force of the Convention for that Party, or of the availability of financial resources in accordance with Article 4, paragraph 3. Parties that are least developed countries may make their initial communication at their discretion.
2. By its decision 30/CP.7, the COP requested the secretariat to prepare the fourth compilation and synthesis of initial national communications non-Annex I Parties, based on submissions received from such Parties between 1 June 2001 and 1 June 2002, and to make that report available to the subsidiary bodies for consideration by the COP at its eighth session.
3. The fourth compilation and synthesis of initial national communications from non-Annex I Parties covers 31 Parties which submitted their initial communications during the time period indicated above. It includes information on the problems and constraints encountered by non-Annex I Parties in using the Guidelines for the preparation of initial communications by Parties not included in Annex I to the Convention (FCCC/CP/1996/15/Add.1, decision 10/CP.2, annex) referred to below as the UNFCCC guidelines, and on other issues raised by non-Annex I Parties. The information contained in this report is structured in accordance with the above-mentioned guidelines.
4. The secretariat noted that Parties, while using the UNFCCC guidelines, provided varying degrees of detail under the various headings and sub-headings of the guidelines. In some instances, the information relevant to a particular section of the guidelines was not readily accessible, due either to its dispersion throughout the text or to an interpretation of a sub-heading which had led to its inclusion under a different section of the communication.
5. Information provided in this document could also serve in supporting the implementation of other COP decisions, particularly those on other matters relating to communications from non-Annex I Parties, on capacity-building in developing countries, on the implementation of Article 4, paragraphs 8 and 9, of the Convention, and on technology transfer. Parties may wish to organize the information presented in their future national communications along these lines. The secretariat will take account of the views expressed by Parties on the structure of the present report and make modifications as appropriate when preparing subsequent compilation and synthesis reports.
6. By its decision 30/CP.7, the COP also requested the secretariat to prepare an executive summary covering the information contained in all the initial national communications from non-Annex I Parties. The summary, which was prepared by the secretariat, includes information from the 83 initial national communications from non-Annex I Parties that had been submitted since the entry into force of the Convention and is contained in document FCCC/SBI/2002/8.

II. NATIONAL CIRCUMSTANCES

7. All reporting Parties provided information on national circumstances in a separate chapter in their national communication with varying levels of detail. Parties also presented information relating to their national circumstances in other thematic chapters such as inventories, vulnerability and mitigation.
8. Fifteen Parties (ATG, BHS, BRB, BWA, COG, CUB, DMA, ETH, KNA, MNG, PNG, SWZ, TCD, TUN, YEM) presented information using a summary table I as provided in the UNFCCC guidelines. This table provides an overview of 15 key socio-economic data sets, such as population size,

gross domestic product (GDP) and literacy rate. Some Parties provided information not only for the year 1994, as requested by decision 10/CP.2, but also for other subsequent years. All Parties except one (MNG) also presented information in other general overview tables on tourist arrivals, education, demography and physical geographic characteristics (e.g. climate and weather patterns, biodiversity, drainage basins).

9. The United Nations Development Programme (UNDP) Human Development Report 2001 classified two of the reporting Parties as having high human development (BHS, BRB), 15 as having medium human development (BWA, COG, COL, GTM, GUY, MDV, MNG, NIC, PAN, PER, PNG, PRY, SWZ, TTO, TUN) and eight as having low human development (BFA, BDI, ETH, HTI, MAR, TCD, TGO, YEM), according to their ranking in the human development index (HDI).¹ Six countries (ATG, CUB, DMA, KNA, LCA, NIU) are not included in the HDI. According to the current list of least developed countries maintained by the United Nations Conference on Trade and Development (UNCTAD), eight of the Parties are also classified as least developed countries (BDI, BFA, ETH, HTI, MDV, TCD, TGO, YEM).

Physical geography

10. All Parties presented information on the physical geography of their countries. This included information on the size and location of the countries and climate. All but one Party reported on the geomorphologic characteristics of their territories. Many Parties provided information on physical and natural characteristics, such as hydrology (22 Parties), biodiversity (14 Parties), ecosystems (14 Parties), coastal zones (nine Parties), and soils (six Parties). Many Parties also provided detailed information on climatic variables, such as rainfall (29 Parties), temperature (25 Parties), humidity (13 Parties), solar radiation (four Parties), and wind (nine Parties).

11. The reported land area of each reporting Party varied from 259 km² for Niue to over 1.5 million km² for Mongolia. Seven Parties (ATG, BRB, DMA, KNA, LCA, MDV, NIU) reported a land area of less than 1,000 km².

12. Most Parties also highlighted specific aspects of their climatic circumstances including, inter alia, exposure to extreme weather events. For example, 14 Parties reported on (severe) tropical cyclones (ATG, BHS, BRB, CUB, DMA, HTI, KNA, LCA, MDV, NIC, NIU, PNG, SWZ, TUN), 11 Parties (ATG, BHS, BWA, COL, CUB, GUY, MNG, PAN, PNG, PER, TTO) on the effects of the El Niño Southern Oscillation (ENSO) phenomenon, seven Parties on droughts (COG, MNG, NIC, PNG, PER, SWZ, TTO) and two Parties (COG, NIC) on flooding. Ten Parties (BWA, BFA, CUB, GTM, MNG, PER, SWZ, TCD, TUN, YEM) indicated that their territories contained arid and semi-arid regions.

13. Twenty-three Parties reported that their territories contained mountainous regions and five of them (ATG, DMA, LCA, NIC, PAN) also reported having active volcanoes. Nine Parties (ATG, BHS, BRB, DMA, KNA, LCA, MDV, NIU, TTO) described themselves as being small island States. Six Parties (ATG, BHS, GUY, MDV, PAN, TTO) stated that their relief included low-lying coastal areas. Five Parties reported that they were landlocked countries and two Parties (PAN, SWZ) highlighted the fact that they were transit countries. Twenty Parties provided information on forested areas. Fifteen Parties stressed that deforestation was an important problem for them.

¹ The human development index is based on three development indicators: (i) a long and healthy life, as measured by life-expectancy at birth; (ii) knowledge, as measured by the adult literacy rate (two-thirds weight) and the combined primary, secondary and tertiary gross enrollment ratio (one-third weight); and (iii) a decent standard of living, as measured by gross domestic product per capita (purchasing power parity in US dollars).

Economic circumstance

14. All Parties included information on their economic circumstances. Two topics were addressed by all Parties in this regard: agriculture and fisheries, and services. All but two Parties also reported on the manufacturing industry. Other topics addressed by a majority of Parties were energy, transport, forestry, mining and tourism.

Primary sector (agriculture, mining, energy)

15. The primary sector was reportedly the largest sector for six Parties (BFA, BDI, ETH, GUY, MNG, NIC). The contribution of the primary sector to GDP for all reporting Parties ranged from 4 per cent (BHS) to 43 per cent (TCD). Eleven Parties (BDI, BFA, CUB, ETH, GUY, MAR, MDV, MNG, NIC, TCD, TGO) stressed that the development of the agriculture sector was a priority for them. Eight Parties (BDI, BHS, BWA, COG, ETH, NIU, TTO, YEM) mentioned that subsistence agriculture was their main form of agricultural activity. Eight Parties (BWA, BDI, COL, MAR, PER, PNG, TCD, TGO) indicated that mining was an important sector of their national economy.

16. All reporting Parties provided information on the energy sector. Estimated reserves of fossil fuels and/or non-fossil fuel energy sources were presented by 12 Parties (BDI, BRB, BWA, COL, ETH, MNG, NIC, PER, TCD, TGO, TTO, YEM). The same number of Parties (ATG, BHS, BWA, DMA, KNA, LCA, MAR, MDV, MNG, NIC, NIU, TCD) stressed that they were highly dependent on fossil fuel imports, while two Parties (TTO, YEM) indicated that they were highly dependent on fossil fuel exports. Eleven Parties (ATG, BDI, BHS, BRB, BWA, COL, CUB, MDV, NIU, TTO, TUN) provided information on the trend in the energy mix used in their countries and described their initiatives to move away from high carbon content fuels such as oil to natural gas and renewable energy sources. Thirteen Parties (COG, CUB, LCA, MAR, MDV, MNG, NIC, PER, TCD, TGO, TTO, TUN, YEM) indicated that favourable circumstances existed for future exploitation of renewable energy resources, and seven Parties (BDI, COL, ETH, GUY, PAN, PER, PRY) reported on the existence of significant potential for hydroelectric power generation in their countries.

Secondary sector (manufacturing industry)

17. Twenty-two Parties indicated the percentage share of their industrial sector in GDP. Only three Parties (COG, MAR, PNG) reported that the secondary sector contributed the largest share to their GDP.

Tertiary sector (services)

18. The tertiary sector contributed the largest share to the GDP of 14 Parties (ATG, BRB, COL, CUB, DMA, GTM, KNA, PER, PRY, SWZ, TGO, TTO, TUN, YEM), the share ranging from 10.5 per cent for Mongolia to 87.2 per cent for Barbados.

19. Nineteen Parties included separate sections on tertiary sector activities. Twenty-three Parties provided information on their transport sector. Nine Parties (ATG, BWA, BHS, BRB, DMA, LCA, MAR, MDV, NIU) highlighted tourism as a particularly important economic sector.

Social and demographic circumstances

20. In the description of their social and demographic circumstances, all Parties included a population profile. A majority of Parties also reported on the distribution of their population, literacy rates, political system, human health and education and/or research.

21. Population size varied widely between Parties, from less than 3,000 (NIU) to more than 53 million people (ETH). Ten Parties (ATG, BHS, BRB, DMA, GUY, KNA, LCA, MDV, NIU, SWZ)

reported having a population of less than one million. All 31 Parties together represented a population of nearly 250 million.

22. The literacy rate varied from 13 per cent (TCD) to 100 per cent (CUB) and the average literacy rate for all reporting Parties was 70 per cent. The share of urban population ranged from below 8 per cent for Burundi to more than 75 per cent for Cuba. The average share of urban population for all reporting Parties was below 50 per cent. Ten Parties (BHS, COG, COL, CUB, MAR, MNG, NIC, PER, PRY, TUN) indicated that 50 per cent or more of their population resided in urban areas.

III. SUSTAINABLE DEVELOPMENT AND THE INTEGRATION OF CLIMATE CHANGE CONCERNS INTO MEDIUM- AND LONG-TERM PLANNING

23. All Parties provided information on their plans for sustainable development and the integration of climate change concerns into medium- and long-term planning. In general, information provided on this issue was very limited and was not specific enough to enable identification of concrete sustainable development activities. Thirteen Parties dedicated a separate section of their communication to sustainable development concerns, while 14 included a section on national planning, and others provided information on these issues within the context of other thematic chapters of the national communications.

24. Twenty-five Parties (ATG, BDI, BHS, BRB, BWA, BFA, COL, CUB, DMA, ETH, GUY, KNA, LCA, MAR, MDV, NIU, PAN, PER, PNG, PRY, SWZ, TCD, TTO, TUN, YEM) provided information on sustainable development and planning by describing national development or environmental plans, institutional arrangements and legislation on the environment and/or development. The reported areas of activity included, inter alia, integrated coastal zone management, environmental impact assessment, fight against air and noise pollution, rational use of natural resources and waste management. Sixteen Parties (ATG, BHS, COL, CUB, DMA, ETH, GUY, KNA, LCA, MAR, MDV, MNG, NIU, TCD, TGO, TUN) emphasized the need to ensure an integrated approach in dealing with environmental, social and economic issues.

25. Fifteen Parties (ATG, BHS, BWA, COL, GTM, GUY, MAR, MNG, NIC, PAN, PRY, PER, TGO, TTO, TUN) mentioned the creation of committees on sustainable development and/or global change. Few Parties reported on concrete activities or priorities in relation to the implementation of Agenda 21.

26. Fourteen Parties (BDI, COG, COL, DMA, ETH, GUY, KNA, LCA, MNG, NIU, PRY, PER, TGO, TUN) indicated that they were in the process of formulating or had already formulated comprehensive national climate change plans and/or policy frameworks to coordinate and facilitate the implementation of the UNFCCC. Many Parties indicated that climate change concerns would be taken into account in future social, economic and environmental policies at the national level.

27. Most Parties mentioned the creation of specific institutional frameworks dedicated to climate change activities. Much of the information on institutional frameworks was related to the establishment of national climate change committees, which involved government institutions, the private sector and non-governmental organizations. Twenty Parties (BDI, BFA, BHS, BWA, CUB, DMA, ETH, GTM, GUY, KNA, LCA, MAR, MNG, NIC, PAN, PER, PRY, TCD, TUN, YEM) described the institutional structures set up to implement the Convention. Many Parties described very broadly the institutional strengthening initiatives necessary for effective implementation of climate change activities. Many Parties also expressed the need for improved capacity to identify national priorities and develop sectoral strategies and measures to address climate change.

28. Many Parties provided information on efforts to coordinate climate change activities. Some Parties stressed the importance of the role of national UNFCCC focal points or designated national

authorities in coordinating various climate change activities. Several reporting Parties described specific coordination activities such as meetings, workshops and the development of databases.

29. Some Parties identified the lack of appropriate legislation as an obstacle to the integration of climate change issues into national planning, and therefore stressed the need for developing and enforcing the required legislation. Some Parties reported on existing and/or planned environmental legislation and/or strategies in various areas including, inter alia, forestry, clean air and the energy sectors.

IV. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS OF GREENHOUSE GASES

30. In accordance with Article 4, paragraph 1(a), and Article 12, paragraph 1(a), of the Convention, the Parties provided information on their national inventory of anthropogenic emissions by sources and removal by sinks of greenhouse gases (GHGs) not controlled by the Montreal Protocol. This section of the report covers inventory information and methodological and analytical issues and problems identified by the 31 non-Annex I Parties which have submitted their national communications.

A. Methodological issues

31. Most Parties followed the UNFCCC guidelines and took into account relevant conclusions of the Subsidiary Body for Scientific and Technological Advice (SBSTA), which encouraged Parties to apply the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (FCCC/SBSTA/1996/20, paras. 30(b) and 31).

Methods and gases

32. All Parties followed the IPCC Guidelines² in compiling their national GHG inventories. Twenty-nine of them used the Revised 1996 IPCC Guidelines, and two Parties (HTI, TCD) used, in addition, the 1995 IPCC Guidelines.

33. Eighteen Parties (BDI, BFA, BHS, BRB, BWA, COL, CUB, DMA, GTM, GUY, LCA, MAR, MNG, NIU, PAN, PER, TCD, TUN) reported problems relating to limitations of the current IPCC methodologies for estimation of emissions in some sectors. The major concerns were the availability, quality, and lack of disaggregated data required to apply the IPCC methodology (see table 1). Some country-specific problems encountered were: lack of methods for estimating carbon sequestration by coral reefs and calcareous algae as well as by soils and fruit trees; grassland in steppe climates and forest fires; lack of methods for estimating non-methane volatile organic compound (NMVOC) emissions from solid waste disposal; difficulties in calculating emissions from waste combustion; the lack of default values for sulphur dioxide (SO₂) emissions from the mining and metallurgy industry; nitrogen emissions from organic matter with high protein content; lack of method for calculating emissions from solvent use; and inappropriate classification of eco-climatic zones.

