



## Introduction

Global climate change models forecast that all of the Indonesian region will face an increase of temperature, a rise in sea levels, more erratic rainfall and seasonal abnormalities.<sup>1</sup>

Based on trend analysis of maximum and minimum temperature data of 1980-2002 for 33 stations across Indonesia, a significant increase in maximum and minimum temperature was observed in most of the stations. The locations of the stations that monitor the air temperature are mostly in urban areas. The increase in population, industries and transportation activities in these areas may contribute partly to the increase of the temperature. It is quite difficult to quantify the single effect of the increase of the Green House Gas (GHG) concentration on site-specific temperatures.<sup>2</sup>

As a result of both the expansion of seawater and the melting of glaciers and polar ice caps, global warming could result in a rise in sea level of between 9 and 100 centimetres. This would accelerate coastal erosion, intrude salt water into groundwater, destroy coastal wetlands and submerge small islands.<sup>3</sup> Indonesia has installed a number of instruments to monitor sea level. The existing Indonesia Sea Level Monitoring Network consists of 65 operational stations. Increasing trends in Mean Sea Level (MSL) has been observed in a number of stations. However the rate of increase varies with locations.<sup>4</sup>

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<sup>1</sup> Indonesia, 2004; Indonesia, 2007b; UNDP Indonesia, 2007

<sup>2</sup> Indonesia, 2007b

<sup>3</sup> UNDP Indonesia, 2007

<sup>4</sup> Indonesia, 2007b



## Introduction

In most of Sumatra, comparing the periods 1961-1990 and 1991-2003, the onset of the wet season is now 10 to 20 days later and the onset of the dry season is now 10 to 60 days earlier. Similar shifts have been seen in most of Java. These patterns seem likely to continue.<sup>5</sup> Based on a record of historical annual rainfall data with a length of about 43 years, from 63 stations (period of record varied from the earliest year 1950 and the latest 1974 until 1997), it was found that all stations show a decreasing trend of annual rainfall depth during the last decades, except for stations in the Lesser Sunda Islands and the eastern coast of Java and the northern part of Indonesia (e.g. Sumatra).<sup>6</sup>

Climate change will also mean Indonesia will experience more frequent and extreme climatic events and natural disasters including, coastal storms, droughts, floods, landslides, peatland fires and forest fires. These events will increase the damage to infrastructure; reduce food production and accessibility, lead to individual property loss and human casualties.<sup>7</sup>

Within the period of 2003-2005 alone, there were about 1,429 disaster incidences in Indonesia. About 53.3% were hydro-meteorological disasters.<sup>8</sup> Of this figure, floods occur most often (34%), followed by landslides (16%). It is likely that global warming will lead to greater extremes of drying and heavy rainfall which will in turn lead to higher risk of climate hazards.<sup>9</sup> A report from UN-OCHA (2006) indicates that Indonesia is one of the vulnerable countries to climate related hazards.<sup>10</sup>

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<sup>5</sup> UNDP Indonesia, 2007

<sup>6</sup> Indonesia, 2007a

<sup>7</sup> Indonesia, 2004; Indonesia, 2007b; UNDP Indonesia, 2007

<sup>8</sup> Bappenas and Bakornas PB, 2006 cited in Indonesia, 2007a

<sup>9</sup> Trenberth and Houghton, 1996; IPCC, 2007 cited in Indonesia, 2007b

<sup>10</sup> cited in Indonesia, 2007b



## Introduction

The El Niño Southern Oscillation (ENSO) has been identified as a natural phenomenon that has resulted in devastating consequences on the climate and the cause of disasters. In Indonesia, ENSO is often related to drought and La Niña (which is the cold phase of ENSO) to floods.

Based on 43 drought events which occurred in the period of 1844-1998, only six drought events were not associated with ENSO.<sup>11</sup> Moreover, ENSO is considered as one of the overriding control factors in major forest/land fire and haze occurrence and frequency.<sup>12</sup>

Over recent years, it is quite clear that the ENSO events have become more frequent as the global temperature anomalies associated with each ENSO continue to increase.<sup>13</sup> This means that the extreme regional weather and climate anomalies associated with ENSO are being exacerbated by increasingly higher temperatures.<sup>14</sup>

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<sup>11</sup> Boer and Subbiah, 2005, ADB and Bappenas, 1999; Quinn et al., 1978 cited in Indonesia, 2007b

