# TIMOR LESTE'S INITIAL NATIONAL COMMUNICATION

## Under United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

Timor-Leste's State Secretariat for Environment
Government of the Democratic Republic of Timor-Leste
- Draft -

Australian Aid

UNDP

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# EXECUTIVE SUMMARY

Timor-Leste ratified the United Nations Framework Convention on Climate Change (UNFCCC) in October 2006 and Kyoto Protocol to UNFCCC in October 2008. As a party to UNFCCC, Timor-Leste has an obligation to report its National Communication to the Conference of the Parties (COP). With support from Global Environment Facility (GEF), Australian Aid, and United Nations Development Program (UNDP), Timor-Leste started the development of its Initial National Communication (INC) in 2011. The development of this INC involved a wide range of stakeholders; among them are representatives from local government institutions, academics, private sector and non-governmental organizations (NGO) in order to capture their inputs and views to the national communication. Timor-Leste's INC was prepared in accordance with UNFCCC Reporting guidelines on National Communications.

## NATIONAL CIRCUMSTANCES

Timor-Leste occupies the eastern half of the island of Timor and is situated at the eastern end of the Lesser Sunda Islands of the Indonesian archipelago and north west of Australia at a distance of about 500 km. Timor-Leste lies between latitudes 8'15 and 10'30 south, and longitudes 124'50 and 127'30 east and has an area of approximately 14,954 $km^2$. This includes the main land area of 13,989 $km^2$, Oecusse enclave of 817 $km^2$, Atauro Island of 140 $km^2$ and Jaco Island of 8 $km^2$. The topography, particularly of the mainland, is comprised of hills and mountain ranges.

The population of Timor-Leste in 2012 was estimated to be 1,210,233 people. The population growth rate is approximately 2.41% per year. Poverty remains a challenge, while unemployment and underemployment are still relatively high. About 41% of the population has a per capita income of less than US $0.88 per day. In addition, household food insecurity is widespread throughout all rural areas. The low input practices of agricultural systems, low crop productivity, unpredictable changes to the annual seasons, characterised by heavy rainfalls and an intense dry season as well as a high rate of population growth are the major contributors to food insecurity in the country.

In 2012, the GDP of Timor-Leste was about US$1,292 million. The highest contributor to the national GDP is the services sector (54.8%) followed by the agriculture sector (27%) and industry (18.1%). Inflation was estimated at 11.8%. The country holds relatively important oil and gas reserves, the revenue from which is the primary source of funding for government expenditure. Oil wealth is estimated at US$24.3 billion or US$22,000 per-capita. Timor-Leste's petroleum fund balance was US$4.2 billion in 2008 and US$5.4 billion in 2009, and in 2010 it reached US$6.9 billion. This figure is projected to rise to above US$14 billion by 2015.

## NATIONAL GHG INVENTORY (NATIONAL GREEN HOUSE GAS INVENTORY)

In 2010, total GHG emissions for the three main GHGs ($CO_2$, $CH_4$ and $N_2O$) without land -use, land use -change and forestry (LULUCF) reached 1,277 Gg $CO_2$-e. With the inclusion of LULUCF, total GHG emissions from Timor-Leste increased to about 1,483 Gg $CO_2$-e (Table 1). The GHG emissions were distributed unevenly between the three gases, i.e. $CO_2$ recorded 466.87 Gg $CO_2e$ (31% of total emissions); methane ($CH_4$) 548.56 Gg $CO_2e$ (37% of total emissions); and nitrous oxide ($N_2O$) 467.18 Gg $CO_2e$ (32% of total emissions). The main contributors are agriculture, followed by energy, LUCF and waste.

It should be noted that GHG emissions from the energy sector did not include GHG from biomass utilization in household, fossil fuel combustions for the industrial sector, fossil fuel combustions for international aviation, fossil fuel combustion for own use in oil and gas fields, and fugitives from oil and gas fields. These gases are estimated but reported separately from the energy sector. The GHG from oil and gas fields is reported separately from the energy sector due to this facility being under joint operation between Timor-Leste and Australia. Currently there is no agreement regarding GHG emissions. The GHG emission from fossil fuel combustion for the industrial sector did not include NGHGI because the industrial activity practically does not exist and therefore the GHG emission from energy consumed in industrial activity can be neglected. The GHG emission from fossil fuel combustion for marine transportation (international as well as domestic) did not include NGHGI because the data was not available.