34. All Parties estimated emissions of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), with the exception of Maldives, which did not include N₂O emissions. Twenty-three Parties (BDI, BFA, BRB, COG, COL, CUB, DMA, ETH, GTM, GUY, HTI, LCA, MAR, NIC, NIU, PAN, PER, PRY, SWZ, TGO, TTO, TUN, YEM) provided emission estimates for all the GHG precursors,³ while five Parties (ATG, BHS, KNA, MNG, TCD) provided estimates for some of these precursors (carbon monoxide

² The title "IPCC Guidelines" refer to both the *1995 IPCC Guidelines for National Greenhouse Gas Inventories* and the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*.

³ Precursors are atmospheric compounds which have an effect on greenhouse gas or aerosol concentrations by taking part in physical or technical processes regulating the production or destruction rates.

(CO), nitrogen oxides (NO_x), NMVOC). Three Parties (BWA, MDV, PNG) did not provide estimates of these gases. Five Parties (BRB, DMA, LCA, PER, SWZ) provided estimates of hydrofluorocarbons (HFCs), while the rest did not provide estimates of HFCs, perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆). Twenty Parties (ATG, BRB, COL, CUB, DMA, ETH, GTM, HTI, LCA, MAR, NIC, NIU, PAN, PER, PRY, SWZ, TGO, TTO, TUN, YEM) reported emission estimates of SO₂.

35. Nineteen Parties (ATG, BFA, BRB, BWA, COG, COL, CUB, DMA, ETH, GTM, GUY, KNA, LCA, PAN, PER, TGO, TTO, TUN, YEM) applied both reference and sectoral approaches. Five Parties (BHS, MDV, PNG, PRY, TCD) used only the reference approach for estimating their fuel combustion emissions, while seven (BDI, HTI, MAR, MNG, NIC, NIU, SWZ) applied only the sectoral approach. Twelve Parties (ATG, BWA, COL, DMA, GTM, KNA, LCA, PER, TGO, TTO, TUN, YEM) performed the comparison between the two approaches and reported observed differences, which ranged from less than 1 per cent (BWA, LCA, TUN) to 40 per cent (TTO).⁴ This comparison is a useful self-verification procedure, which greatly improves the transparency of the inventories by giving an indication of the level of uncertainty of the data used. The usefulness of applying both approaches would be enhanced if the identified differences were explained by all Parties.

36. Estimates of emissions from international aviation and/or marine bunker fuels were reported by 24 Parties (ATG, BFA, BHS, BRB, BWA, COG, COL, CUB, DMA, ETH, GTM, GUY, KNA, LCA, MDV, MNG, NIU, PAN, PER, SWZ, TGO, TTO, TUN, YEM). Fourteen Parties (BHS, BRB, COG, COL, CUB, DMA, GUY, LCA, MDV, NIU, PAN, TTO, TUN, YEM) provided a breakdown into marine and aviation bunkers. In conformity with the IPCC Guidelines, these emissions were not included in the national total but reported separately.

37. The IPCC Guidelines request Parties to make efforts to report the estimated range of uncertainty in their emission estimates, where appropriate. The reporting of uncertainties was done by more than half of the reporting Parties (17), three (BWA, NIC, TGO) of them providing the information quantitatively, and 13 (ATG, BDI, BRB, COL, DMA, ETH, GUY, KNA, LCA, PAN, SWZ, TUN, YEM) qualitatively. Cuba reported both qualitatively and quantitatively. The sectors covered in estimating the range of uncertainty were often energy, agriculture and land-use change and forestry (LUCF), and in some cases, waste and industrial sectors.

Activity data

38. Most of the reporting Parties identified the lack of activity data as a major constraint for estimation of emissions of some source categories in at least one sector, which was usually the energy and LUCF sectors, and to a lesser extent the agriculture, industrial processes and waste sectors.

39. Unavailability of activity data in a suitable form for compiling the national GHG inventory in accordance with the IPCC Guidelines was reported by 14 Parties (ATG, BHS, BWA, COL, DMA, GUY, KNA, LCA, NIC, NIU, PER, PNG, PRY, TCD). This mainly concerned the energy, LUCF and agriculture sectors.

40. Eighteen Parties reported that some important activity data are either lacking or are not accessible due to lack of adequate data collection and/or management systems. Seven Parties (ATG, BFA, COL, CUB, LCA, MAR, TTO) reported generally on the issue, while 11 (BHS, BRB, BWA, GUY, MDV, NIC, NIU, PAN, PER, PRY, TGO) elaborated on their needs, which related mainly to the energy and forest sectors. These needs were often identified as lack of institutional capacity for the collection, archiving and management of data for preparing the inventory and systematization/standardization of

⁴ For countries with oil and gas exports, such as TTO, the observed difference between the two approaches is larger than for other countries.

activity data. Peru reported problems with the calculation of fugitive emissions in the petroleum industry and data on the import of gaseous fluoride compounds.

41. Regarding energy use, 18 Parties (ATG, BDI, BFA, BRB, BWA, COL, DMA, GUY, KNA, MAR, MDV, NIU, PAN, PER, PNG, TUN, TCD, YEM) indicated broadly or specifically the lack of activity data. The fields specified were household biomass consumption, vehicles and equipment efficiency in the transport and industrial subsectors, and international bunker fuels. Panama mentioned the discontinuation of the energy balance following privatization of its energy sector. Peru was developing an energy balance that was expected to improve information needed for future inventories.

42. Fifteen Parties (ATG, BFA, BHS, BRB, COL, CUB, DMA, GUY, MAR, PAN, PER, PNG, SWZ, TUN, YEM) reported difficulties in obtaining activity data in the necessary time series for the LUCF sector, as requested by the IPCC methodology. Data on land use and forest cover were often outdated. For example, for Bahamas data date back to a survey carried out during the period 1971 to 1976 while for Peru the time series used for changes in forest and woody biomass stock was for the period 1965 to 1994. Barbados and Colombia mentioned their inability to estimate abandonment of agricultural land during the past 20 years. Swaziland reported immense difficulties in estimating areas converted over different periods of time. Dominica and Saint Kitts and Nevis used expert judgement to evaluate land-use change over the past 20 years.

43. In the industrial processes sector, eight Parties (BDI, BHS, BRB, COL, PER, TGO, TTO, TUN) faced problems in collecting activity data. Togo reported that the needed data were considered to be confidential, while Colombia indicated problems related to the harmonization of the IPCC source categories with those used locally.

44. The source of the activity data used for the emission estimates of the different sectors and source categories was referenced by all Parties with varying levels of detail, even though this information is not explicitly requested by the UNFCCC guidelines. Parties indicated that activity data were obtained from various national sources, such as national statistics provided by the respective ministries, municipalities and agencies, or from industrial facilities. Nicaragua also indicated having used expert judgement when data were not available.

Emission factors

45. Twenty-one Parties (ATG, BDI, BRB, COL, CUB, DMA, ETH, GTM, GUY, KNA, LCA, MAR, MDV, NIU, PNG, SWZ, TCD, TGO, TTO, TUN, YEM) reported that the default emission factors provided by the IPCC Guidelines often did not reflect national circumstances well, hence their use in inventory calculation led to uncertainties in the estimates. Emission factors were specifically reported to be inappropriate for the industrial processes and waste sectors mainly, and to a lesser extent for agriculture and LUCF. Trinidad and Tobago and Maldives mentioned significant uncertainties in the emission estimates as a result of the unavailability of factors specific to small island developing States.

46. The IPCC Guidelines do encourage the development and use of local emission factors that suit national circumstances. However, all Parties used IPCC default methods except three that developed their own methodologies regarding fuel combustion for electricity generation (BRB), CO₂ emissions from venting and flaring (COL), LUCF (COL), and enteric fermentation of poultry (GUY). Four others developed their own emission factors or conversion coefficients for CO₂ and non-CO₂ from fuel combustion (BWA, CUB), CH₄ from manure management and enteric fermentation (GUY), CO₂ from biomass burned on site (BWA), and biochemical oxygen demand (BOD) value for waste water (MNG). Four Parties used regionally available factors or coefficients, mainly with regard to non-CO₂ emissions from savanna burning (BWA), fractions of biomass burned on and off site (DMA, KNA, LCA) and emissions from poultry (LCA).

Reporting tables

47. Fifteen Parties (ATG, BFA, BHS, BRB, BWA, CUB, DMA, ETH, GTM, GUY, LCA, NIU, PER, PRY, TTO) used the IPCC summary tables⁵ and 12 Parties (BDI, COG, COL, HTI, KNA, MAR, MNG, NIC, PAN, SWZ, TGO, YEM) provided information using tables with a similar format. Tunisia adopted the IPCC summary tables in a separate inventory document and a similar format in the national communication. Three Parties (MDV, PNG, TCD) did not use the IPCC summary table(s) or a similar format.

48. None of the reporting Parties strictly used table II in this way. Three Parties (MDV, PER, PNG) adopted a modified format of that table. All but two Parties (GTM, PNG) included sectors or source categories of the IPCC other than those explicitly required by UNFCCC table II (see table 2). In some cases it was not clear whether certain source categories were not reported because they were not relevant for the country or had not been estimated for other reasons.

49. Eight Parties (BFA, BRB, COG, CUB, DMA, LCA, TTO, TUN) provided all the necessary IPCC worksheets,⁶ which give detailed calculations of the estimation of GHG emissions as well as numerical information on aggregate emission factors and activity data for inventories using the IPCC default methods. Botswana, Panama and Peru provided some of the IPCC worksheets and the rest did not provide any worksheet. The provision of these worksheets contributes substantially to the transparency of the inventories.

50. The degree of completeness in reporting on IPCC sectors and subsectors was high. Only six Parties (ATG, BHS, MDV, MNG, PNG, PRY) did not report on emissions from agricultural soils. All but two Parties (BHS, MDV) reported on CO₂ emissions from the LUCF sector.

51. Fourteen Parties used the notation keys indicated in the IPCC Guidelines.

B. Presentation of results

52. Table 3 summarizes inventory data in terms of aggregate emissions and removals provided for the years 1990 and 1994. This table also includes data from Parties which provided data only for a year other than these two years. In accordance with the UNFCCC guidelines, the analysis provided in this section is based on 1994 inventory data, whenever possible. When needed, estimates provided by Parties have been converted into CO₂ equivalent estimates using 1995 IPCC global warming potentials (GWPs) in order to facilitate comparison of inventory results. Such a presentation shows, for example, the relative contributions of the different GHGs and the different sectors to a Party's total GHG emissions. It should be noted that 22 Parties (BDI, BFA, BWA, COG, COL, CUB, ETH, GTM, GUY, HTI, LCA, MAR, MNG, NIC, PAN, PER, SWZ, TCD, TGO, TTO, TUN, YEM) used the GWPs to estimate the relative contribution of each individual GHG or sector to their aggregate GHG emissions, although this is not required by the UNFCCC guidelines.

53. Other reporting issues were also noted during the process of compiling the inventory information. Different emission estimates for the same sector or source categories were indicated in different places or tables in the communication. Some Parties changed the format of the IPCC summary tables.

⁵ The summary tables and worksheets are automatically generated when using the IPCC software. See *Greenhouse Gas Inventory Software for the Workbook of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories - Instruction Manual*.

⁶ See footnote 5.

Emissions by sources and removals by sinks

54. Most reporting Parties constituted a net source of GHG emissions, with the exception of 10 Parties (BDI, BWA, COG, DMA, GTM, GUY, NIC, NIU, SWZ, TCD) which were net GHG sinks due to the relatively large CO₂ removals reported in the LUCF sector compared to emissions from all the other sectors. When considering CO₂ only, fourteen Parties (BDI, BWA, COG, CUB, DMA, ETH, GTM, GUY, KNA, LCA, NIC, NIU, SWZ, TCD) showed that removals by sinks in LUCF exceeded their total CO₂ emissions.⁷

Aggregate GHG emissions expressed in terms of CO₂ equivalent⁸

55. In terms of total GHG emissions expressed as CO₂ equivalent, CO₂ was the primary GHG for about half of the Parties (ATG, BHS, BRB, COL, CUB, DMA, GUY, KNA, MAR, MDV, MNG, NIU, PER, TTO, TUN, YEM). For 11 Parties (BDI, BFA, BWA, COG, ETH, HTI, LCA, NIC, PAN, SWZ, TCD), CH₄ was the most important contributor to aggregate GHG emissions, and for four Parties (GTM, PNG, PRY, TGO) N₂O was the highest contributor.

56. The energy sector was the largest source of GHG emissions for 16 Parties (ATG, BHS, BRB, COG, COL, CUB, DMA, GUY, KNA, MAR, MDV, MNG, NIU, TTO, TUN, YEM), while for 11 Parties (BDI, BFA, BWA, ETH, GTM, HTI, NIC, PNG, PRY, SWZ, TCD), it was the agriculture sector. The LUCF sector was the main source of GHG emissions for three Parties (PAN, PER, TGO) while the waste sector was for one Party (LCA). Agriculture was the second largest emitter for most Parties. For Trinidad and Tobago and Peru, industrial processes constituted the second and third sources of emissions, respectively. Removals by LUCF in most Parties offset GHG emissions from this sector, with the exception of eight Parties (COL, HTI, MNG, PAN, PER, PNG, PRY, TGO).

57. The level of emissions varied widely among reporting Parties. Aggregate GHG emissions expressed in CO₂ equivalent, excluding LUCF, of all small island developing States (12 Parties) amounted to 76,843 Gg. This represented 12 per cent of the total emissions of all 31 reporting Parties. Five Parties reported emissions lower than 1,000 Gg, while for 23 Parties the emissions were lower than 50,000 Gg. In contrast, two reporting Parties had aggregate emissions totalling over 100,000 Gg, ranging from about 137,000 Gg (COL) to above 142,000 Gg (PRY). Peru had emissions of above 61,000 Gg.