<sup>12</sup> Indonesia, 2007b

<sup>13</sup> Hansen et al., 2006

<sup>14</sup> Indonesia, 2007b



## Agriculture

Parts of Indonesia, particularly in regions located south of the equator, could have longer dry seasons and shorter, but more intense, wet seasons. Affected regions are exposed to higher flood risks and drought risks, which has a significant impact on food crop production. Water shortages and droughts are causing crop failures, forcing farmers to switch crops from rice to secondary crops, reducing the areas planted under irrigation production.<sup>15</sup>

The poorest regions are also likely to suffer food shortages. Long droughts followed by crop failure in the province of Nusa Tenggara Timur, for example, have already had severe consequences and acute malnutrition is evident across the province, between 32 and 50%.<sup>16</sup>

The increase in temperatures and CO<sub>2</sub> concentrations will also affect rice yields. Some studies showed that for every 1°C increase in the minimum temperature, rice yields decrease by 10%.<sup>17</sup>

Climate change is also leading to a change in crop pests and potentially an invasion of new races of pests and diseases.<sup>18</sup> The outbreak of crop pests and diseases as well as human vector borne diseases was often reported connected to climate extreme events.<sup>19</sup>

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<sup>15</sup> Indonesia, 2004; Indonesia, 2007b; UNDP Indonesia, 2007

<sup>16</sup> UNDP Indonesia, 2007

<sup>17</sup> Peng et al., 2004 cited in UNDP Indonesia, 2007

<sup>18</sup> Indonesia, 2004; Indonesia, 2007b; UNDP Indonesia, 2007

<sup>19</sup> Gagnon et al., 2001; Hopp and Foley, 2003 cited in UNDP Indonesia, 2007



## Forestry

Indonesia has been losing forests at an ever faster rate – 600,000 hectares per year in the 1980s but around 1.6 million hectares per year by the end of the 1990s. As a result, forest cover has been declining rapidly – from 129 million hectares in 1990 to 82 million in 2000 and a projected 68 million in 2008. Thus, each year, Indonesia is now capable of sequestering much less carbon dioxide.<sup>20</sup>

The decrease in rainfall and length of wet season will directly reduce soil water availability. A number of studies have indicated that in tropical countries the projected depletion of soil moisture would likely caused reduction forest productivity.<sup>21</sup>

Higher temperatures will dry out the soil, reducing groundwater resources, degrading the land and in some cases leading to desertification.<sup>22</sup>

Changes in forest productivity will have implications on logging regulations, for example the length of concession period. To anticipate this change, policy response is required.<sup>23</sup>

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<sup>20</sup> UNDP Indonesia, 2007

<sup>21</sup> IPCC, 1996 cited in Indonesia, 2007b

<sup>22</sup> UNDP Indonesia, 2007

<sup>23</sup> Indonesia, 2007b



## Forestry

Droughts combined with changing patterns of land use have led to an increasing fire risk. In Central Kalimantan, for example, the Peat Project in the 1990s aimed to convert one million hectares of peatland for palm oil plantations. This proved to be a failure, causing enormous environmental damage.

It has also undermined the livelihoods of communities in the surrounding areas that relied on rubber plantations as their main source of livelihood. Many of their trees have caught fire as a result of the burning of the peat land. Since then, the fires have proved very difficult to control, especially during El Niño years, and particularly because canals have been built to drain the swamps and fire has been used to clear lands.

During the ENSO event in 1997, the total area of fire-damaged peat land in Indonesia was estimated at 6.8 million ha. These fires have not only caused health problems but also damaged people's livelihoods – increasing poverty rates by one-third or more. Fire in ENSO years has caused major damage across the country: in 1997 alone, the cost was estimated at between US\$662 million and US\$1,056 million.<sup>24</sup>

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<sup>24</sup> UNDP Indonesia, 2007



## Coastal communities and urban areas

Climate change, particularly rising sea levels has severe impacts on the coastline of Indonesia. Currently, around 42 million people in Indonesia live in areas less than 10 metres above the average sea level. Many industries and sectors also operate in these coastal areas such as oil and gas exploration, transportations, fisheries, settlements, agriculture and tourism.<sup>25</sup>

A sea level rise of between 8 and 30 centimetres would also have a serious impact on coastal cities such as Jakarta and Surabaya, which will become even more vulnerable to flooding and storm surges. This problem has been made worse in Jakarta because at the same time as the sea level has been rising, the ground level has been falling: the construction of tall buildings and the increasing extraction of ground water have been causing the land to subside.<sup>26</sup>