Table 1 **Summary of 2010 GHG emission (in Gg $CO_2e$)**

| Sources | CO2 | CH4 | N2O | Total |
|---|---|---|---|---|
| Energy | 249.48 | 0.55 | 0.67 | 250.70 |
| Agriculture | - | 516.35 | 449.92 | 966.27 |
| LUCF | 206.03 | - | - | 206.03 |
| Waste | 11.36 | 31.66 | 16.60 | 59.62 |
| **Total** | **466.87** | **548.56** | **467.18** | **1,482.61** |
| Biomass utilization | 770.04 | 44.70 | 8.80 | 823.54 |
| International Bunker for Aviation* | 5.92 | 0.00 | 0.05 | 5.97 |
| GHG from oil and gas production | 492.58 | 0.36 | 0.27 | 493.21 |

Notes: GHG emissions from energy used in industry/manufacturing were not included in this INC inventory because there is practically no industry activity in Timor-Leste. GHG from the utilization of solvent and other products are also not covered in this INC inventory because the data was not available. GHG emissions from biomass utilization, international bunker for aviation, and activities in offshore oil and gas production facilities are reported separately from the energy sector. GHG from offshore is under joint operation of Timor-Leste and Australia.

Within the period of 2005-2010, it can be seen that GHG emissions from agriculture and waste sectors were increased significantly. The GHG from LUCF and energy sectors were intended to decrease after 2006 and 2007 respectively. The agricultural and energy sectors remains as the main source of emissions in Timor-Leste during this period, more than 80% of the total country emission.

Table 2 **Emission Trend from the four sectors and other sources (in Gg $CO_2$-eq)**

| Source Categories | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|
| Energy | 200.20 | 207.00 | 313.48 | 261.50 | 222.44 | 250.67 |
| Agriculture | 882.69 | 900.66 | 956.86 | 996.75 | 933.01 | 966.27 |
| Land-Use Change & Forestry | 115.05 | 1,036.53 | 734.42 | 441.48 | 225.07 | 206.06 |
| Waste | 46.82 | 52.27 | 54.06 | 55.86 | 57.73 | 59.62 |
| **Total** | **1,244.76** | **2,196.46** | **2,058.82** | **1,755.61** | **1,438.25** | **1,482.62** |
| Biomass utilization | 704.80 | 727.61 | 750.86 | 774.59 | 798.81 | 823.54 |
| International Bunker for Aviation* | 2.17 | 1.59 | 3.70 | 4.88 | 5.96 | 5.97 |
| GHG from oil and gas production | 544.76 | 668.06 | 593.04 | 624.08 | 524.27 | 493.04 |

Within the four sectors, there are 25 sub-categories of emission sources. Of these 25 sources, only 10 sources are considered as key categories, i.e. emission sources which contribute to 95% of the total national emission as shown in Figure 1. Of the 10 key categories, three sources already contributed to 50% of the total emissions, namely emissions from (i) stationary combustion in offshore oil and gas production facilities ($CO_2$), (ii) forest and grassland conversion ($CO_2$), and (iii) from enteric fermentation in domestic livestock ($CH_4$).

## GENERAL DESCRIPTION OF STEPS TAKEN TO IMPLEMENT THE CONVENTION

To meet Timor-Leste's obligation to the convention for communicating its status of GHG emission, mitigation and adaptation actions including constraints, barriers and needs related to financing, technology and capacity building issues, the Government of Timor-Leste assigned the Directorate for International Environmental Affairs and Climate Change (DIEACC) to develop an Initial National Communication. This directorate is under the State Secretariat for the Environment, one of the State Secretaries under the prerogative of the Ministry of Commerce, Industry and Environment (MCIE).