Emissions of main greenhouse gases (CO₂, CH₄ and N₂O)

58. *Carbon dioxide.* Fuel combustion in the energy sector accounted for the largest share of CO₂ emissions for all Parties, ranging from 66 per cent (TTO) to 100 per cent (ATG, BFA, BHS, BWA, DMA, GUY, HTI, KNA, LCA, MDV, SWZ, TCD) of total CO₂ emissions. Within the fuel combustion sector, the energy industry was the largest source of emissions for most Parties, except for 13 (BDI, BFA, COG, COL, DMA, ETH, GTM, HTI, KNA, PAN, PER, SWZ, TGO). On average, transport accounted for 26 per cent of CO₂ emissions from fuel combustion, while for 12 Parties it was the most important source, ranging from 35 to 65 per cent. CO₂ emissions from international bunker fuels were reported by 24 Parties and were equivalent to between 0.5 per cent (MNG) and 416 per cent (SWZ) of total CO₂ emissions. The LUCF sector as a whole constituted a net sink of CO₂ for 21 Parties. For four Parties

⁷ In view of the different role of the *land-use change and forestry* sector in the different Parties - in some, this sector offsets total emissions, while in others it is a large source of emissions - and the request by the IPCC Guidelines to provide net emissions or removals in the different source categories of this sector, the term "total CO₂ emissions" in this document denotes the sum of CO₂ emissions from all sectors except CO₂ emissions and removals in *land-use change and forestry*. This enables presentation of the data in a consistent and comparable manner.

⁸ Aggregate GHG emission estimates given in this document represent the sum of total CO₂, CH₄ and N₂O emissions expressed in CO₂ equivalent, using IPCC 1995 GWP values.

(ATG, NIC, PAN, PER) emissions from the forest and grassland conversion subsector in absolute value exceeded the total net emissions or removals. In the case of four Parties (BFA, COL, HTI, PNG), the largest emissions in the LUCF sector were from changes in forest and other woody biomass stocks. For 19 Parties, however, this subsector constituted the main removal by sinks. For four Parties (BRB, PAN, PER, TGO), removal by sinks in the subsector of abandonment of managed lands was larger than that from changes in forest and other woody biomass stocks.

59. *Methane.* Agriculture was the largest source of CH₄ emissions, ranging from 33 to 100 per cent of total methane emissions for 21 reporting Parties. Fugitive fuel emissions were the most important CH₄ source for three Parties (BDI, NIU, TGO), accounting for between 56 and 86 per cent of total methane emissions. The waste sector constituted the primary source of CH₄ emissions, ranging from 77 to 100 per cent for seven Parties (ATG, BRB, DMA, KNA, LCA, MDV, TTO). In the agriculture sector, livestock was the most important subsector for 25 reporting Parties. Rice cultivation or other agricultural activities was the largest source for the other Parties.

60. *Nitrous oxide.*⁹ Agriculture was the most important source of N₂O emissions for 26 reporting Parties, ranging from 50 per cent (COG) to 100 per cent (PNG), while fuel combustion was the largest source for only one Party (MNG) with a value of 100 per cent. For two Parties, the waste sector constituted the most important source of N₂O, with values ranging from 59 (NIU) to 100 per cent (ATG).

C. Current trends

61. While the inventory data for the base years 1990 or 1994 are requested by the UNFCCC guidelines, eight Parties (BHS, BRB, COL, CUB, ETH, GUY, MNG, PRY) provided a GHG inventory for both 1990 and 1994. This allowed for a preliminary analysis of the trends of GHG emissions in these countries. It should also be noted that Barbados provided an annual GHG inventory for 1997 and that Guyana and Mongolia provided annual GHG inventories from 1990 to 1998, while Ethiopia provided such information from 1990 to 1995. Togo provided annual GHG inventories from 1992 to 1998.

62. Total CO₂ emissions (excluding LUCF) increased over the period 1990 to 1994 in some countries: 10 per cent (ETH), 13 per cent (BHS), 15 per cent (BRB), 16 per cent (COL), 23 per cent (GUY) and 150 per cent (PRY). In others, total CO₂ emissions declined by 22 per cent (MNG) and 40 per cent (CUB). Trends in CO₂ emissions differed when the LUCF sector was included in total CO₂ emissions.¹⁰ In that case, the increase in total CO₂ emissions was higher by 1 per cent (COL), 15 per cent (PRY) and 171 per cent (ETH), while in Barbados the increase remained unchanged. For Mongolia and Cuba the decreases in emissions were 37 and 71 per cent, respectively. In Guyana, CO₂ emissions decreased by 11 per cent.

63. CO₂ emissions from fuel combustion increased in 1994 compared to 1990 for four Parties (BRB, COL, ETH, GUY) while four other Parties (BHS, CUB, MNG, PRY) reported a decline. The largest increase was reported by Barbados (35 per cent), and the sharpest decline by Paraguay (71 per cent).

64. Between 1990 and 1994, CH₄ emissions increased in six Parties (BRB, COL, ETH, GUY, MNG, PRY) by amounts ranging from 0.2 (MNG) to 302 (PRY) per cent. Emissions decreased, however, for Cuba (13 per cent) and the Bahamas (50 per cent). Total N₂O emissions in 1994 increased in four Parties (COL, ETH, GUY, PRY) compared to 1990 levels (15 per cent for Colombia, 118 per cent for Ethiopia, 26 per cent for Guyana and 145 per cent for Paraguay). CH₄ emissions sharply decreased for Cuba (70 per cent), and remained stable for two Parties (BRB, MNG).

⁹ Maldives did not provide N₂O estimates and the Bahamas provided only a national total for N₂O emissions.

¹⁰ Due to incomplete reporting for the year 1994, the Bahamas was not taken into account for this comparison.

V. MEASURES CONTRIBUTING TO ADDRESSING CLIMATE CHANGE

65. All Parties, with the exception of Trinidad and Tobago, included in their national communication, information on programmes containing measures that could contribute to addressing climate change. Twenty-three Parties presented measures on limiting the increase of GHG emissions, 12 on enhancing removals by sinks and 11 on both measures. In the reports, Parties covered aspects such as national policies that have implications on GHG emissions; potential abatement options in sectors, including methodologies, scenarios, models and criteria used for the assessment, constraints and implementation strategies; and lists of projects proposed to mitigate climate change.

66. Parties used two general approaches to provide information. Some Parties described the sectoral policies and measures adopted by the country that would affect their future emissions, while the majority of Parties identified the most important sectors in terms of either present or future GHG emissions and analysed the sectoral measures or projects that could contribute to reductions in GHG emissions or enhancement of removals by sinks. The sectors covered in the reports included energy, agriculture, LUCF and waste.

67. Several Parties reported on the criteria used for the assessment and selection of potential mitigation options. Criteria mentioned included integration of mitigation options into national and sectoral development plans and programmes, possible impacts on the economy, enhancement of economic growth and development, availability of financial resources, potential environmental impact, potential emission reductions and implementation feasibility and cost-effectiveness.

68. The status of implementation of mitigation options differed among Parties. Many Parties indicated that studies were at an early stage and that the development of more detailed recommendations would require consultation with, and input from, stakeholders in the public and private sectors, as well as the development of appropriate policy and legal measures. A few Parties mentioned sectoral measures implemented in previous years, as well as measures that were under implementation. Some Parties also provided information on the proposed mitigation projects, including costs, source of financing, expected emission reductions and/or status of implementation.

A. Energy

69. Thirty Parties reported on possible measures in the energy sector, covering the supply and demand sides. Measures on the supply side included, among others, energy conservation and efficiency, cogeneration, increasing transformation efficiency, modernization of thermoelectric utilities, fuel switching, electricity imports, reduction of losses in transmission and distribution, improvement of transport infrastructure, development of plans to promote rural electrification and use of renewable energy sources.

70. On the demand side, Parties identified mitigation options in the industrial, residential, commercial and/or transport sectors. Regarding the industrial, residential, and commercial sectors, the main reported measures related to enhancement of energy efficiency in lighting, cooling, cooking and air conditioning; implementation of demand-side management programmes; promotion of fuel switching; and use of renewable energy.

71. In the transport sector, measures identified by Parties covered development of road transportation master plans; introduction of electric or compressed natural gas vehicles, encouragement of early adoption of hybrid vehicles, discouragement of the use of private vehicles, improvement of the public transport system, introduction of vehicle emission standards, adoption of legal measures to limit the importation of used and/or reconditioned vehicles, modernization of locomotives, improvement of road infrastructure as well as passenger and freight vehicle efficiency, and switching from diesel to electric traction on railways.

72. Parties used either expert judgement or elaborated models for the assessment of mitigation options in the energy sector. Parties that used expert judgement, based the assessment on the results of the GHG inventories, economic growth patterns and national or sectoral development plans.

73. Parties that used models (BFA, BWA, ETH, MNG, NIC, SWZ, TGO, TUN) projected the level of future emissions using business-as-usual and one or two mitigation scenarios. The main variables used to develop scenarios were: population growth, urban population, energy demand, GDP, and oil consumption. Emission projections were mainly made for the years 2005, 2010, 2020 and 2030. Models mentioned by Parties included LEAP,¹¹ GACMO,¹² MEDEE-S,¹³ EFOM-ENV¹⁴ and WASP.¹⁵

74. Many Parties indicated that abatement options in the energy sector were at an early stage of assessment and that further studies will be required. Seven Parties (LCA, MDV, MNG, NIC, TCD, TUN, SWZ) presented the strategies that have to be developed to implement the potential mitigation options, including aspects such as programmes, resources, lead agencies and time frames as well as political and administrative considerations.

75. Some of the mitigation measures identified for implementation were the use of solar water heaters (ATG, BRB), use of solar techniques for drying sugar cane (BRB), electricity generation using bagasse (CUB), the use of biogas technology (BWA, COL), reduction of venting and flaring of natural gas and increase of efficiency in new vehicles (PAN, PER), cogeneration (GUY, PER), increase of hydro and/or natural gas and/or geothermal electricity generation (PAN, NIC), adoption of improved wood stoves (NIC) and the promotion of photovoltaic energy supply (BWA). Ten Parties (ATG, BRB, COL, DMA, GUY, KNA, MAR, MNG, PAN, PER) reported on the possibility of using wind energy as a mitigation measure.

B. Agriculture and livestock

76. Ten Parties (BDI, BWA, COL, ETH, GUY, HTI, LCA, MNG, TCD, TUN) reported on measures to reduce GHG emissions from agriculture and livestock. Measures reported under agriculture included: introduction of new varieties of rice and management of paddies to reduce CH₄ emissions, rational use of fertilizers, increase of soil water absorption, reduction of agricultural burning, use of mineral instead of organic fertilizers and altering of tillage practices to reduce N₂O emissions.

77. Measures in the livestock-related operations included improvement of cattle feed, reduction of CH₄ emissions from enteric fermentation, manure management and management of livestock population.

78. The level of reporting in the agriculture and livestock sector was in general limited to lists of potential mitigation options; however, six Parties (BDI, BWA, MAR, MNG, TCD, TUN) estimated the emissions for various time horizons and two (BWA, MAR) provided information on the costs of mitigation measures.

79. Few reporting Parties elaborated on the methodology used for the assessment and selection of mitigation options in this sector. They used mainly expert judgement based on the results of the GHG emissions inventory, the national development programmes and the feasibility of implementation of the identified measures. Ethiopia indicated that strategies must be formulated in such a way as to increase food production to feed the rapidly growing population of the country in a sustainable manner. No Party made reference to the use of any particular models in this sector.

¹¹ Long-range Energy Alternative Planning system.

¹² Greenhouse Gas Costing Model.

¹³ Modèle de Demande en Energie pour l'Europe – Sud.

¹⁴ Energy Flow and Optimization Model – Environment.

¹⁵ Water Quality Analysis Simulation Program.

C. Waste management

80. Sixteen Parties (BDI, BRB, BWA, COG, COL, ETH, GUY, HTI, LCA, MAR, MDV, MNG, NIU, PNG, TCD, TUN) presented information on measures to address emissions from the waste sector. Most of them reported on potential options or projects and a few on national policies that have implications on the emissions from this sector.

81. Reported measures included reduction of disposal of organic materials in landfills and/or recovery of methane (BRB, BWA, ETH, GUY, HTI, LCA, MAR, MNG, TCD, TUN), use of biogas from landfills to generate electricity (BWA, TUN), solid waste and/or sewage management (COG, COL, MDV, MNG, PNG), recycling of biodegradable waste (GUY, MNG, NIU) and composting (ETH, GUY, NIU, PNG, TUN), waste processing and waste water treatment (BDI), incineration (ETH), revision and strengthening of legislation and promotion of education, training and public awareness on waste issues (PNG).

82. Few Parties described the methodological aspects of the assessment of mitigation options in the waste sector; however, based on the information provided it is possible to conclude that most reporting Parties used the judgement of experts. Seven Parties (BDI, BRB, BWA, ETH, MAR, TCD, TUN) projected the emissions reductions that could be obtained through the application of some of the selected measures, but no Party made reference to the use of any particular models in this sector.

83. In general, reporting Parties indicated that the potential options are only at an early stage of assessment. Botswana, Morocco and Tunisia presented specific data on costs of some of the proposed measures. Ethiopia indicated that the selection and adoption of mitigation options in this sector depended upon technology, cost of labour, and capacity of local communities.

D. Land-use change and forestry

84. Twenty-five Parties (BDI, BFA, BHS, BWA, COG, COL, CUB, ETH, GTM, GUY, HTI, LCA, MAR, MDV, MNG, NIC, NIU, PAN, PER, PNG, PRY, SWZ, TCD, TGO, TUN) presented information on measures to enhance removals by sinks in the LUCF sector. They provided information either on current national policies that would affect their future emissions or made an assessment of the potential measures in the forestry sector.

85. Measures reported by Parties included: establishing a legal framework for long-term management of forests, establishing forest inventories, setting up a national forest management plan, legislating on types of activities to be authorized within forests, implementing programmes and plans to develop territorial management, investing in alternative sustainable economic activities for rural populations, introducing an environment services tax, avoiding forest fires and pest outbreaks, implementing a master plan to control forest fires, replacing wooden poles by steel fencing, promoting sustainable exploitation of forests, introducing tax incentives and subsidies for forests sectors, and promoting programmes of conservation, regeneration, reforestation, afforestation and agroforestry.

86. Parties indicated that the main criteria used for the assessment and selection of mitigation options were the possibility of including these options in national development plans, and a cost-benefit analysis of the forestry sector and policies to prevent deforestation. Chad included a list of socio-economic, environmental, administrative and institutional considerations of the identified mitigation measures.

87. Ten Parties (BDI, BWA, MAR, MNG, NIC, PER, SWZ, TCD, TGO, TUN) projected the emissions for various time horizons (2010, 2020, 2025) and four Parties (BFA, ETH, SWZ, TGO) used the COMAP model. Eight Parties (BDI, BFA, BWA, MAR, NIC, SWZ, TGO, TUN) provided information on the costs of mitigation measures.

88. Many Parties indicated that, in order to implement the potential mitigation options, further aspects of these options should be elaborated, including more comprehensive studies, consultations with stakeholders in the public and private sectors and development of policy and legal frameworks. Three Parties (CUB, PAN, PER) mentioned specific measures that have already been implemented relating mainly to policy instruments and forestry laws.