But Jakarta has regularly been subject to regular flooding as a result of heavy rainfall: in early February 2007, flooding forced 422,300 to leave their homes, of which 1,500 were destroyed. Total damaged was estimated to be about US\$695 million. One study has estimated that the combination of a sea level increase of about of 0.5 metres and continuing land subsidence would lead to the permanent inundation of six locations – three in Jakarta (Kosambi, Penjaringan and Cilincing) and three in Bekasi (Muaragembong, Babelan and Tarumajaya) – with a total population of approximately 270,000 people.<sup>27</sup>

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<sup>25</sup> UNDP Indonesia, 2007

<sup>26</sup> UNDP Indonesia, 2007

<sup>27</sup> UNDP Indonesia, 2007



## Coastal communities and urban areas

Many other parts of the country have recently experienced flood disasters. Heavy floods in Aceh, for example, at the end of 2006 took 96 lives and displaced 110,000 people who saw their livelihoods and assets destroyed. In 2007 in Sinjai, South Sulawesi, several days of floods destroyed roads and bridges and isolated 200,000 people. Later in the year, floods and landslides in Morowali, North Sulawesi forced 3,000 people to move into tents and barracks.

A rise of about 1 metre could inundate around 405,000 hectares of coastal land, causing the disappearance of many low-lying islands along with coral reefs. This has implications for Indonesia's national borders: recent studies indicate that at least 8 of 92 of the outermost small islands that establish the baseline for Indonesia's territorial water are very vulnerable to sea level rise.<sup>28</sup>

Many sections of the coast have been rendered even more vulnerable by erosion – which has also been exacerbated by human activity such as the building of jetties and sea walls, the damming of rivers, sand and coral mining, and the destruction of mangrove forests.<sup>29</sup>

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<sup>28</sup> UNDP Indonesia, 2007

<sup>29</sup> UNDP Indonesia, 2007



## Fishing communities

Climate change has major implications for millions of coastal fishermen. They rely on highly sensitive ecosystems in which even small changes can have large effects: changing water temperatures that damage coral reefs, for example, will exacerbate other, human-induced stresses such as pollution and over-fishing and thereby cause a reduction in fish stocks. Fishing boats will also have to cope with more erratic weather and high waves.

Climate change has already undermined livelihoods in many islands in Maluku, for example, where fishermen say they can no longer predict the right times or places to catch fish because of the different climate patterns. Rising sea levels could also inundate many of the shrimp and fish ponds in Java, Aceh and Sulawesi.<sup>30</sup>

The increase in sea temperature has also caused serious problems for the coral ecosystems and coral bleaching is observed in many places such as in the eastern part of Sumatra, Java, Bali, and Lombok.<sup>31</sup> In 'thousands islands' (north of the Jakarta coast), about 90 to 95% of the corals located 25 metres below sea surface have been bleached.<sup>32</sup>

Warmer seawater can inhibit the development of plankton and limit the supply of nutrients to fish. Some species of fish are likely to migrate to other areas that offer better conditions of temperature and food.<sup>33</sup>

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<sup>30</sup> UNDP Indonesia, 2007

<sup>31</sup> Indonesia, 2004; Indonesia, 2007b

<sup>32</sup> Indonesia, 2007b

<sup>33</sup> UNDP Indonesia, 2007



## Water resources

The decrease of rainfall because of climate variability and seasonal variation with the increase of temperature have significant effects on water reserves, which have impacts on the domestic/human settlement sector, agriculture, fisheries, animal husbandry, industry and environment. The water volume in reservoirs has decreased significantly and could decrease the contribution of hydro power to the total supply of energy and reduce the availability of water for irrigation and for drinking.<sup>34</sup>

In Lombok and Sumbawa islands, between 1985 and 2006, the number of water sources for irrigation and drinking water fell from 580 to 180 (EM-DAT, 2007 cited in UNDP Indonesia, 2007). Across the country, many more rivers now have much lower flows, such as the Ular (North Sumatra), the Tondano (North Sulawesi), the Citarum (West Java), the Brantas (East Java), the Ciliwung-Katulampa (West Java), the Barito-Muara Teweh (Central Kalimantan), and the Larona-Warau (South Sulawesi).<sup>35</sup>

The high rate of deforestation has caused serious problems in many watersheds in Indonesia. Based on data from 52 rivers in Indonesia, it was found that the number of rivers in which the minimum flow would potentially cause drought problems has increased significantly. Similarly, the number of rivers in which the peak flow would potentially cause flooding also increased quite significantly.<sup>36</sup>

Reduced fisheries production due to the lack of fresh water supply, especially during dry seasons;

Social, economy and environmental problems in the affected areas.