Day to day work on the development of the INC was conducted by the Initial National Communication Team in collaboration with six Thematic Working Groups (TWGs). These TWG were established from various government agencies, academia, civil society organizations and the private sector. The six TWGs are (i) Greenhouse Gas Inventory; (ii) Vulnerability and Adaptation; (iii) Mitigation Options; (iv) Technology Transfer; (v) Research and Systematic Observation; and (vi) Education, Training and Public Awareness Building. Capacity development of the Working Group members and DIEACC should be continuously pursued especially in areas pertaining to GHG inventory development and mainstreaming of climate change considerations in planning and policy making at relevant agencies. For agencies implementing adaptation and mitigation measures, there is also a need to strengthen capacity in monitoring, evaluating and reporting (MER) on program implementation.

The Government of Timor-Leste has proposed one National Adaptation Plan of Action (NAPA) to focus on institutional capacity development. This Action Plan will build on and enhance Timor-Leste's capacity to coordinate/integrate climate change into strategic planning in moving towards sustainable development and poverty reduction. The expected outcome from this NAPA activity is that Timor-Leste will have a 'National Strategy and Action Plan for Low Emissions Climate Resilient Development'.

## MEASURES TO FACILITATE ADEQUATE ADAPTATION TO CLIMATE CHANGE

Due to its geographical location, topography and socioeconomic conditions, Timor-Leste is considered to be one of the top 10 countries most at risk of disaster (9th rank). Together with the other 10 countries, the vulnerability and susceptibility of Timor-Leste is high, with a significant lack of coping capacity and adaptive capacity. Based on the vulnerability assessment at the village (suco) level, there are 61 villages categorized as being vulnerable to very vulnerable to climate change. High levels of exposure and sensitivity and low adaptive capacity characterize the vulnerable and very vulnerable sucos. The level of exposure, sensitivity and adaptive capacity of the sucos are represented by socio economic and biophysical condition. The most vulnerable sucos are mainly located in the western part of the country (Figure 1). These vulnerable and very vulnerable villages will be more seriously affected by the impact of climate change than those less vulnerable. The implementation of adaptation actions should be prioritized in these vulnerable villages.

The occurrence of El Niño and La Niña phenomena which is normally associated with extreme climate events have resulted in serious damage and disasters affecting different socioeconomic sectors of the country. Observations have indicated that El Niño events will become more frequent. Many studies suggest that increasingly high temperatures are exacerbating the extreme regional weather and climate anomalies associated with El Niño (Hansen et al., 2006; Timmerman et al. 1999).

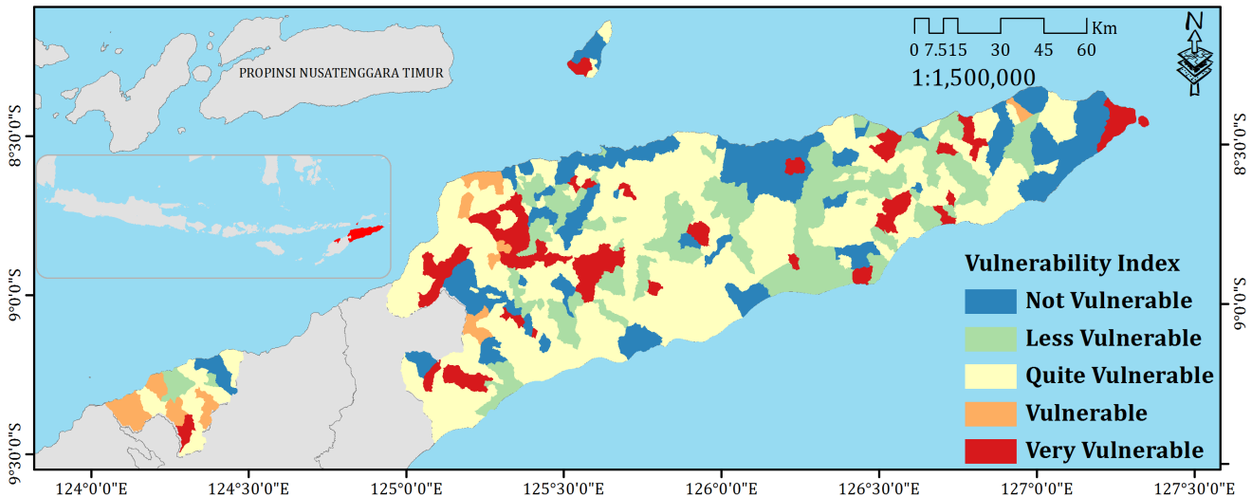



Figure 1 **Categorization of villages at Timor-Leste based on the vulnerability index**