E. Projects

89. Seventeen Parties (ATG, BDI, BFA, BRB, BWA, COL, CUB, ETH, HTI, MAR, MDV, MNG, NIC, PER, TCD, TGO, TUN) included in their national communications a list of proposed projects aimed at reducing GHG emissions and enhancing removal by sinks. Five Parties (BFA, BRB, HTI, MAR, MNG) elaborated on the associated costs to implement some of the projects and six Parties (COL, MAR, MNG, NIC, PER, TUN) indicated the mitigation potential. Seven Parties (BFA, BRB, CUB, HTI, MDV, TGO, TUN) described project concepts which included expected outcomes of the project and in some cases their environmental and social benefits. A list of projects by country is maintained by the secretariat at the web page <http://unfccc.int/program/nai/ncweb0201.pdf>.

90. In the energy sector, the mitigation projects identified in the energy supply area related primarily to more efficient production and a wider adoption of renewable sources. Some of the projects proposed were to evaluate the potential of solar, photovoltaic and wind technology, to identify and overcome barriers to widespread adoption of renewable energy, such as wind, photovoltaics, hydroelectricity, biomass and biogas, urban/rural electrification, to decentralize electrification by photovoltaic systems, to adopt a combined cycle expansion of a thermoelectrical plant which uses natural gas, and to conduct energy resources audits. Within the industrial, residential and transport subsectors, projects concerned improving energy efficiency, cogeneration, demonstration and introduction of smokeless and high efficiency coal briquetting technology, developing sustainable energy centres, substitution of fuel and materials, efficient lighting systems, development of a sustainable inter-island sea-based mass transportation system (MDV) and vehicle fuel efficiency improvement. On the demand side, projects concerned management programmes, building insulation improvement, replacement of incandescent bulbs by compact fluorescent lamps, and dissemination of ecological kitchens and improved stoves.

91. In the agriculture sector, projects pertained to information, education and communication and research and development in technologies for GHG mitigation in agriculture and livestock farming, implementation of programmes for livestock breeding and development of vegetable gardening.

92. In the waste sector, projects included improvement of carbonization techniques, collection and utilization of wood waste, development of sewage treatment facilities, an integrated waste management system designed to mitigate GHG emissions, collection and transportation of solid waste in the capital cities, and reprocessing of landfill gas.

93. In the LUCF sector, the projects related to reforestation, wood conservation, conservation and restoration of forests and national parks, forest management and agro-forestry, establishment, restoration and conservation of humid tropical forests, prevention of conversion of agricultural lands, recovery of ecosystems, and hydrological restoration of a plantation's water supply basin.

VI. RESEARCH AND SYSTEMATIC OBSERVATION

94. Most reporting Parties provided information on research and systematic observation, either in a dedicated chapter or in a section of their national communication. Some Parties, however, provided information on this issue in various sections, and a few Parties did not provide any information specifically related to research and systematic observation.

95. Most of the research activities identified or planned by Parties were those included in climate change vulnerability and adaptation assessments and identification of adaptation and mitigation options. Agriculture, water resources, coastal zones and forestry sectors were the most common sectors in which research and systematic observation were undertaken or planned.

A. Research

Ongoing and planned activities

96. Most reporting Parties provided information on their ongoing or planned research programmes and activities, which focused on a better understanding of the impacts of climate change and variability on environment, biodiversity, forests, agriculture, livestock, water resources, coastal zones, fisheries, human health and socio-economic sectors (see table 4). Mitigation programmes included plans to develop renewable energy sources and/or shift to lower CO₂ emitting fuels. Research programmes on the impacts of climate change included activities relating to the maintenance of the sustainability of agriculture and forests through various means, such as: development and adoption of new and appropriate technologies to reduce impacts of climate change, investigation of the quantity and quality of surface and ground water resources, improvement of soil management and a better understanding of fishery activities, coral bleaching and marine ecosystems.

97. Other areas of ongoing or planned research on the impacts of climate change included a better understanding of the ENSO phenomenon, climate variability and extremes, climate prediction, reduction and management of uncertainty related to climate change, development of climate change scenarios appropriate to national assessments, food security, diversification and intensification of agriculture, CO₂ fertilization of crops, forest species composition and coverage, socio-economic implications of climate change, and desertification.

98. About half of the Parties (ATG, BHS, BRB, BWA, COL, CUB, DMA, ETH, GUY, KNA, LCA, NIC, NIU, PNG, TTO) provided information on their research and monitoring activities: collection of data and monitoring of trends for temperature, rainfall and sea level; climate change and tourism; feasibility of demand-side management of energy systems; flaring and gas recovery schemes from landfilling of solid waste; handling of waste water; links between climate and ecosystems structure and function; land-atmosphere interactions and the effects of forest fires; effects of clouds and trace gases on the Earth's radiation balance; climate change effects on human health, coastal and marine ecosystems; and effects of radiation on cloud feedback mechanisms.

99. Some Parties (ATG, BHS, BRB, BWA, COL, CUB, GUY, NIU, PNG) highlighted the importance of monitoring, forecasting and predicting climate and weather, assessing the impacts of drought and rainfall variability, monitoring climate-related public health events, and promoting integrated coastal zone management.

100. About half of the Parties (ATG, BFA, BRB, COL, CUB, DMA, GUY, KNA, LCA, MAR, MDV, PAN, PNG, TCD, TGO, TTO) reported on some of their ongoing or planned research programmes on adaptation to climate change in various sectors. Some of these adaptation research programmes included the evaluation of a range of coastal adaptation options, plant and animal breeding programmes, integrated pest management, improved soil and crop management, evaluation and costing of adaptation in agriculture, water supply and use, development of new adaptation technologies and development of new resistant plant and crop species.

101. Several Parties (ATG, BHS, BRB, BWA, CUB, GUY, KNA, LCA, MAR, NIU, PNG, TTO) provided information on their ongoing or planned research programmes on mitigation in various sectors of their economies. These programmes included a comprehensive assessment of wind and other

renewable energy sources, evaluation of the applicability of the proposed mitigation measures, options for energy recovery and end-use, reduction of GHG emissions, evaluation and costing of mitigation measures, investigation of solar power, promotion of renewable energy sources, and technologies for methane recovery from waste treatment for use in energy generation.

Specific scientific research

102. Many reporting Parties (ATG, BHS, BRB, BWA, COL, CUB, GUY, KNA, LCA, MAR, MDV, MNG, NIC, NIU, PAN, PNG, TTO, TUN) provided information on ongoing or proposed specific scientific research on the impacts of climate variability, ENSO and extreme climatic events on various sectors of their economies. Specific scientific research topics were: the effects of hurricanes and tropical storms, severe rainfall and wind events, droughts and floods and the effects of the El Niño and La Niña phenomenon on human health, agriculture, coastal zone and fishery sectors.

Pilot and demonstration projects

103. Four Parties indicated their involvement in ongoing pilot or demonstration projects relating to the use of photovoltaic systems (BRB), wind energy and solar driers (TTO), conversion of motor vehicles to use compressed natural gas as fuel (COL), and sequestration of carbon in soils (GUY).

Cooperation and collaboration

104. Parties also reported on activities within the context of the preparation of their national communications that were undertaken in close collaboration with national, regional and international programmes and institutions. For example, island countries of the Caribbean region (ATG, BHS, BRB, KNA, LCA, TTO) participated in a regional climate change programme, with financial support from the Global Environment Facility (GEF) and technical and administrative support from national agencies, the University of the West Indies and the Organization of American States (OAS). Papua New Guinea was collaborating with the United States Department of Energy on its atmospheric radiation measurement programme. Peru reported that, in addition to financial and technical support received from its own agencies, it had received financial support from the GEF, and technical support from the United Nations Environment Programme (UNEP), the United Nations Institute for Training and Research (UNITAR) through its climate change training programme (CC:TRAIN), and the Danish Agency for Development Assistance (DANIDA).

B. Systematic observation

105. Most Parties reported on the ongoing or planned activities relating to systematic observation including national observation networks. They also described the upkeep and maintenance of the network of meteorological and hydrological observing stations. The areas for which systematic observation was undertaken included sea-level monitoring (ATG, GUY, MDV), disaster preparedness and response capabilities and early warning systems (DMA), meteorological and hydrological observations (ATG, BHS, BWA, COL, CUB, DMA, ETH, GTM, GUY, KNA, LCA, MDV, MNG, NIC, NIU, PAN, PER, PNG, TTO), and terrestrial and space observations (MAR).

106. Five Parties (ATG, BHS, CUB, KNA, LCA) reported on their observation and monitoring of cyclone and hurricane tracks across oceans by use of satellites and others described the monitoring of water flows, vegetation change, air quality, incidence of diseases and the level of SO₂ concentrations (BWA).

Observation networks and stations

107. Many Parties included information on their observation records and the types of observation networks and stations that are in use. These observation systems include a network of observation and monitoring stations which collect meteorological data (temperature, atmospheric pressure, cloud conditions, precipitation, relative humidity, wind), oceanographic data (tides, sea water temperature, sea level, circulation), and hydrological data (runoff and groundwater). Cuba reported that it also monitors and collects data on the levels of stratospheric ozone and stratospheric aerosols while the Bahamas measures ultraviolet (UVB) radiation.

108. Many Parties also described the number of observation stations and networks involved in systematic observation. For instance, Botswana operates a network of 400 rainfall and 14 synoptic stations, while Cuba has a network of 75 meteorological and 11 rain water quality monitoring stations. Ethiopia has 629 meteorological/climatological stations, 18 synoptic stations and 338 stream gauging stations; Morocco has 44 synoptic stations and over 1,000 climatological stations. In addition to meteorological stations in operation, Mongolia monitors the concentration levels of CO₂, CH₄ and carbon monoxide (CO) over the Gobi desert. Morocco has a network of regional drought observation units within its observation network. Small island States such as Antigua and Barbuda, the Bahamas, Barbados and Papua New Guinea also operate a tide gauge, which measures relative sea-level change.

109. Six Parties (ATG, CUB, DMA, LCA, MDV, MNG) reported on the involvement of non-governmental environmental agencies in the monitoring and assessment of natural ecosystems and monitoring of biological and physiological changes of the coral reef systems.

110. A few Parties mentioned their participation in various global observing systems, such as the Global Sea Level Observing System (BHS), World Meteorological Surveillance, Global Atmosphere Surveillance, Global Climate Observing System, Global Ocean Observing System, Background Atmospheric Pollution Monitoring Network and World Ozone Observing System (CUB), and World Weather Watch (ETH).

111. Some reporting Parties provided information on their cooperation and collaboration with regional and international organizations in systematic observation. Regional organizations include the World Meteorological Organization (WMO) (DMA, GUY, PNG, TUN), Caribbean Meteorological Organization and Caribbean Institute of Meteorology and Hydrology (ATG, LCA), Caribbean Planning for Adaptation to Climate Change through the Organization of American States (ATG, BHS, BRB, TTO), African Centre for Meteorological Applications and Development/Drought Monitoring Centre (ETH, TGO), Southern Africa Development Community/Drought Monitoring and Prediction (BWA), South Pacific Regional Environment Programme, South Pacific Sea Level and Climate Monitoring Programme, South Pacific Geoscience Commission and South Pacific Regional Meteorological Centre (NIU).

112. The international organizations which have cooperated and collaborated with the reporting Parties include WMO, UNEP, GEF, UNDP, the World Health Organization (WHO) and the International Atomic Energy Agency (IAEA).

VII. CLIMATE CHANGE IMPACTS, VULNERABILITY, ADAPTATION AND RESPONSE STRATEGIES

113. All reporting Parties provided information on their current and future vulnerability as well as on adaptation measures and response strategies. The information related to the methods and approaches used in vulnerability and adaptation assessments, limitations of methods and tools, problems and difficulties encountered, sectors studied as well as methods for analysing and evaluating adaptation needs and priorities for financial and technical support, and institutional arrangements and networking. Some

Parties also provided information on other technical areas of work relating to vulnerability and adaptation that they would envisage undertaking if they had sufficient financial resources and technical support.

A. Methods and approaches

114. A wide range of models as well as expert judgement were used in the analysis of impacts in various sectors (see table 5). The models were either process-based or integrated for sectors such as agriculture, water resources, coastal zones, terrestrial ecosystems (forests and grasslands), and human health.

115. Most of the Parties reported on the use of the *IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations*, including the IPCC emission scenarios (IS92 series), but several other Parties did not specify the methods and approaches they used in their assessments. Some Parties (CUB, KNA, LCA, TCD) specifically reported on the use of the *UNEP Handbook on Assessing Vulnerability and Adaptation to Climate Change* (UNEP Handbook), while other Parties (BHS, COL, CUB, GTM, HTI, TTO) also used expert judgement in their assessment of vulnerability. Ethiopia also considered population, and economic and environmental scenarios in its assessment of impacts and vulnerability and Antigua and Barbuda indicated the use of synthetic scenarios of climate change.

116. Many Parties indicated the use of various global circulation models (GCM) to generate climate change scenarios. Fifteen Parties used the integrated model system for the assessment of GHG-induced climate change and the scenario generator (MAGICC-SCENGEN) for generating regional climate change scenarios based on various GCM results (see table 5). Burkina Faso used a Japanese model for assessing water resources. Some Parties also used other types of climate scenarios such as incremental or analogue scenarios for various time horizons up to the year 2100, while a few of these Parties (ATG, BRB, HTI) also reported having used statistical and/or historical methods and downscaling of GCMs (BHS, COL, CUB, GTM, HTI, TTO). Other Parties based their studies on past climate data (BDI, ETH), simulation methods (ETH, PER) or a combination of methods.

117. A wide range of sea-level rise scenarios for different time horizons up to the year 2100 were indicated by six Parties that reported on sea-level rise (BHS, COL, CUB, GTM, MDV, PNG). Parties also carried out sensitivity analyses by projecting high and low emission scenarios on the future sea-level change. For example, Papua New Guinea used the IS92a scenario for a sea-level rise of 80 mm for the year 2020 and 490 mm for the year 2100, and twice these amounts with the IS92e scenario for the same years.

118. Only a few Parties reported on the limitations of the methods and tools used in the assessments. Botswana indicated that GCMs do not address land cover changes arising from the effects of climate change, while Colombia stressed the shortcomings of the IPCC Guidelines in relation to coastal erosion and flooding, vulnerability of water resources and agriculture and the temporal changes in the incidence of malaria and dengue. Paraguay indicated that, given the size of the country and the poor resolution of the GCM outputs, it was not possible to carry out detailed analyses of impacts on biophysical systems/sectors, and Saint Kitts and Nevis highlighted the contradictions between various GCM results. Swaziland indicated that lack of experimental data made it difficult to calibrate and validate statistically the modelling outputs on a number of crops.

119. Only Cuba provided information on the way it dealt with the uncertainties inherent in climate change and emission scenarios. Botswana adopted a variety of GCMs to cover variations in precipitation.

120. Six Parties (ATG, BHS, COL, PAN, PRY, TTO) reported a major constraint in applying the IPCC *Technical Guidelines for Assessing Climate Change Impacts and Adaptation*, mostly due to lack of downscaling of GCM outputs to suit national circumstances.