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<sup>34</sup> Indonesia, 2004; Indonesia, 2007b; UNDP Indonesia, 2007

<sup>35</sup> UNDP Indonesia, 2007

<sup>36</sup> Indonesia, 2007b



## Water resources

Heavy rainfall also increases the turbidity and this will increase the cost of water processing in reservoirs.<sup>37</sup> The quality of water in the Citarum watershed also decreased significantly. Observations at station B.Tb.49 located at Tarum Barat Canal showed that a rapid change in turbidity occurred after 1997.<sup>38</sup>

In coastal areas the loss of groundwater combined with rising sea levels will also allow more sea water to intrude into water sources.

The threat of salt water intrusion could cause:<sup>39</sup>

Reduced quality and quantity of fresh water supply during dry season that will increase the processing cost for drinking water;

Threat of salt water intrusion to the sources of drinking water (water intake sites in rivers) because of sea level rise;

Damage to the function of rice fields as agriculture land and also damage to the function of rivers as fresh water resource;

Damage to the structure of buildings;

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<sup>37</sup> Indonesia, 2004; Indonesia, 2007b; UNDP Indonesia, 2007

<sup>38</sup> Indonesia, 2007b

<sup>39</sup> Indonesia, 2007a



## Health

Heavy rainfall and flooding can overwhelm rudimentary systems of sanitation in slum areas of towns and cities, exposing people to water-borne diseases such as diarrhea and cholera. Prolonged intense heat waves coupled with high humidity will also lead to heat exhaustion particularly among the urban poor and the elderly. And higher temperatures will also allow mosquitoes to spread to new areas – with the ensuing hazards of malaria and dengue.<sup>40</sup>

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<sup>40</sup> Indonesia, 2007a; UNDP Indonesia, 2007



## Adapting to climate change

Although Indonesia does not have any obligation to reduce its GHG emissions, it does have an interest in playing an active role in global efforts to tackle climate change.

There are number of Acts/Decrees which are either directly or indirectly associated with atmospheric pollution and natural resource management.<sup>41</sup>

See Appendix 1 (included in electronic version of this paper).

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<sup>41</sup> Indonesia, 1994



## Appendix 1

### ADAPTING TO CLIMATE CHANGE

- Although Indonesia does not have any obligation to reduce its GHG emissions, it does have an interest in playing an active role in global efforts to tackle climate change.
- There are number of Acts/Decrees which are either directly or indirectly associated with atmospheric pollution and natural resource management:<sup>1</sup>
  - Act No.6/1996, regarding the ratification of the United Nations Framework on Climate Change.
  - Presidential Decree No. 23/92 concerning the ratification of Vienna Convention for Protection of the Ozone layer as adjusted and amended by the second meeting of the parties, London, June 1990.
  - Act No. 24/1992 concerning spatial use management.
  - Act No. 23/1992 concerning health.
  - Act No. 12/1992 concerning crop culture system.
  - Presidential Decree No. 43, 1991 concerning energy conservation.
  - Act No. 5/1990 concerning natural resource conservation and ecosystem management.
  - Act No. 17/1985 concerning the ratification of the United Nations Convention on the Law of the Sea.
  - Act No. 9/1985 concerning fisheries.
  - Act No. 5/1983 concerning the Exclusive Economic Zone of Indonesia.
  - Act No. 4/1982 concerning the basic provisions for the management of the Environment.
  - Act No. 1/1973 concerning the continental shelf of Indonesia.
  - Act No. 5/1967 concerning the basic provision for forestry.
- Indonesia ratified the United Nations Framework Convention on Climate Change through Act No.6, in 1994. Ten years later, Indonesia ratified the Kyoto Protocol through Act No. 17, in 2004. This commitment now requires a thorough effort and real action, covering all sectors that contribute to GHG emissions and carbon sequestration. This commitment must also be implemented along with efforts to improve welfare and environmental quality, which is reflected in the management of consumption and production