Based on historical climate data and the results of climate scenarios, generated with Regional Climate Model (RCM) using the A1B emission scenario, and with 20 Global Circulation Models (GCMs) using new emission scenarios, Representative Concentration Pathways (RCPs), the following conclusions have been reached:

- In the longer term, annual mean temperature over Timor-Leste has increased consistently with a rate of about 0.016°C per year. It is very likely that temperatures in Timor-Leste will continue to increase. Prior to the 2040s, the mean temperature anomalies in Timor-Leste are expected to increase by up to as much as 1°C for all emission scenarios. Post 2040s, the rate of increase will vary based on different scenarios. For the high emission scenario (RCP8.5) the increase in temperature relative to current conditions may reach 3°C by 2100, while for the low emission scenario (RCP2.6) it may increase by up to 0.5°C.

- Historically, the sea level surrounding the main island of the country has risen at about 5.5 mm/year. Over 100 years, the sea level rise may reach 76 cm. Based on the Pacific Climate Change Science Program (2011); Pacific Ocean acidification has also been increasing in Timor-Leste's waters. It will continue to increase and threaten coral ecosystems.

- Historical data suggests that during the 20th century and early 21st century, there were already some shifts in the peak of the wet season. In the future, the wet season onset may be delayed by about 20 days from the current climate pattern, while dry season onset will be delayed by as much as 11 days depending on the period and emission scenarios. Thus, in some areas the length of the wet season would shorten.

- Extreme rainfall events are projected to become fewer but more intense as a result of decreasing numbers of tropical cyclones albeit with stronger intensity (Pacific Climate Change Science Program 2011).

- Decreases in rainfall are projected in some parts of the country, as well as changes in its seasonal distribution, with respect to the 1981-2010 conditions. For example, the drier area on the northern coast of the country (annual rainfall less than 1000 mm) will expand in the future.

- The water balance suggests that the area with a duration of water deficit period (LDP) of more than 8 months will expand while the area with LDP<5 months will shrink.

**The implications of the changes in climate in Timor-Leste include:**

- Potential areas for the establishment of new agricultural areas (expansion) will become more limited.

- Increasing cropping intensity will be more difficult without supporting irrigation water. In some areas of the north coast of Timor-Leste, even planting crops once a year is not possible. Changes in climate would result in a reduction of maize yield between 5% and 20% from the current yield depending on climate scenarios. Crop failures due to extreme climate events may also increase.

- Water scarcity will become more serious in the future particularly in those areas with a longer water deficit period.

- Economic loss (damaged vital infrastructure such as offshore oil and gas infrastructure) due to extreme climate events might increase as a result of exacerbated hazard events (flooding, landslides, storms and drought).

- Risk of dengue and malaria may increase in the future, however after 2040 it might decrease.

**Some key adaptation actions include:**

- Research and development of technologies more adaptive to climate change particularly for key sectors, i.e. agriculture, water resources and coastal/maritime (e.g. development and introduction of varieties resistant to climate stresses, climate proof infrastructure, etc.).

- Improvement of water management including development and utilization of rainfall harvesting technologies particularly in high prone drought areas.

- Protection and rehabilitation of rainfall catchment areas should be accelerated to ensure sustainable water supplies. Priority should be given to watersheds that supply water for agriculture and domestic uses.

- Protection and rehabilitation of mangrove ecosystems in priority areas to protect economic, social and environmental assets against climate risks.

- Strengthening capacity of national and local institutions as well as communities in managing climate risks through the development of an effective climate information system (improving the skills of climate forecasters) including the development of early warning system and decision support system tools for policy makers.