121. Information provided by Parties on the current and future vulnerability of the sectors was dependent on the relative importance of these sectors in their economy (see table 6). A wide range of sectors and/or areas including agriculture and food security, water resources, coastal zones and marine ecosystems, terrestrial ecosystems (forests, rangelands, etc.), human health and human settlements, fisheries, and others such as biodiversity, infrastructure, coral reefs, tourism and energy were covered in the assessments of vulnerability and adaptation to climate change and its consequent sea-level rise.

Agriculture

122. Almost all reporting Parties assessed the vulnerability of agriculture and indicated that it will be affected by increased climate variability and extreme events such as droughts and hurricanes, a loss of soil fertility and erosion, leaching of mineral fertilizers, heat stress on animals and the indirect effects of sea-level rise. These impacts were expected to translate into lower productivity in general. Another effect identified was a lower quality of fodder that will result in a lower productivity of livestock. Some Parties quantified the reductions in crop productivity, while others mainly used a qualitative assessment.

123. Mongolia reported that its socio-economic development, which is heavily dependent on nomadic livestock husbandry, will be at risk, while Peru stressed the problem of increase in caloric stress on livestock, which is currently a problem with the already high temperatures. Many Parties stated that the very low productivity of their agricultural system will be exacerbated by increased erosion and loss of soil fertility resulting from climate change.

124. Maldives indicated that sea-level rise, accompanied by salt water intrusion in groundwater, will pose a threat to the little agriculture practised on low atoll islands. Antigua and Barbuda reported on the beneficial effects of wetter conditions on most crops and trees and Panama indicated that rice production will diminish while that of corn is likely to increase. Swaziland reported that the effect of climate change was likely to vary with different crops; the yield of maize, a staple crop, was likely to decline by as much as 60 per cent.

Coastal zones

125. Many reporting Parties assessed the vulnerability of coastal zones (see table 6) with some Parties (ATG, BHS, BRB, COG, COL, CUB, DMA, GUY, HTI, KNA, LCA, MDV, NIU, PAN, PNG, TGO, TTO, YEM) conducting the assessment under different sea-level rise scenarios. The main impacts identified were erosion and setback of coastlines, increase of salinity in estuaries and wetlands with the death of mangroves, salt water intrusion into aquifers, beach degradation and losses, decrease in productivity of coastal fisheries and devastating effects on species of coral. Almost all coastal countries, including the small island developing States, reported that climate change and its consequent sea-level rise will have a devastating effect on coastal communities and infrastructure. Dominica reported that 15per cent of its coral reef already showed some signs of bleaching, while Papua New Guinea indicated inundation of some 25per cent of its existing shoreline. Maldives reported that, due to the low elevation of land in the country, it considered its territory as coastal and therefore highly sensitive to sea-level rise.

Water resources

126. Many reporting Parties provided information on the assessment of climate change impacts on water resources. Some of the Parties (BWA, COL, CUB, DMA, GUY, PNG, TGO) reported a potential increase in runoff due to more intense rainfalls and the risk of flash flooding while a few (BFA, ETH)

stressed the decrease in water resources. The negative impacts of salt water intrusion on water quality, sedimentation and evapotranspiration were indicated by most of the reporting Parties, which also stated that they already faced problems of water shortage.

127. Swaziland reported that its summers will get wetter and its winters drier under various scenarios of future climate change. This is likely to cause changes in water supply and demand, putting additional pressure on irrigation.

Human health

128. Many Parties reported information with varying levels of detail on the assessment of climate change impacts on human health. Most of the reporting Parties indicated that the incidence of water- and vector-borne diseases will certainly increase, as well as those related to water contamination. A number of diseases have been identified, the most common being malaria, dengue and diarrhoea, which are likely to increase in incidence under future climate change. Many Parties also mentioned the additional stress higher temperatures will have on the population, which is likely to make them more prone to sicknesses. Some Parties indicated a likely increase in the incidence of endemic diseases as a consequence of climate change, due to population growth and poorer sanitary conditions.

129. Guyana specifically reported on an increase in the incidence of skin cancer within a section of the population as a result of higher incidences of UVB radiation and higher surface temperatures. Maldives indicated that no study has been conducted on the relationship between health and climate change. Nicaragua reported increases of the malaria index ranging from 38per cent to 150per cent under various scenarios of temperature increase.

Terrestrial ecosystems

130. Many Parties provided information on the assessment of climate change impacts on terrestrial ecosystems. Most of the reporting Parties indicated a decrease in land cover vegetation as a result of an increase in aridity and the lower productivity of forests and rangelands. Some Parties (COL, CUB, DMA, GUY, MNG, PER, SWZ) indicated the change and displacement of ecosystems as well as the changes in species composition, and stressed that deforestation is likely to lead to a loss of biodiversity. Other Parties reported on the risk of frequent occurrence of forest fires in the dry season and the related increase in soil erosion.

131. Colombia and Mongolia quantified the resulting climate change effects on different ecosystems. Cuba estimated that 14per cent of the forest area will be affected while Peru reported a 21.8per cent retreat of the area under glaciers. Swaziland reported that assessment of the vulnerability of several tree species showed that their composition, production and distribution is highly likely to be affected by climate change.

Fishery resources

132. Eleven Parties (ATG, BRB, DMA, GUY, LCA, MDV, NIU, PER, PNG, TGO, TTO) reported with varying levels of detail on the assessment of climate change impacts on fishery resources. Impacts were expected to stem from destruction of nursery areas and breeding grounds, such as mangroves and coral reefs, availability of nutrients and increased water temperatures. Antigua and Barbuda indicated that climate change and variability may affect the availability of fish by altering the distribution of the resources that fish depend on. Maldives indicated the need to study the spatial variations of ocean upwellings in relation to tuna migration to better understand the vulnerability of this fishery resource to climate change. Peru reported on a reduction of fishing activities during ENSO events.

Other sectors or resources and biodiversity

133. Some Parties provided information on the vulnerability of other sectors or resources, such as human settlements, tourism and biodiversity. Some Parties (ATG, BHS, BRB, COL, GUY, KNA, LCA, MNG, TTO) indicated the potential effects of frequent storms and hurricanes on infrastructure, energy systems and tourism. Colombia and Mongolia reported on soil degradation and desertification, and wind and water erosion, respectively.

B. Adaptation measures and response strategies

134. Most Parties provided information on adaptation options, measures and/or strategies related to climate change impacts for a wide range of sectors. Many Parties reported on adaptation options for water resources and indicated various water policy reforms to be introduced such as those focusing on water conservation, inter-basin water transfer, desalination, flood management and construction of dams. Some Parties (BFA, BWA, COL, CUB, DMA, GTM, GUY, ETH, HTI) reported on adaptation options and/or strategies in agriculture, which varied from development of drought-tolerant crops to improving early warning systems, enhancing erosion control, and training and assisting farmers. Other Parties (ATG, BHS, BRB, KNA, LCA, NIU, PAN, PER, PNG) reported on adaptation measures which could be undertaken in coastal zones, namely integrated coastal zone management, and yet others reported on human health, forests, tourism, fisheries, human settlements, biodiversity and wildlife. Reported measures included improvement of the health care system, enhancement of forest management, protection of tourism infrastructure, strengthening of environmental legislation and promotion of conservation.

Methods of assessing and analysing adaptation

135. Many reporting Parties did not provide a clear indication of the methods used in assessing and analysing adaptation measures. Some Parties used expert judgement based on the GCM results or projections by impact models. Haiti also used a statistical method while Mongolia reported on the use of a screening matrix where the selected options were assessed in accordance with a set of criteria. Many Parties identified adaptation strategies and measures without using any particular analytical or evaluation method.

Stakeholder participation

136. A few Parties reported on the level of engagement of stakeholders, including policy makers, in the vulnerability and adaptation process. Mongolia reported that it was important to engage private enterprises and academic and educational institutions along with government agencies in the planning and implementation of activities, while Guyana, Niue and Trinidad and Tobago indicated that many of their activities relating to the vulnerability and adaptation assessment process involved various stakeholders through consultations and workshops. Niue mentioned the adoption of a participatory approach that made it possible to involve stakeholders.

137. A few Parties reported on the participation and collaboration between national experts and institutions in vulnerability and adaptation assessment work, and Togo indicated that there was a low level of participation in such work.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

138. All reporting Parties provided information on education, training and/or public awareness. However, the nature, scope and level of detail of information provided varied widely from one Party to another. Eleven Parties (BWA, CUB, ETH, MNG, NIC, NIU, PER, TCD, TGO, TTO, YEM) dedicated

a separate chapter to at least one of the three issues. The other Parties provided related information in other chapters.

139. Twenty Parties (ATG, BFA, BHS, BWA, CUB, DMA, ETH, GUY, KNA, LCA, MAR, MDV, NIC, NIU, PER, PNG, TCD, TGO, TTO, YEM) reported on the development and implementation of educational and public awareness programmes on climate change and its effects. Sixteen Parties expressed their need for financial and technical support to address their concerns on education, training and public awareness. Twelve Parties reported on actual or needed international cooperation in the development and exchange of educational and public awareness materials.

A. Education

140. Twenty-one Parties (ATG, BDI, BFA, BWA, CUB, DMA, ETH, GUY, MAR, MDV, MNG, NIC, NIU, PAN, PNG, PRY, SWZ, TGO, TTO, TUN, YEM) provided general information on existing initiatives and/or future plans to incorporate the issue of climate change into primary, secondary and tertiary educational programmes. Some of these Parties had already started teaching climate change, mainly at university level.

141. Nine reporting Parties (ATG, BFA, CUB, ETH, GUY, MAR, NIU, PNG, TCD) provided information on the extent of participation in international and/or regional educational programmes and workshops relating to climate change.

142. Information on public access to information on climate change and its effects was included in 16 initial national communications (ATG, BFA, BWA, CUB, ETH, GUY, LCA, MAR, MDV, NIC, NIU, PAN, PER, TGO, TTO, YEM). Niue indicated its commitment to granting scholarships for the study of the science of climate change.

B. Training

143. Twenty-three Parties provided information regarding training on issues related to climate change. The nature of the information and level of detail provided did not allow for clear identification of the focus and magnitude of training programmes or a clear distinction between actual activities and needs. Only four Parties (ATG, ETH, MDV, TTO) clearly outlined concrete actions and programmes.

144. Sixteen Parties (BFA, BWA, CUB, DMA, ETH, GUY, KNA, LCA, MAR, MDV, MNG, NIU, PNG, PRY, TGO, TTO) indicated target groups for training activities.

145. Twenty Parties highlighted the importance of the various training activities they had been involved in during the preparation of the initial national communication. They indicated the valuable input they had received from international experts as well as from the various multilateral and bilateral training programmes on the different components of the national communication.

146. Six of the reporting Parties (ATG, BHS, CUB, ETH, PER, PNG) provided information on their participation in, and/or organization of, regional and international training programmes and workshops.

147. Eleven Parties expressed the need to have training on specific technical and policy issues relating to climate change and sustainable development.

148. Seven Parties (BFA, ETH, HTI, MAR, PAN, PNG, TGO) expressed the need to build capacity for the formulation of climate change project proposals in the required format and/or to access bilateral and multilateral funds for project development and implementation.

149. Cuba provided specific information on the number of sufficiently trained personnel and policy makers it had at its disposal to carry out its obligations under the Convention effectively. It indicated

that it had a critical mass of experts that would guarantee its full participation in future implementation of the UNFCCC and the fulfilment of its commitments under the Convention.

150. Nine Parties (BFA, BRB, GUY, HTI, MAR, NIC, NIU, TGO, TTO) provided information on the need for existing national centres to promote the exchange of information on climate change.

C. Public awareness

151. Twenty-two reporting Parties stressed the importance of public awareness in the area of climate change. Several Parties highlighted the challenges they faced in improving public awareness on climate change. However, information provided on the focus and scope of public awareness programmes was often scanty and general in nature.

152. Seven Parties (BHS, CUB, ETH, GUY, HTI, MDV, TTO) provided information on the content of public awareness materials needed or being used. Four Parties indicated that public awareness materials needed to include basic information on climate change and its effects on the country.

153. Nineteen Parties (ATG, BRB, CUB, DMA, ETH, GUY, HTI, KNA, LCA, MAR, MDV, MNG, NIC, NIU, PER, PNG, PRY, TGO, TTO) reported on the ways and means used for existing and planned public awareness activities. The means employed to improve public awareness included, inter alia, workshops, radio and television programmes, newspapers, films, pamphlets and web sites.

154. Five reporting Parties (COL, KNA, NIU, PNG, TGO) clearly indicated public participation in programmes and activities aimed at addressing climate change and its effects at the national level.

155. Nine Parties (ATG, DMA, ETH, KNA, NIC, NIU, PNG, TGO, TTO) reported on planned, ongoing and/or implemented special awareness campaigns for specific groups such as decision makers, journalists, artists, academia, coastal communities, insurance companies and industrialists.

IX. FINANCIAL AND TECHNOLOGICAL NEEDS AND CONSTRAINTS

A. General financial, technological and capacity-building needs and constraints

156. All reporting Parties provided information on the financial, technological and capacity-building needs and constraints they encountered in the preparation of their national communications and the implementation of the Convention. The level of detail provided by each reporting Party on these issues varied considerably and the information presented as constraints and needs was scattered within the various chapters of the communications.

157. Almost all Parties acknowledged receiving financial and technical assistance from the GEF and its implementing agencies and other multilateral or bilateral programmes for the preparation of the initial national communication. Twenty-eight Parties expressed their need for further financial and/or technical support for improving the national communications and/or implementing the Convention, including support for a number of programmes and activities addressing climate change in general.

158. Fourteen Parties (ATG, BDI, BHS, BRB, COL, DMA, ETH, LCA, MDV, NIU, PER, SWZ, TGO, TTO) indicated their needs for capacity-building in the collection, archiving and management of data needed for the preparation of national communications. Ten of the reporting Parties (BDI, BFA, BWA, CUB, ETH, MAR, MNG, PAN, TTO, TUN) provided information on their needs for building national capacity for climate change project development and management. The same number of Parties (ATG, BHS, BWA, DMA, ETH, GUY, LCA, MDV, PNG, TTO) reported on the need for building capacities to generally address climate change.

159. Fourteen Parties (ATG, BDI, BFA, BHS, DMA, ETH, KNA, LCA, MDV, NIU, PAN, PRY, TGO, TTO) stressed the need to promote information sharing and networking at the national, subregional/regional, and international levels. Ten Parties (ATG, BHS, DMA, ETH, GUY, KNA, LCA, MAR, MDV, NIU) indicated their needs in relation to the integration of climate change into national planning and policy-making towards sustainable development.