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<sup>1</sup> Indonesia, 1994

priorities for mitigation and adaptation.<sup>2</sup>

- The danger at present is that climate change can be seen simply as an environmental issue – and a responsibility only of the Ministry of Environment. In fact, however, all departments of government and of national planning need to take into account the impact of future climate change on their own programmes. Issues as diverse as poverty reduction, community development, spatial planning, food security, infrastructure maintenance, disease control, urban planning, disaster management, all have to be readdressed from the perspective of climate change.
- The challenge is to ‘climate proof’ development planning. The impact of climate change on the economy and on human development needs to be properly assessed and mapped out. Then adaptation strategies need to be integrated into plans and budgets, both at national and local levels. Poverty reduction efforts need to be scaled up in areas especially affected by climate change, and additional investment is needed to promote disaster risk reduction.
- These efforts also need to be closely integrated with the efforts of communities and households. They, after all, have had a long experience of adaptation – with measures that have been practiced for many centuries. People in flood-prone areas have built their houses on stilts and many continue to do so, even if they use more modern materials such as concrete pillars or corrugated iron roofs. In areas vulnerable to landslides, people have built strong retaining walls. Farmers exposed to drought have learned to diversify their sources of income, cultivate drought-resistant crops and optimise the use of scarce water, or even migrate temporarily in search of work elsewhere.
- Whether through public or individual initiatives, adaptation has to be about strengthening livelihoods and reducing vulnerability. This will require a change in development direction. In the past, much of Indonesia's development has been based on the exploitation of natural resources – with the economic benefits being reaped in the cities and the ecological costs being borne by the rural areas. That pattern has to change. Communities in both rural and urban areas should already be aiming for sustainable human development, but the threat of climate change adds extra urgency. If we do not change the pattern of development, then the resources available to all – food, water, and living space – are likely to diminish.<sup>3</sup>
- This implies a broader adaptation strategy involving governments, civil society and the private sector – combining approaches at the government and

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<sup>2</sup> Indonesia, 2007a

<sup>3</sup> UNDP Indonesia, 2007

institutional level with bottom-up approaches rooted in regional, national and local knowledge. While adaptation is vital across a whole range of development activities, it is particularly important for agriculture, coastal zones, water supplies, and the health sector and for urban areas, with water playing a cross-sectoral role in all these areas.<sup>4</sup>

## **GENERAL ADAPTATION IN DEVELOPMENT PLANNING**

- Review the core policies that directly or indirectly will be influenced by climate change. Afterwards identify the adjustment needed to the programme that was designed according to those policies, with consideration of the direction of climate change and sea level rise as well as the change in social and economic conditions to support policies and programmes that are more resilient to climate change.
- Increase the capacity to integrate climate change by mainstreaming climate change adaptation into infrastructure planning and design, conflict management and ground water distribution for water management institutions.
- Mainstreaming climate change adaptation into various sectors' policies and programmes (with a focus on disaster management, water resources, agriculture, health and industry).

### *Examples*

- Establishment of the National Committee for Climate Change through Environmental Ministerial Decree No.53/2003. The members of this National Committee are representatives from departments and institutions related to climate change.
- Revision on Act No.23/1997 concerning Environmental Management to include climate change issue.
- Formulation of Presidential Regulation concerning Climate Change that will function as an umbrella to all activities related with climate change impact, both in terms of mitigation and adaptation.<sup>5</sup>
- Establishment of the National Commission on the Clean Development Mechanism (CDM) based on Ministry of Environment Decree No.206/05 as Designated National Authority (DNA) to give national approval to CDM project proposals that have satisfied sustainable development criteria. The National Commission on CDM consists of nine departments, and is chaired by Deputy III, State Ministry of Environment. In the two years since it was established

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<sup>4</sup> UNDP Indonesia, 2007

<sup>5</sup> Indonesia, 2007a

(until August 2007), the National Commission on CDM has approved 24 CDM project proposals, and nine of them have been registered internationally by the UNFCCC executive board. From these 24 projects, total emissions of CO<sub>2</sub> could be reduced by 33,079,993 tonnes.<sup>6</sup>

## **AGRICULTURE**

- Climate change actions related to agriculture are primarily the responsibility of the Ministry of Environment, Department of Public Works, and Local Government.<sup>7</sup>
- Improving technology and information transfer to farmers in order to speed up adaptation and innovation and adoption.<sup>8</sup>
- Strengthening research, development, and dissemination of sustainable agriculture practices.<sup>9</sup>
- Supporting research and technology that will ensure that the agricultural sector can deal successfully with the various challenges of the future.
- Promote improved agricultural practices that emit the least amount of GHGs.
- Staple food diversification by promotion of non rice food sources.
- Improve water management in rice production.
- Regionalisation of agricultural research and development.<sup>10</sup>
- Adopting varieties that are tolerant of extreme conditions – drought, or deep water, or salt – or new fast-maturing rice varieties that are suitable for a shorter wet season.<sup>11</sup>
- Looking at ways of increasing the amount of organic matter in the soil so as to help it retain water – by using more natural fertilisers.<sup>12</sup>