- Development and enhancement of sectoral capacity to coordinate the implementation of adaptation actions and also to integrate climate change into strategic planning in moving towards sustainable development and poverty reduction.

**The Government of Timor-Leste has proposed nine programs under the NAPA (National Adaptation Plan of Action-2010) which cover all the above key adaptation actions. The nine programs are as follows:**

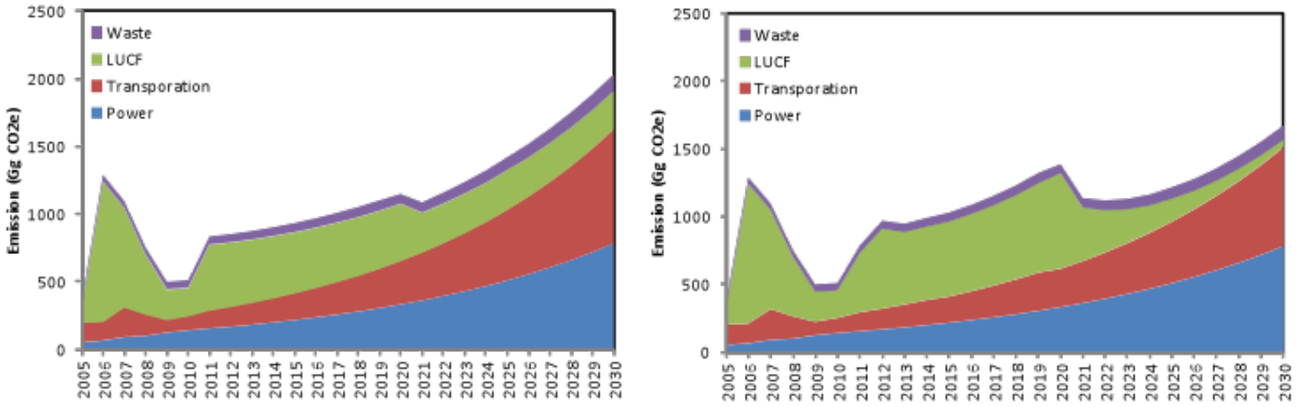
1. Building resilience of rural livelihoods to ensure national food security.
2. Promotion of Integrated Water Resource Management (IWRM) to guarantee water access to people in the context of increasing climate risks.
3. Enhancing capacity of the health sector to anticipate and respond to changes and reduce the vulnerability of populations at risk from expansion of climate related diseases.
4. Improving institutional, human resource and information management capacity in the disaster management sector in relation to climate change induced risks at national, district and community levels.
5. Restoration and conservation of mangrove ecosystems and awareness raising to protect coastal ecosystems exposed to sea level rises.
6. Improved strategic planning, institutional frameworks and methodologies to promote sustainable, integrated livestock production under changing climate conditions.
7. Review and revise legislation, regulations and standards to enhance climate change resilient infrastructure.
8. Support to the ambitious national poverty reduction target (Timor-Leste Strategic Development Plan 2011-2030) in relation to the expected increased storm intensity at sea by improving capacity to forecast and adapt offshore oil and gas infrastructure to withstand strong storms and waves.
9. National Institutional Capacity Development to build and enhance Timor-Leste's capacity to coordinate and integrate climate change into strategic planning in moving towards sustainable development and poverty reduction.

International support is urgently required to implement the above actions.

## MEASURES TO MITIGATE CLIMATE CHANGE

Future GHG emissions in Timor-Leste for the four key source categories namely: energy use (electricity), transportation, land use change and forestry, and waste will continue to increase in the absence of mitigation policies. By 2030 the rate of GHG emissions would reach 2,254 Gg $CO_2e$. With mitigation policies, this rate of emissions could be reduced by about 30% (1,565 Gg $CO_2e$; Figure 2). Key mitigation measures proposed for these four sectors can be seen in Table 3.

Figure 2 **Projection of GHG emissions under BAU (left) and mitigation scenarios (right).**




Note: From LUCF, there would be a sudden decrease in emissions in 2021 as it is assumed that there would be no development of new agricultural areas after 2020.