160. Some Parties mentioned the need for better institutional arrangements to enable data collection and analysis while others indicated the needs for further capacity-building and human resource development in the context of the preparation of national communications. Other Parties identified improved coordination and cooperation between relevant institutions and agencies as key factors in facilitating the integration of climate change concerns into policy-making processes. A few Parties indicated the need to improve the capabilities of national climate change coordinators and national institutions to manage and coordinate climate change programmes.

B. National greenhouse gas inventories

161. Almost all Parties reported difficulties they encountered in preparing their national GHG inventories and indicated that these stemmed from lack of quality data (including organization and accessibility of data), lack of technical and institutional capacities, and problems related to methodologies (emission factors and activity data). Therefore many Parties expressed the need to improve national activity data collection, archiving, quality, accessibility and management (24 Parties) and to develop appropriate local emission factors (25 Parties). Cuba proposed to undertake further research to reduce the level of uncertainties in the estimation of CO₂ emissions and removals. Two Parties (KNA, LCA) identified the need for assistance and support from the GEF on data collection and management and 10 Parties also indicated the need to enhance national policies for improving GHG inventories.

162. Twenty-two Parties referred to the need to strengthen institutional arrangements for the preparation of GHG inventories. Tunisia indicated the need for financial support for institutional strengthening. Panama mentioned a review of the role of the institutions involved with preparation of the inventory and the need to build capacity for developing a more effective information system. Saint Lucia stressed the need for further development of institutional arrangements to ensure data gaps are filled. Guyana reported that the sector agencies do not have the appropriate staff and/or equipment to perform required tasks.

163. Twenty Parties (ATG, BHS, BRB, BWA, COL, CUB, DMA, ETH, GUY, KNA, LCA, MAR, MDV, NIU, PAN, PNG, TCD, TGO, TTO, TUN) provided information on the need to train personnel in the compilation and analysis of GHG inventories. Areas identified were improvement of skills in the collection and compilation of data, establishment of appropriate databases, archiving, analysis and dissemination of data on climate change and GHG emissions, and identification of major sources and sinks.

164. Sixteen Parties provided information on the need to improve GHG inventory methodologies suitable for use under a range of national circumstances. The Bahamas and Trinidad and Tobago pointed out that carbon sequestration by coral reefs and marine ecosystems should be included in the inventories. Cuba expressed the need for expanding the emission sources and to include their emission factors, and for financial assistance to acquire or use satellite and aerial photographs for the estimation of emission removals in the LUCF sector. Panama reported problems in estimating emissions from waste burning. Niue recommended further disaggregation of tropical forest under LUCF while Botswana proposed that natural mortality be taken into account and that anthropogenic savanna fires be separated from natural ones. Tunisia identified the need for improvement of the IPCC methodology relating to transnational gas transport, carbon uptake in arboriculture, soil emissions and solvent use. Peru found that the IPCC

methodologies did not fully account for the estimation of SO₂ emissions due to the lack of data for the metal mining industry.

C. Measures for addressing climate change

165. Several problems and constraints and the needs for undertaking specific activities were mentioned by Parties relating to the assessment and possible implementation of mitigation options. Among the problems mentioned were inadequate institutional arrangements, lack of information, lack of understanding of the need to undertake GHG mitigation assessment, lack of methods for calculating and analysing the costs of mitigation measures (CUB), lack of systematized information related to the conditions and quality of forests (NIC), lack of capacity for mitigation analysis and project development (MAR).

166. Parties highlighted several constraints to the possible implementation of mitigation measures, including the lack of public awareness, education, training and/or development in the different sectors (BHS, KNA), lack of tax incentives and/or policies that promote the introduction, production and use of more efficient appliances, as well as the use of renewable sources of energy (NIC), aversion to the risk of adopting new technologies, higher cost of mitigation technologies, lack of public and political support for the implementation of mitigation measures and lack of long-term policy in the transport sector (MAR), absence of a suitable database on wind measurements for potential applications (ATG) and barriers to transfer of the appropriate technologies (GUY).

167. Some Parties provided information on the barriers to implementing the mitigation measures identified in the proposed projects. These barriers often related to lack of financial resources, policy, technology awareness, economic benefits and capacity. Panama mentioned that, due to the privatization of its energy sector, the number of projects for alternative sources of energy had diminished and that they were not likely to emerge in the short-term. Peru also stressed that the pre-feasibility study on improving the energy efficiency of industrial boilers demonstrated that, in some cases, the mitigation options were profitable, but they would not be assumed by the private sector. Morocco indicated a low level of energy consumption in rural areas, and difficulties in reducing energy use from biomass and changing agricultural practices.

D. Assessment of vulnerability to climate change

168. Twenty Parties reported on problems and constraints in, and the need for, assistance for vulnerability assessments (ATG, BDI, BFA, BHS, BRB, BWA, COL, CUB, DMA, GUY, KNA, MAR, MNG, NIU, PAN, PER, PNG, TGO, TTO, TUN). The needs related mainly to upgrading of research capacity, data collection and analysis on vulnerability and adaptation measures, and of human capacity and skills to assess and respond to the impacts of climate change. Ten Parties (ATG, BDI, BFA, BHS, DMA, ETH, KNA, NIU, PAN, TGO) highlighted the need for enhancing the performance of models used for developing climate change scenarios so as to improve the results of vulnerability studies. Other identified needs were financial and technological resources, institutional strengthening, and the determination of the cost of identified measures. The areas of focus varied according to Parties' circumstances and very often included agriculture, water resources, coastal zones and human health.

169. Four Parties (DMA, GUY, KNA, NIU) indicated the need for more in-depth vulnerability and adaptation studies on sectors such as coastal zones, forestry, agriculture, marine resources and coral reefs. In the case of Botswana, assistance was requested for the assessment of the vulnerability of wildlife, the interpretation of complex data sets and the interaction of human-environment systems. Peru needed technology transfer to identify disease vectors. Burkina Faso expressed the need for assistance in modelling and improvement of methodologies for vulnerability and adaptation assessments.

170. Many Parties provided information on their needs and priorities for education, training and research relating to vulnerability and adaptation assessments. Sixteen Parties emphasized the need for training while 14 Parties emphasized research. The needs for training and education primarily concerned strengthening human and institutional capacities to undertake in-depth research on vulnerability and adaptation in various sectors.

171. Some Parties envisaged the need for improving projections of future changes in temperature and precipitation as well as reducing the level of uncertainty in vulnerability and adaptation assessments. Togo identified model development as an important factor in this context. Four Parties (ATG, DMA, GUY, TGO) reported a low level of national capacity and expertise in vulnerability and adaptation assessment work, and emphasized the need for promoting regional and international cooperation, networking and sharing of information, pooling of resources and transfer of appropriate technologies on vulnerability and adaptation.

172. Three Parties (CUB, DMA, TTO) emphasized the need to strengthen existing institutions to carry out further work on adaptation to climate change. Paraguay identified training of technical staff to undertake the task of making vulnerability and adaptation assessments, and Guyana particularly emphasized the need for equipment and trained personnel. Cuba reported the need to strengthen its national surveillance and observation systems.

E. Measures to facilitate adaptation

173. Many of the reporting Parties (ATG, BFA, BHS, BRB, CUB, DMA, ETH, GUY, KNA, MAR, MNG, NIC, NIU, PER, PNG, TGO, TTO, TUN) provided information on the financial and technological needs to support and facilitate the identification, evaluation and/or implementation of measures to adapt to the adverse impacts of climate change.

174. Needs identified by Parties on adaptation comprised improving human and institutional capacities, improving methodologies and models, promoting awareness of the community-based organizations and government and private sector institutions on issues relating to adaptation, promoting the transfer of adaptation technologies, and improving scientific research, data collection and analysis. Adaptation measures were identified in the agriculture, water resources, human health, coastal zones, forestry and biodiversity sectors.

175. Some Parties indicated the need for more detailed in-depth studies in order to formulate adaptation measures. Antigua and Barbuda mentioned that adaptation options should be cross-sectoral and aimed at reducing existing vulnerabilities and also building capacities for enabling sustainable development. Cuba indicated that most of the measures proposed had been considered in its present legislation and in the national strategies for the conservation and protection of natural resources.

176. Antigua and Barbuda mentioned the need to establish a framework process for applying and integrating adaptation measures into national development, and Maldives expressed the need to strengthen the legal, institutional and administrative arrangements to respond to the effects of climate change. Dominica reported on the need to facilitate the adaptation process while Niue advocated the integration of measures into national planning processes.

F. Research and systematic observation

177. Many of the problems, difficulties and constraints relating to research and systematic observation for some reporting Parties were broadly identified as lack of financial resources and technical support and lack of human capacities and capabilities. For instance, lack of financial resources imposed severe restrictions on technical and logistical support for institutions and agencies responsible for collecting, collating, managing and using meteorological and hydrological data. Lack of financial resources and

human capabilities also limited the capacity to adequately monitor environmental and climatological parameters in areas where such gaps existed.

178. In terms of gaps, needs and priorities for systematic observation, 17 reporting Parties indicated that many significant gaps existed, particularly for establishing new monitoring stations, improving technical capacities and capabilities, upgrading and maintaining equipment, coordinating and strengthening institutions responsible for education, training and research, particularly in the science of meteorology and climatology, database development and management, and upgrading, rehabilitating and strengthening existing observation systems, stations and networks. Other priority needs included detection and prediction of climate change, improvement of systems for collection, management and use of data and the capacity to maintain equipment on a regular basis. Eighteen reporting Parties (ATG, BDI, BHS, BRB, CUB, DMA, ETH, GUY, KNA, LCA, MAR, MDV, MNG, PAN, PER, PNG, PRY, TGO) expressed the need for improving research and systematic observation through capacity-building in scientific research, and for development of a wide range of educational materials.

179. Fifteen reporting Parties (ATG, BFA, BRB, COL, CUB, ETH, GUY, MAR, MDV, NIC, PAN, PER, TGO, TTO, TUN) drew attention to the need to strengthen universities and research institutions to undertake climate change studies. Maldives indicated the need to establish partnerships with other international research institutions, and other small island countries, on research related to climate change and sea-level rise, while Nicaragua indicated the need to fund teaching activities at universities and to encourage undergraduate teaching and research in climate change issues.

G. Education, training and public awareness

180. Twenty-five Parties (ATG, BDI, BFA, BHS, BRB, BWA, CUB, DMA, ETH, GUY, KNA, LCA, MAR, MDV, MNG, NIC, NIU, PAN, PER, PNG, PRY, TGO, TTO, TUN, YEM) provided information on the need for developing or improving national programmes for formal and non-formal education, as well as raising awareness on climate change issues in academic and research institutions and among the public at large. Five reporting Parties (BFA, MDV, NIU, PER, PNG) mentioned the need for sharing of public awareness materials and development and dissemination of awareness materials in local languages. Thirteen of the reporting Parties (ATG, BFA, BHS, BRB, CUB, GUY, MAR, NIU, PAN, PNG, TGO, TTO, TUN) indicated a need for the establishment and/or enhancement of national and/or regional centres of excellence in order to improve the exchange of information between stakeholders and to facilitate public access to information on climate change.

181. Two Parties (MAR, MDV) reported on the need for assistance for the development of educational materials and four Parties (BFA, ETH, MAR, TGO) highlighted the need for training of media practitioners in developing or updating climate change awareness materials. One Party (TGO) expressed the need for common methodologies and approaches for training programmes on education, training and public awareness.

182. Twelve Parties (ATG, BHS, BRB, COL, CUB, DMA, MAR, MNG, PER, PRY, TGO, TUN) reported on the need for information exchange among national, regional and international experts, and intergovernmental and non-governmental organizations on research and systematic observation. Antigua and Barbuda, Barbados, the Bahamas and Dominica mentioned the various organizations and programmes in the Caribbean region, such as the Caribbean Meteorological Organization, the Caribbean Institute of Meteorology and Hydrology, the Caribbean Foresters' Society and the Caribbean Planning for Adaptation to Climate Change, as important regional cooperation initiatives which would need strengthening. Cuba stressed the collaborative role of its experts in the region while Tunisia reported on the need to create a climate change network to promote information exchange and cooperation.

Table 1. Problems encountered and areas for further improvement in respect of activity data (AD), emission factors (EF) and methods (M) by Parties in the preparation of GHG inventories

Party	Problems/ Areas		Comments
	AD	EF/M	
Antigua and Barbuda	X	X	<p><u>Problems:</u> Lack of <i>activity data</i> in the energy, agriculture, LUCF and waste sectors. General lack of country-specific <i>emission factors</i>, more especially regarding the industrial processes.</p> <p><u>Improvements:</u> Need to enhance the collection, management, archiving, analysis, interpretation and dissemination of data on climate change; and to strengthen the institutional capability for the national GHG inventory as well as for improving on data quality and availability.</p>
Bahamas	X	X	<p><u>Problems:</u> Lack of <i>activity data</i>: in the transport sector on fuel usage and number, types and sizes of vessels in marine transport; and in the industrial sector. Data not available in commercial and recreational fishing subsectors. In most cases data held in statistical databases could not be made available for the inventory without violating existing rules and regulations. Unavailability of data in a suitable format to allow a "bottom-up" approach. LUCF information will require special attention, and a system for updating and reporting on changes in land use needs to be developed so as to provide reliable data for future national inventories. <i>Methodology:</i> The IPCC reference or tier 1 approach had to be modified in order to accommodate the type, format and accuracy of the data collected by national authorities. The GHG inventory, by design, did not consider carbon sinks that have moderated climate over geological time. For example, carbon sequestration from coral reef expansion, the growth of calcareous algae and the production of carbonate sands and muds, is not calculated.</p> <p><u>Improvements:</u> Need to develop a national system for data collection, storage, archiving and retrieval.</p>
Barbados	X	X	<p><u>Problems:</u></p> <p><i>Activity data:</i> Energy: Lack of data on fuels imported, exported, and consumed for non-energy purposes. Problem to convert unit used for data collection. <i>Industrial processes:</i> Lack of data and problem to collect them from the private sector. <i>Agriculture:</i> Unavailability of certain data and lack of reliability of most data (because of the way they were collected). <i>LUCF:</i> Lack of specific information on the area of land formerly under agricultural production, and no data on species composition of the regrowth. <i>Waste:</i> No data available for 1990, therefore extrapolations were made.</p> <p><i>Emission factors:</i> In general, IPCC emission factors are ill-suited to the tropical situation of Barbados.</p> <p><i>Methodology:</i> Energy: Problem to convert the tonnage of fuel into its energy equivalent (net calorific value). <i>Industrial processes:</i> Tier 1 methodology requires data that even the customs cannot provide.</p> <p><u>Improvements:</u> Some improvement can be made in the documentation of methodologies for data collection. Need for greater investigation into gas flaring.</p>
Botswana	X	X	<p><u>Problems:</u> <i>Activity data:</i> Lack in the energy and LUCF sectors. <i>Methodology:</i> Does not consider natural mortality and decay on land which has not been transformed (LUCF). Savanna fires: disagreement with the condition of anthropogenic emissions.</p> <p><u>Improvements:</u> Financial support is needed to improve the way national statistics are collected</p>
Burkina Faso	X	X	<p><u>Problems:</u> Party expressed the lack of <i>activity data</i> in the energy and LUCF sectors. Party reported on the fact that the IPCC <i>methodology</i> did not consider properly the mix of gasoline and oil used by motorcycles; and that the LUCF forest categories were not appropriate in the case of Burkina Faso.</p> <p><u>Improvements:</u> Party indicated that, in the future, particular attention should be given to the transport sector (aircraft, and motorcycles).</p>