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<sup>6</sup> Indonesia, 2007a

<sup>7</sup> Indonesia, 2007a

<sup>8</sup> Indonesia, 1994

<sup>9</sup> Indonesia, 2007a

<sup>10</sup> Indonesia, 1994

<sup>11</sup> UNDP Indonesia, 2007

<sup>12</sup> UNDP Indonesia, 2007

## FORESTRY

- Climate change actions related to forestry are primarily the responsibility of the Department of Forestry, Ministry of Environment, and Local Government.<sup>13</sup>
- Improving forest policy and enforcement of stronger regulations in forest management.
- Improving technology and information transfer in order to speed up adaptation and innovation and adoption.
- Strengthening research and development of sustainable forest management.
- Review and revise present forest and land management policies to provide stronger and more accountable measures.
- Prevent the occurrence of forest fires through better preparation, especially in areas prone to forest fires.
- Provide land grants to universities for forestry research.
- Support research and development of fast growing high quality forest trees.
- Replenish the forests in rural areas and replant trees in urban areas.
- Promote low impact logging practices.<sup>14</sup>
- Inventory biodiversity in Indonesia (genetic bank).<sup>15</sup>
- Protection of forest ecosystems.<sup>16</sup>

### *Examples*

- Addressing Forest Fire:<sup>17</sup>
  - Government Regulation No. 4/2001 concerning Environmental Damage Control and or Environmental Pollution related with Forest and Land Fire.
  - Preventive Forest Fire effort that consists of satellite monitoring, field monitoring of companies, air quality monitoring, and community empowerment to change the practice of land clearing from slash and burn

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<sup>13</sup> Indonesia, 2007a

<sup>14</sup> Indonesia, 1994

<sup>15</sup> Indonesia, 2007a

<sup>16</sup> Indonesia, 2007a

<sup>17</sup> Indonesia, 2007a

- to not using fire or controlling fire. The implementation of this preventive effort is conducted by increasing community participation while at the same time increasing community income (related with poverty alleviation) of farmers in areas vulnerable to fire, among others, through distribution of technical equipment to clear the land without fire, and training for farmers.
- Establish “Manggala Agni” that have a duty to monitor, prevent and address the forest fire.
  - Issued the Presidential Instruction No.4/2005 regarding the elimination of illegal tree cutting in forest areas and its distribution throughout the Republic of Indonesia territory. In this decree, the President has ordered 12 ministries, prosecutors, police, the armed forces and the leaders of local governments to accelerate the elimination of illegal tree cutting in forest areas and their distribution throughout the Republic of Indonesia territory.
  - Addressing flooded land and preventing the occurrence of flooding. The objective of this management action is to prevent methane gas emissions and the accumulation of domestic waste because of flood.
  - Land Rehabilitation and Reforestation:<sup>18</sup>
    - National Movement for Land rehabilitation (Gerhan) is a movement to replant forest over 59 million ha of critical land in Indonesia. This programme will be focused on 3 million ha of river watersheds in Indonesia. In the period of 2003-2007 an area of 4 million ha has been planted.
    - Toward Green Indonesia (MIH), is a programme to supervise the performance of districts in enforcing natural resource conservation regulations and controlling environmental damage. This programme has run from 2006 with classification of highland areas, lowland areas, and small islands. The targets of MIH are the increase of vegetation coverage (improvement of water management, soil and coastal stabilisation), increased energy conservation and increased atmospheric protection. This is in accordance with Government Regulation NO. 47/1997 regarding National Spatial Plan and Act 27/2007 regarding Spatial Plan.
  - Management of Peat Land:<sup>19</sup>
    - Presidential Instruction No. 2/2007 concerning Revitalisation and Rehabilitation of Sustainable Peat Land.