Table 3 **Key mitigation measures**

| Key Sectors | Mitigation Measures |
|---|---|
| Power | Potential mitigation actions on the demand side can be achieved through the improvement of energy efficiency (i.e. by implementing cleaner energy and more efficient technologies for end use of energy appliances/technologies such as efficient lamps, renewable based energy technology (biogas, micro hydropower, photovoltaic, wind propelled electric generators, etc.); while on the supply side mitigation can be achieved through efficiency improvement throughout the entire process of electricity generation by utilizing efficient technology and implementing cleaner energy. |
| Transportation | Potential mitigation actions can be achieved through (a) increasing efficiency of combustion technology by replacing old cars with newer cars through incentive or stimulus, (b) increasing energy efficiency by providing public transport (bus or mini/micro bus), (c) providing pedestrian and bicycle lanes so that more people want to walk or ride, and (d) replacing oil fuels with gas fuels (LPG, CNG or LGV) in the transportation sector through developing infrastructure for the gas utilization in transport (conversion kits, gas station, gas supply infrastructures, etc.). The utilization of biofuel in this sector cannot be considered since the government of TL does not allow the utilization of land for biofuel plantation. |
| Land Use Change and Forestry (LUCF) | Implementation of sink enhancement programs namely (a) Planting of teak, ai-naa (rosewood) and sandalwood in managed rotations for shrubland areas (b) development of agroforestry using candlenut as main crop species in agriculture mixed shrubland areas, and (c) mangrove restoration on swampy shrubland areas. For the period of 2011-2050, the total area needed for implementation of the program is 57,300ha consisting of 52,100ha of shrubland, 400ha of swampy shrubland, and 4,800ha of agriculture mixed with shrublands (this is an increase of about 48,500ha from the baseline). |
| Waste | Potential measures (starting from 2020) for GHG mitigation relevant for these sources are (a) waste composting and 3R (about 10% of waste), (b) change from open landfill to managed landfill equipped with flaring unit (about 70% of LFG recovery) and leachate treatment; and (c) reducing open burning from 41% (2005-2010) to 20% (2020-2030) of the total waste generation. |

## OTHER INFORMATION

Timor-Leste has carried out various efforts to increase its climate resilience through technology development and implementation adoption, research, education, training, public awareness, and dissemination of information.

In terms of research, producing information and developing know-how, and creating the capacity within the national territory to deal with climate variability and climate change is one of the most important aspects in meeting commitments to the UNFCCC (United Nations Framework Convention on Climate Change). The establishment of national research capacity is also important. At present, two national agencies that work quite actively in conducting climate change research and systematic observation are ALGIS and the National Directorate for Meteorology and Geophysics (NDMG) with support from a number of international agencies such as the Australian Bureau of Meteorology, UNDP etc. However, until now, Timor-Leste has not developed a national research program on climate change. Most of the national and international institutions interviewed agreed that the Government of Timor-Leste needs to develop a national research program on climate change.

The types of research activities being recommended include: assessment of climate change impact on sectors, particularly on agriculture and fisheries, socio-economic impact of climate change, vulnerability assessment at household, community and ecosystem levels, and utilization of local technologies for adaptation and mitigation (Figure 3). Research on the development of systematic observations for ecosystems vulnerable to climate change and for climate change impact on infrastructure also received attention.

In terms of technology, common climate change related technologies implemented by communities with support from the Government of Timor-Leste and NGOs include biogas, organic agriculture, efficient cooking stoves, agro-forestry, and rainfall harvesting. These technologies need further improvement and replication or up scaling. Based on views from a number of institutions, other important technologies needing to be implemented are recycling of agricultural waste and water conservation.

The Government of Timor-Leste has implemented a number of programs for supplying electricity in rural areas through the use of renewable energy, particularly hydropower, solar PV and biogas. Up to 2012, the government had installed pico hydro in three districts supplying electricity for 733 HH; Solar PV about 9,300 units with a total capacity of around 0.465 MW; and biogas energy for 270 HH and 1 school. Development of renewable energy (RE) in Timor-Leste has good potential. Potential emissions reduction from the use of RE which include wind, solar and hydropower energy, might reach 484 million tons of $CO_2e$ with a total mitigation cost of about US$154 million.