Table 1. (continued)

Party	Problems/ Areas				Comments
	AD	EF	M		
Burundi	X	X	X	X	<u>Problems: Activity data:</u> Lack of activity data for all the sectors. <u>Emission factors:</u> Lack of appropriate emission factors for agriculture. <u>Methodology:</u> the eco-climatic classification of the IPCC is not appropriate to Burundi. <u>Improvements:</u> Need for: more appropriate emission factors for agriculture; setting up a data collection system and establishing a database; supporting research institutions (university...); and supporting institutions in charge of the forestry inventory.
Chad	X	X	X	X	<u>Problems: Activity data:</u> Lack of activity data for the following sectors: energy, agriculture and waste. The activity data are not available in a suitable format for the agricultural sector. <u>Emission factors:</u> Lack of certain appropriate emission factors. <u>Methodology:</u> Non-availability of all IPCC documents in French.
Colombia	X	X	X	X	<u>Problems: Activity data:</u> Lack of activity data or non-availability in a form suitable for compiling the inventory for the following sectors: energy (transport), agriculture, and LUCF. <u>Methodology:</u> Problems were identified in the following sectors: industrial processes (ambiguities in the options for data to be used in order to calculate emissions); LUCF (the guidelines are not clear enough with regard to the calculation of biomass stock) and waste sector (terms used in the guidelines correspond to countries with advanced techniques for waste treatment). <u>Improvements:</u> It is recommended national emission factors be determined for each module of the inventory. The Party also mentioned the need: to build up a system to collect and systematize the transport sector data; to establish a system for validating the information contained in the national energy balance as well as to conduct studies aimed at reducing the uncertainty on firewood consumption; to systematize livestock information and to strengthen the forest statistical system; to acquire, classify and analyse satellite images related to the LUCF sector; to develop methodologies and calculate emission factors, and generally to improve data collection and management.
Cuba	X	X	X	X	<u>Problems: Lack of activity data:</u> sugar cane burning and fertilizer utilization; forest fires; to calculate CO ₂ removals from conversion of pasture lands to agricultural lands; laundering of clothing with non-aqueous organic solvents. Lack of appropriate maps in order to estimate CO ₂ emissions and removals from soils. <u>Methodology:</u> Some emission sources are not included in IPCC Guidelines, nor are the corresponding emission factors, e.g.: sugar cane production, tobacco industry and nickel production. <u>Improvements:</u> To improve activity data in order to apply more complex methods (tiers) and to improve the quality of data. To increase the scientific and technical capacity and the infrastructure, to carry out investigations with the objective of generating local emission factors. To strengthen the national system for estimating emissions and removals of GHG. To improve the estimates of emissions already calculated in those key sectors.

Table 1. (continued)

Party	Problems/ Areas			Comments
	AD	EF	M	
Dominica	X	X	X	<p><u>Problems:</u> <i>Activity data:</i> Difficulty of disaggregating data into IPCC data sets leads to data gaps. Lack of activity data: energy: international bunkers; LUCF: acreage of forest that is anthropogenically impacted, and non-forest trees. Some data not available in a suitable format for the inventory: energy sector; agriculture: animal population; LUCF: actual area disturbed by logging operations and charcoal production. <i>Emission factors</i> do not reflect national circumstances: LUCF: annual growth rate of forests; industrial processes: NMVOC emission factors due to the age and condition of Dominica's factories; waste sector: N₂O emissions from human waste. <i>Methodology:</i> Difficulty of disaggregating data into IPCC data sets leads to data gaps; and IPCC default conversion factors, by expert judgement, may not be representative of national circumstances.</p> <p><u>Improvements:</u> Future improvements should focus on training, research and data collection activities, particularly (i) strengthening of local capacity to undertake future inventory compilations; (ii) research in such areas as forest species coverage, using for instance, remote sensing coupled with GIS methods; and (iii) obtaining local data and developing country specific emission factors.</p>
Ethiopia	X			<p><u>Problems:</u> The is a high level of uncertainty concerning CO₂ emissions from the LUCF sector, as well as for N₂O, NO_x, CO, NMVOC and SO₂ emissions from all sectors.</p> <p><u>Improvements:</u> Party expressed the need to improve the collection and quality of national activity data and to develop local emission factors.</p>
Guatemala		X	X	<p><u>Problems:</u> Party did not estimate GHG emissions from pulp and paper due to the lack of national <i>emission factor</i>. <i>Methodology:</i> emissions from solvent use not included because guidelines do not include specific methods.</p>
Guyana	X	X	X	<p><u>Problems:</u> <i>Activity data:</i> Needed for: (i) energy; (ii) agriculture: field burning of agricultural residues, total area of savannah burning annually; (iii) LUCF sector: fraction of forested land anthropogenically impacted and rate of forest conversion; annual growth rate of forest; (iv) waste sector: urban population statistics and actual municipal solid waste disposed of at solid waste disposal sites. Party indicated that data were not available in a suitable format for the inventory in: (i) energy sector: subcategories disaggregation for sectoral approach methodology, international bunker fuels, and biomass (charcoal and firewood); (ii) agriculture: classification of livestock population. <i>Emission factors:</i> do not reflect the national circumstances for prescribed burning of savannahs. <i>Methodology:</i> (i) the methodology lacks an emission factor for enteric fermentation of poultry; (ii) the methodology is not clear on the definition of "managed forest"; (iii) time series estimation of CO₂ uptake resulting from regrowth of forest in LUCF; (iv) the methodology lacks a section on how to estimate emissions from incinerators.</p> <p><u>Improvements:</u> Party indicated that: (a) it needs to develop the capacity to prepare emission factors for local conditions and not rely on defaults for all sectors and all gases; (b) it needs to establish a unit in an existing department or agency to ensure a networking system between the unit in the lead agency and the units in other departments/agencies, and provide: (i) adequate staff and equipment for this unit. (ii) Data management: computer systems and relevant software must be provided to each sector agency so that the inventory can be electronically archived; an attempt should be made to address emissions from waste incinerators.</p>

Table 1. (continued)

Party	Problems/ Areas			Comments
	AD	EF	M	
Maldives	X	X		<u>Problems:</u> Lack of detailed <i>activity data</i> required for the sectoral approach was the biggest shortcoming. Data were not available to estimate GHG emissions in all sectors. Uncertainties may arise from the use of default <i>emission factors</i> not appropriate to the local circumstances. <u>Improvements:</u> Party mentioned the need for training in collecting statistical data and modifying the <i>IPCC Guidelines</i> to capture the small scale of GHG emissions in the Maldives.
Mongolia	X		X	<u>Problems:</u> Lack of reliable activity data in general. <i>Methodology:</i> The use of the IPCC default coefficients likely introduces some uncertainty in the GHG estimates. Party mentioned that "anthropogenic steppe and forest fires were not included in national emission totals because the IPCC Guidelines do not consider this an anthropogenic source at this time". The IPCC Guidelines do not recognize some country-specific sources of GHG emissions (e.g., mining as a source of CO ₂ because it requires conversion of grasslands to mine sites.
Morocco	X		X	<u>Problems:</u> <i>Lack of activity data</i> on sectoral energy consumption, bunker fuels, and forestry. Regarding the <i>methodology</i> the Party mentioned that emissions from fuelwood combustion should be accounted for in the energy sector and not the LUCF sector. <u>Improvements:</u> Need to improve both activity data and <i>emission factors</i> .
Nicaragua	X			<u>Problems:</u> The lack of <i>activity data</i> , or their availability in an unsuitable format, implied more frequent use of expert judgement. <u>Improvements:</u> Need to improve the quality of activity data in LUCF (develop a national forest inventory).
Niue	X	X	X	<u>Problems:</u> <i>Activity data:</i> Large gaps in activity data collection were indicated. Specific sectors not reported for lack of activity data are small-scale cottage industries. It was difficult to differentiate the residential from the agriculture/forestry/fisheries sector due to a large amount of unrecorded data and discrepancies within the data available. In addition, 1994 for Niue, did not give a true representation of the actual greenhouse gas emissions due to major construction and development work undertaken on the island in that year. <i>Emission factors and methodology:</i> Party felt that the IPCC Guidelines and default values were excessive for such a small island nation with a negligible population base. The IPCC default values for LUCF which were used were very general for tropical forest; therefore Party felt that there should have been a further disaggregation of the tropical forest into smaller categories.

Table 1. (continued)

Party	Problems/ Areas			Comments
	AD	EF	M	
Panama	X	X	X	<p><u>Problems:</u> Lack of sectoral <i>activity data</i>, as well as lack of systematization and standardization of the activity data. Concerning LULUCF, a more detailed analysis of the satellite images and aerial photographs should be carried out, in order to determine with more precision the different classes of vegetation. The national energy balance is not produced on a regular basis any more. Lack of well trained staff, able to manage data. <i>Methodology:</i> The IPCC Guidelines do not present a methodology to calculate emissions from waste combustion. The domestic institutional reality does not allow for an appropriate response to the methodological requirements, particularly in the case of LUCF. Need to revise the IPCC methodology regarding the wood extracted from natural and planted forests for long-term use.</p> <p><u>Improvements:</u> To improve the database on energy; to examine the data and the application of the IPCC Guidelines for the sectoral approach and sink categories; to analyse the quality of the results and quality control of verification procedures for the activity data of the natural forests; more detailed digital analyses of the satellite images; revision and approval of the methodologies applied in the forest cover studies, carried out in 1970, 1986 and 1992; revision of the IPCC methodology regarding the wood extracted from the natural and planted forests for the long term use (construction, furniture, etc.).</p>
Papua New Guinea	X	X		<p><u>Problems:</u> Lack of <i>activity data</i> (energy, agriculture, LUCF and waste sectors) as well as some data not available in a suitable format (agriculture).</p> <p><u>Improvements:</u> This first GHG inventory is still a "work in progress"; data gaps in all sectors need to be addressed.</p>
Paraguay	X			<p><u>Problems:</u> Party reported the lack of <i>activity data</i> for all the sectors of the inventory.</p> <p><u>Improvements:</u> Need to (mainly for LUCF): (a) develop information and/or a database which would support the periodic preparation of GHG inventory in all sectors ; (b) reduce uncertainty related to certain data from energy, forestry and agricultural sectors and/or required information generation; (c) access national and global information on methodologies and emission factors; (d) create a climate database with meteorological and hydrological updating. Need to: (a) improve data quality and update data in all sectors; (b) create a database both for consumption and end-use in the energy sector, mainly for industry, residential and rural use.</p>
Peru	X	X	X	<p><u>Problems:</u> Lack of adequate statistical <i>data</i> (fugitive emissions). Some data are not available in a suitable format (energy, agriculture). Some of the categories set by the IPCC <i>methodology</i> do not correspond to the situation in the country. Some national specificities are not fully covered by the IPCC methodology: it does not present default values for SO₂ emissions from the mining and metallurgy industry. The IPCC methodology does not consider nitrogenous emissions from organic matter with high protein content.</p>
Saint Kitts and Nevis	X	X	X	<p><u>Problems:</u> Lack of <i>activity data</i> in the energy, agriculture, LUCF and waste sectors. Activity data not available in a suitable form for compiling the inventory in the energy, agriculture and LUCF sectors. Data are generally dispersed between a number of agencies and no computerized database exists. <i>Emission factors:</i> the IPCC default emission factor for N₂O from human sewage may not be applicable to the country.</p> <p><u>Improvements:</u> Future efforts should focus on training, research and data collection activities, particularly (i) strengthening of local capacity to undertake future inventory compilations; (ii) research in such areas as forest species coverage, using for instance, remote sensing coupled with GIS methods; and (iii) obtaining local data and developing country-specific emission factors.</p>

Table 1. (continued)

Party	Problems/ Areas		Comments
	AD	EF M	
Saint Lucia	X	X	<p><u>Problems:</u> Lack of <i>activity data</i>: the number of non-forest trees; abandonment of managed lands; the actual amount of waste deposited on solid waste disposal sites. Some data are not available in a form suitable for compiling the inventory: fuels used in the different subcategories; charcoal and firewood (biomass) burning and international marine bunkers; animal populations since existing data did not address all types of livestock. <i>Emission factors</i>: LUCF: country-specific values such as annual growth rate of forests may be quite different from IPCC default; industrial processes: NMVOC emission factors may be somewhat unrepresentative due to the age and condition of the factories. <i>Methodology</i>: Some IPCC default values used due to lack of country-specific emission factors were judged to be non-applicable to St. Lucia's national circumstances. Non-applicability of IPCC default methods (e.g. N₂O emissions from human waste).</p> <p><u>Improvements:</u> The areas of need for improvement include: research in such areas as forest species coverage, using remote sensing and GIS tools and methods; establishment of institutional focal points for coordinating inventory preparation and for data collection at the sectoral level, particularly for non-energy sectors where important gaps remain in certain areas; and to obtain local data for the development of country emission factors in the various sectors.</p>
Swaziland	X	X	<p><u>Problems:</u> <i>Activity data</i>: Party reported "immense difficulties" with area converted annually, area converted under different periods of time, area of abandoned land, net change in biomass density, and fraction of biomass burned onsite.</p> <p><u>Improvements:</u> Party reported the need to do further work to develop local specific emission factors and ratios. Party also mentioned that access to satellite imagery and capacity-building in all areas remains necessary.</p>
Togo	X	X	<p><u>Problems:</u> <i>Data gaps</i> for all sectors of the inventory. <i>Emission factors</i>: The emissions factor provided for CH₄ generation from waste is not appropriate for the local conditions.</p> <p><u>Improvements:</u> Need to improve both activity data and emission factors in the future GHG inventories was expressed by the Party.</p>
Trinidad and Tobago	X	X	<p><u>Problems:</u> <i>Data gaps</i>: for the industrial processes sector, data were based on surveys or information from major private sector companies; for the agriculture, LUCF and waste sectors, data gaps also exist. Regarding LUCF, the absence of ground-truth data was reported; and concerning the waste sector some inadequacy of information on the quantity of solid waste generated was reported.</p> <p><i>Emission factors</i>: The use of default factors resulted in emission overestimates.</p> <p><u>Improvements:</u> The Government will seek support in developing suitable databases or in adapting and applying existing databases that can accommodate the data requirements of the IPCC reporting format. Need for an evaluation of the fuel efficiency and GHG emission rates of the various types of automobile; determination of the percentage of forest cover of young versus old forests and absorptive capacity for CO₂; determination of the absorptive capacity of coastal ecosystems within the exclusive economic zone and development of emission factors suitable and relevant to the scale of activities of small island developing States. In LUCF sector, the Government will examine options for providing the ground-truth data by seeking the necessary funding and technical assistance. Technical assistance is needed in the waste sector, in order to develop a database on solid and liquid waste generation, research and develop waste treatment technologies and implement a cost-benefit analysis of the use of modern methods of waste water treatment.</p>