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<sup>18</sup> Indonesia, 2007a

<sup>19</sup> Indonesia, 2007a

- Draft formulation on Sustainable Peat Land Management.
- Ministry of Environment has conducted an inventory and mapping of peat characteristics. This information has been presented by the State Ministry of Environment to the related local government and institutions for spatial planning formulation and permit requirement.
- Conduct peat environment restoration by damming channels to increase and maintain the water level of the peat land.
- River watershed programmes based in Forestry and Plantation Ministry No. 284/Kpts-II/1999 stated that 472 river watersheds should be addressed, consisting of 62 priority 1 river watersheds, 232 priority 2 river watersheds and 178 priority 3 river watersheds.
- The Heart of Borneo is a name given to 22 million ha of tropical rain forest in Kalimantan that extends through Indonesia, Malaysia and Brunei Darussalam. This region consists of conservation and cultivation areas that are managed for sustainability. The Heart of Borneo declaration was signed on 12 February 2007 and included the three countries' commitment to manage the Kalimantan forest region in a sustainable way.
- Improvement of land policy. Effective land policy could indirectly result in the reduction of emissions through the decrease of forest degradation and deforestation. The certainty of rights and duties particularly related to land title can reduce negative impacts and make land users more capable to adapt to climate change.

## **WATER RESOURCES**

- Climate change actions related to water resources are primarily the responsibility of the Ministry of Environment, Department of Public Works, and Local Government.<sup>20</sup>
- Increasing water supply or rehabilitating reservoirs, for example, relining canals, or harvesting rainwater.<sup>21</sup>
- Reducing water demand by cutting leakage from pipes or making more efforts to treat wastewater using 'green infrastructure' such as sand filters and wetlands.<sup>22</sup>

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<sup>20</sup> Indonesia, 2007a

<sup>21</sup> UNDP Indonesia, 2007

<sup>22</sup> UNDP Indonesia, 2007

## MARINE RESOURCES AND FISHERIES

- Climate change actions related to marine resources and fisheries are primarily the responsibility of the Ministry of Environment, Department of Marine Affairs and Fisheries, Department of Public Works, and Local Government.<sup>23</sup>
- Continue and develop the national marine resources evaluation and planning programme to include management issues and institutional support to assist the Provincial and District Bappedas to increase the level of community participation in the spatial planning process.
- Continue the national surveying and mapping programme as well as develop the national geographic information system in which coastal areas and small islands are prioritised.
- Promote coral reef rehabilitation planning and management, as well as mangrove rehabilitation and management programmes, piloting community based management of coastal resources as a key initiative to implement coastal zone management plans under the 1992 Spatial Planning Act No. 24.
- Continue promoting and strengthening water resources management with particular emphasis on national networking of hydrology information systems, which will link in with other natural resources information systems.
- Develop and integrate the nationwide tide gauge station network to enable sea level rise monitoring in the country for a long run period. Vertical datum definition studies will be conducted with reference to an absolute International Terrestrial Reference Frame (ITRF) through an international co-operation in the Asia and Pacific region.
- Prepare long term adaptation strategies for the possibilities of sea-level rise due to climate change in various coastal areas.<sup>24</sup>
- Protect the coast by building hard structures such as seawalls. But apart from being very expensive, these can have damaging side effects by displacing erosion and sedimentation. It is therefore generally better to use 'soft' options such as creating or restoring coastal wetlands and planting varieties of mangrove and vegetation that can cope with extreme changes of salinity.<sup>25</sup>
- Moving: many households and businesses can do this of their own accord, though local governments will also have a part to play in establishing 'set-back zones' requiring new developments to be at a specified distance from

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<sup>23</sup> Indonesia, 2007a

<sup>24</sup> Indonesia, 1994

<sup>25</sup> UNDP Indonesia, 2007

the water's edge.

- Introducing different varieties of fish to estuary, river mouth and lagoon areas and developing new forms of aquaculture.
- Coastal communities will also need much better warning systems for extreme weather events along with emergency evacuation plans for relocation in the event of a sudden inundation.<sup>26</sup>