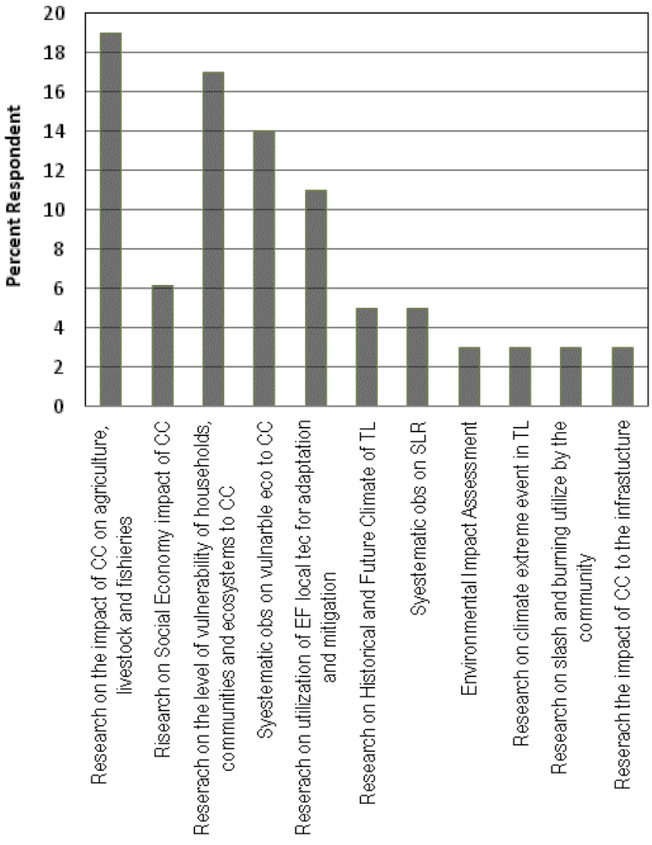



Figure 3 **Recommended climate change research activities from national and international agencies in Timor-Leste.**

Most respondents considered it important to have more pilots in addition to training and comparative studies to enable communities to implement climate change adaptation and mitigation activities. The presence of supporting policies such as providing extension services, establishment of information centres (e.g. agribusiness clinics), providing subsidies and strengthening education and dissemination of information regarding technologies will be a key factor for ensuring the successful implementation of climate change mitigation and adaptation actions.

In terms of Education, Training, and Public Awareness (ETPA), the Government of Timor-Leste in collaboration with UNICEF is developing a curriculum for environment sciences for primary and secondary schools, for training staff at the district level and also a public awareness program. A general introduction about environmental issues (e.g. climate change) will be introduced in primary schools at grade 5 and will be continued through related subjects at higher grades. At present the Government is still in the process of disseminating information on environmental education to all 13 districts. So far there has been implementation in four districts. In addition, the SoSE and international agencies and/or local NGOs have also implemented ETPA on climate change at primary and secondary schools at the district and sub-district levels. However the number of activities being implemented is still very low.

Some of the challenges in developing and implementing the environment curriculum and ETPA in Timor-Leste have been identified. These include (i) lack of funding for environmental education, (ii) lack of trainers and teachers with an environmental background, (iii) lack of awareness of sustainable development considerations in general, (iv) poor access to internet and lack of availability of reliable electricity supply for supporting web-based information on climate change information, awareness raising and education, (v) lack of coordination between donors to utilize available training programs efficiently, and (vi) few available instructional materials, especially those appropriate to the local context.

The development of a good web-based information system has been considered to be important for promoting information sharing of climate change. At present, only a few national institutions have established web-based information systems, while at local institutions there are almost none. Moreover, over 70% of Timorese living in rural areas have very limited access to information and means of communication. However, there is still a strong connection between individuals, communities, the environment, history and cultural traditions. Therefore, 'adat' (uma-lisan or clan) leaders can play important roles in the dissemination of information to communities.

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