Table 1. (continued)

Party	Problems/ Areas			Comments
	AD	EF	M	
Tunisia	X	X	X	<p><u>Problems</u>: Party mentioned lack of <i>data</i>, specifically in the energy, industrial processes, and LUCF sectors. Some <i>emission factors</i> were also questioned, and the <i>IPCC methodology</i> does not address some issues specific to the country (transnational transport of natural gas; carbon sequestration by fruit trees; emissions and removals from soils).</p> <p><u>Improvements</u>: Party reported on the need for the following future improvements: <i>Activity data</i>: crude oil refinery; HFC, PFC, SF₆; solvent use; manure management; carbon sequestration; road transport; take-off and landing of planes; characteristics of soils.</p> <p><i>Emission factors</i>: road transport; energy, i.e. electricity generation, manufacturing industries, fugitive emissions, oil refining, and charcoal production.</p>
Yemen	X	X		<p><u>Problems</u>: Party pointed to the lack of <i>data</i> in the agriculture and LUCF sectors; and stated that the <i>IPCC default emission factors</i> seem unrealistic in the case of Yemen.</p> <p><u>Improvements</u>: The area for further inventory improvements identified by the Party were: emission factors, type of vehicle, country specific data for livestock, household energy for the whole country, well documented forestry inventory, and afforestation, tree plantation and removal, estimates of CO₂ emissions from re-growing biomass through securing the necessary information on dispersed trees and date palms to be included in the biomass stock calculation, information on forestland and grassland converted to croplands over the last 20 years, emissions/uptake from soils, CO₂ removal from abandonment of managed lands.</p>

Table 2. Completeness of reporting according to table II of the UNFCCC guidelines

Greenhouse gas source and sink categories	CO ₂		CH ₄		N ₂ O	
	Total	%	Total	%	Total	%
Total (net) national emissions (gigagrams per year)	31	100	31	100	30	97
1. All energy	31	100	24	77	23	74
<i>Fuel combustion</i>						
Energy and transformation industries	25	81	16	52	15	48
Industry	22	71	16	52	13	42
Transport	25	81	18	58	14	45
Commercial/institutional	21	68	15	48	13	42
Residential	33	74	18	58	18	58
Other (please specify)	12	39	9	29	9	29
Biomass burned for energy	20	65	2	6	2	6
<i>Fugitive fuel emissions</i>						
Oil and natural gas systems	4	13	9	29	-	-
Coal mining	3	10	6	19	-	-
2. Industrial processes	19	61	4	13	5	16
3. Agriculture	1	3	30	97	28	90
<i>Enteric fermentation</i>	-	-	27	87	-	-
<i>Rice cultivation</i>	-	-	17	55	-	-
<i>Savannah burning</i>	1	3	16	52	15	48
<i>Other (please specify)</i>	1	3	24	77	25	81
Manure management	-	-	22	71	14	45
Agricultural soils	1	3	-	-	25	81
Field burning of agricultural residues	1	3	17	55	16	52
Other	-	-	-	-	-	-
4. Land-use change and forestry	29	94	21	55	21	68
<i>Changes in forest and other woody biomass stock</i>	27	87	-	-	-	-
<i>Forest and grassland conversion</i>	25	81	19	61	19	61
<i>Abandonment of managed lands</i>	20	65	1	3	1	3
5. Other sources as appropriate and to the extent possible (please specify)	28	90	29	94	28	90
<i>CO₂ emissions and removals from soils</i>	16	52	-	-	-	-
<i>Other (land-use change and forestry)</i>	-	-	-	-	-	-
Waste	4	13	29	94	27	87
<i>Solid waste disposal on land</i>	-	-	28	90	-	-
<i>Waste-water handling</i>	-	-	19	61	25	81
<i>Waste incineration</i>	-	-	-	-	-	-
<i>Other (waste)</i>	-	-	1	3	-	-
<i>International bunkers</i>	24	77	8	26	7	23

Notes:

Sectors and source categories not to be reported as "other" in table II of the UNFCCC guidelines are given in shaded cells. The values given in bold indicate that the percentage of reporting by non-Annex I Parties is equal to or higher than 80.

Table 3. Aggregate emissions and removals of CO₂, CH₄ and N₂O in CO₂ equivalent by major source/sink category, including and excluding land-use change and forestry (gigagrams and percentage of total by Party)

	Energy		Industrial processes		Agriculture		Other		Total (excluding LUCF) (Gg)	Land-use change and forestry (Gg)	Total (including LUCF) (Gg)	Percentage of LUCF in total GHG %
	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%				
1990												
Antigua and Barbuda	288.1	74.3			22.3	5.7	77.4	20.0	387.8	-96.8	291.0	-25.0
Bahamas	1,894.2	97.8					42.0	2.2	1,936.2	-3,600.0	-1,663.8	-185.9
Barbados	1,388.3	42.5	177.0	5.4	66.9	2.0	1,623.2	49.6	3,269.7	-11.0	3,258.7	-0.3
Colombia	51,140.5	43.0	4,810.7	4.0	55,427.1	46.6	7,543.0	6.3	118,921.3	10,869.1	129,790.4	9.1
Cuba	33,705.8	53.0	3,297.7	5.2	23,956.8	37.7	2,630.4	4.1	63,590.8	-23,998.0	39,592.8	-37.7
Ethiopia	6,274.0	14.4	139.0	0.3	35,371.0	81.3	1,754.0	4.0	43,517.0	-31,810.0	11,707.0	-73.1
Guatemala	4,584.0	30.9	544.7	3.7	8,831.5	59.4	895.3	6.0	14,855.5	-39,659.2	-24,803.6	-267.0
Guyana	1,198.0	51.0			961.0	40.9	189.0	8.0	2,348.0	-23,777.0	-21,429.0	-1,012.6
Mongolia	13,783.7	71.4	301.0	1.6	5,113.5	26.5	88.2	0.5	19,317.4	5,486.0	24,803.4	28.4
Paraguay	10,558.5	18.6	334.3	0.6	42,994.0	75.5	3,028.3	5.3	56,915.1	3,530.5	60,445.6	6.2
Trinidad and Tobago	9,928.8	60.4	5,116.9	31.1	338.4	2.1	1,060.6	6.4	16,444.8	-1,524.0	14,920.8	-9.3
Total	134,744.0	39.5	14,721.3	4.3	173,082.6	50.7	18,931.4	5.5	341,503.6	-104,590.5	236,913.1	-30.6
1993												
Chad	309.7	3.8			7,299.0	88.6	655.7	8.0	8,239.5	-46,441.4	-38,201.9	-563.6
1994												
Bahamas	1,866.2	84.9			21.0	1.0			2,197.2			
Barbados	1,875.4	50.1	38.0	1.0	66.9	1.8	1,770.2	47.3	3,744.9	-11.0	3,733.9	-0.3
Botswana	3,842.5	41.4	210.8	2.3	5,066.6	54.5	172.5	1.9	9,292.5	-38,734.3	-29,441.9	-416.8
Burkina Faso	908.3	15.0			4,708.4	77.7	444.9	7.3	6,061.6	-1.5	6,060.1	0.0
Colombia	62,260.4	45.3	5,298.0	3.9	61,444.4	44.7	8,579.9	6.2	137,582.6	14,505.3	152,088.0	10.5
Congo	845.9	51.8	43.4	2.7	338.0	20.7	407.0	24.9	1,634.5	-70,120.3	-68,485.8	-4,290.1
Cuba	22,891.5	60.1	978.9	2.6	12,395.3	32.5	1,836.0	4.8	38,104.9	-26,469.6	11,635.3	-69.5
Dominica	77.0	50.6			14.7	9.7	60.4	39.7	152.1	-371.9	-219.7	-244.5

Table 3. (continued)

	Energy		Industrial processes		Agriculture		Other		Total (excluding LUCF) (Gg)	Land-use change and forestry (Gg)	Total (including LUCF) (Gg)	Percentage of LUCF in total GHG %
	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%				
Ethiopia	7,229.0	15.1	310.0	0.6	38,447.0	80.1	2,085.2	4.3	48,005.0	-15,063.0	32,942.0	-31.4
Guyana	1,445.8	50.1			1,219.6	42.3	219.4	7.6	2,884.7	-26,664.5	-23,779.8	-924.3
Haiti	419.3	8.2			4,087.0	80.1	403.3	7.9	5,104.9	954.4	6,059.4	18.7
Maldives	129.0	84.3					24.0	15.7	153.0			
Mongolia	9,791.3	64.6	95.0	0.6	5,184.9	34.2	88.2	0.6	15,159.4	400.0	15,559.4	2.6
Morocco	26,839.0	60.5	3,158.0	7.1	12,092.0	27.3	2,284.0	5.1	44,373.0	-4,511.0	39,862.0	-10.2
Nicaragua	2,689.6	28.7	354.8	3.8	4,270.6	45.5	2,064.2	22.0	9,379.3	-14,784.1	-5,404.8	-157.6
Niue	4,464.6	99.6			1.1	0.0	17.9	0.4	4,483.6	-1,199,915.0	-1,195,431.4	-26,762.3
Panama	3,903.0	32.3	412.9	3.4	4,725.6	39.1	3,031.3	25.1	12,073.1	22,330.1	34,403.2	185.0
Papua New Guinea	947.6	18.9	193.0	3.9	3,871.7	77.2			5,012.2	413.0	5,425.2	8.2
Paraguay	3,264.5	2.3	733.7	0.5	136,297.3	95.9	1,852.6	1.3	142,148.1	17,812.3	159,960.4	12.5
Peru	22,153.9	36.0	9,899.2	16.1	22,809.1	37.0	6,741.9	10.9	61,604.1	37,196.8	98,800.9	60.4
Saint Kitts and Nevis	74.0	45.0			42.4	25.8	48.1	29.3	164.5	-89.8	74.7	-54.6
Saint Lucia	271.1	30.3			26.0	2.9	596.2	66.7	893.3	-352.1	541.2	-39.4
Swaziland	1,056.0	40.0			1,233.5	46.7	351.2	13.3	2,640.6	-3,257.7	-617.1	-123.4
Tunisia	15,251.1	71.4	2,839.5	13.3	6,018.3	28.2	1,032.1	4.8	21,357.0	-1,772.7	19,584.3	-8.3
Total	194,495.9	33.9	24,565.2	4.3	324,381.4	56.5	34,110.5	5.9	574,206.0	-1,308,506.4	-734,300.4	-227.9
1993												
Chad	309.7	3.8			7,299.0	88.6	655.7	8.0	8,239.5	-46,441.4	-38,201.9	-563.6
1995												
Togo	1,307.2	24.5	403.5	7.6	3,278.9	61.5	339.3	6.4	5,328.8	19,964.1	25,292.9	374.6
Yemen	10,131.9	56.7	546.7	3.1	6,295.9	41.5	894.5	5.9	17,869.0	-9,670.6	8,198.4	-54.1
Total	11,439.1	49.3	950.2	4.1	9,574.8	41.3	1,233.8	5.3	23,197.8	10,293.5	33,491.3	44.4
1998												
Burundi	799.7	40.1	0.1	0.0	1,091.6	54.7	106.0	5.3	1,995.8	-3,000.4	-1,004.6	-150.3

Table 5. (continued)

Method	A	B	B	B	B	B	C	C	C	C	D	E	G	G	H	K	L	M	M	N	N	N	P	P	P	P	S	T	T	T	T	Y			
	T	D	F	H	R	W	O	O	O	O	M	T	T	T	T	N	C	A	D	N	I	I	A	E	N	R	W	T	T	T	E				
	G	I	A	S	B	A	G	L	L	L	A	H	M	U	I	A	R	V	G	C	C	N	R	R	Y	Z	O	O	O	M					
<i>Terrestrial ecosystems</i>								X										X																	
Holdrige or GAP																																			
National methods						X																		X											
Qualitative	X			X																															
Other					X																														
Not specified			X		X		X					X	X	X	X	X	X																		
Human health																																			
Statistical approach																																			
Qualitative	X			X	X																		X												
Not specified		X	X				X				X		X	X	X	X		X	X								X								
Other sectors¹⁶																																			
Qualitative																																			
Other																																			
Not specified		X	X								X																X								
Integrated analysis																																			
Qualitative	X	X		X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Not specified																																			
Quantitative methods									X																		X								

Note: "Qualitative" means an approach that includes expert assessments and qualitative assessments of possible impacts of climate change.

¹⁶ Includes fisheries, energy, industry, human settlements.

Table 6. Summary of the results of impacts and vulnerability assessment by Parties, by sector

Country	Sector									
	Agriculture and food security	Water resources	Coastal zones and marine ecosystems	Terrestrial ecosystems (forest, rangelands, etc.)	Human health and human settlements	Fisheries	Other			
Antigua and Barbuda	- q	q	√		√ q	√	√ tourism			
Bahamas	- q	q	√		√ q		√ tourism, infrastructure			
Barbados	- q	q	√		√	√	√ infrastructure			
Botswana	- q	- q		- q	√		- crop production			
Burkina Faso	- q	- q		- q	√					
Burundi	- q	- q		- q	√					
Chad	-	-								
Colombia	-	- q	- q	- q	- q		- soils and desertification			
Congo	-	- q	- q				- biodiversity			
Cuba	-	-	-	-	- q					
Dominica	√	-	- q	- q	- q	√	- tourism			
Ethiopia	√	√		√	√		- wildlife			
Guatemala	√	√			√					
Guyana	- q	√	√	√	√	√	√ energy, tourism			
Haiti	- q	- q	-							
Maldives	-	- q	-		√	√	√ tourism, infrastructure			
Mongolia	-	-	-	- q						
Morocco	- q	- q								
Nicaragua		√		√	√					
Niue	- q	- q	- q	√	√	√	√ hydropower			
Panama	√	- q	√	√	√		√ biodiversity, infrastructure			
Papua New Guinea	- q	- q	- q	√	√					
Paraguay	√				√					
Peru	√	√		√	√		√ infrastructure			
St. Kitts and Nevis	√	- q	- q	- q	√		√ tourism			
St. Lucia			- q	√	√	√	√ tourism			
Swaziland	- q	- q		- q						
Togo	-	-	-	- q	- q	- q				
Trinidad and Tobago	- q	- q	- q	√	√	√	√ tourism, energy, biodiversity			
Tunisia	√	√		√						
Yemen	√	√	√							

q negative impact on a sector presented qualitatively.

√ sector that is likely to be affected by future climate change.

- negative impact on a sector.