### *Examples*

- Integrated Coastal Management has been conducted through mangrove forest planting activities in the north of Java (Pemalang, Batang, Brebes, Pekalongan, Tegal), east coast of Sumatra and several provinces (Nangroe Aceh Darussalam, North Sumatra). The purpose of this programme among others are to empower the community including women, to prevent the degradation of coastal vegetation that also functions as carbon sequestration. This is also conducted to develop economic potential such as ecotourism, coconut charcoal production for coastal area to prevent the used of mangrove as source of energy. For example the mangrove planting in Ulujami regency (Pemalang District), that also supports soft shell crabs farming.
- Formulation on draft Guidance for Water Conservation (absorption well and water reservoir) and National Water Saver Partnership Movement.
- Coral reef management has been conducted by transplantation method such as in Sabang waters. Coral transplantation is a method by transplantation and cutting of live colony of coral reef to be moved or planted in other places, for the purpose of accelerating the regeneration of the damage coral reef.
- Breakwaters are used to reduce erosion in coastal areas such as implemented in Tanah Lot by using Tetrapod model. However, not all sites can use the same model, because the technology used in one location is dependent on the pattern of local currents and waves.
- The APEC Marine and Fisheries Ministerial Meeting in Bali in September 2005 adopted the "Bali Plan of Action". This document is a reference for Asia-Pacific countries in marine resource sustainable management to anticipate the impact of climate change to national development.<sup>27</sup>
- In September 2007 in the APEC Summit at Sydney, Australia, the 21 leaders of the APEC members supported the marine initiative proposed by Indonesia, namely "Coral Triangle Initiative" (CTI). The Indonesian proposal was submit

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<sup>26</sup> UNDP Indonesia, 2007

<sup>27</sup> Indonesia, 2007a

together with 5 other countries, which are Malaysia, Philippines, Papua New Guinea, Timor Leste and Solomon Islands. One of the main agenda of the CTI programme is the mitigation and adaptation of the climate change impact at the regional level through conservation and preservation of 75,000 km<sup>2</sup> coral reef in the six countries (CT-6).

- For “*semi-enclosed water*”, according to United Nations Convention on the Law of the Seas 1982 (UNCLOS-1982) paragraph 122-123, the “Arafura and Timor Seas Expert Forum” (ATSEF) programme supports cooperation between Indonesia, Australia and Timor Leste for protection of the ecosystem and marine conservation in the Arafura and Timor Seas. Likewise in the northern Indonesian waters, cooperation with Malaysia has been initiated for marine conservation through the Sulu-Sulawesi Marine Eco-region (SSME) programme.<sup>28</sup>

## ENERGY

- Climate change actions related to energy are primarily the responsibility of the Department Energy and Mineral Resources, Ministry of Environment, Department of Finance, and Local Government.<sup>29</sup>
- Gradual removal of energy market distortions, such as fuel and electricity subsidies.
- Promote use and development of renewable energy, through incentives such as tax breaks for investors on the technology, encouraging research and so on.
- Encourage public adoption of energy conservation & efficiency, by adopting techniques such as public campaigns, while at the same time using economic incentives to further promote energy efficiency products and energy conservation practices.
- Promote clean and efficient energy use for industry and commercial sectors. Various technologies, for example, clean production, are available to help the industry and commercial sectors become more efficient. Such technologies will be promoted by the government.
- Restructure the price for various energy sources according to the emission and externalities that the energy source emits.<sup>30</sup>

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<sup>28</sup> Indonesia, 2007a

<sup>29</sup> Indonesia, 2007a

<sup>30</sup> Indonesia, 1994

- Energy Diversification:<sup>31</sup>
  - Mapping the potential, research and development on new energy and renewable energy that appropriate with Indonesian characteristics.
  - Giving incentive to the development and utilisation of new energy and renewable energy.
  - Encourage for more reasonable price (commodities, technology and fuel) by calculating and include the social costs and environmental costs (internalising the external cost) in the production cost and/or the selling price of that product and technology. For example, Nordhaus (2007) proposes an amount of carbon tax of 30 USD per tonne emission of CO<sub>2</sub>.
  - Increase the local role in renewable energy development.
  - Encourage economic growth based on low pollution energy growth by increasing new energy and renewable energy utilisation, with eradication of fossil fuel subsidies gradually in stages.
  - Conduct a decentralised energy system, among others through island space grid systems where the generation system, transmission and distribution of electric power is not totally centralised, but it is arranged based on network per island with the utilisation of existing local grid systems. The decentralised energy generation should use local new energy and renewable energy.
  - Build more infrastructure for low emission technology.
  
- Energy Conservation:<sup>32</sup>
  - Dissemination of Information about energy conservation to the energy consumers.
  - Incentives and disincentives through financial mechanisms.
  - Regulation to implement energy conservation to all user sectors and implement saving energy standards.
  - Reduce energy intensity, amongst others, with implementation of carbon labelling in the production of industry.
  - Utilise science and technology to develop light weight, functional, efficient and good quality products.
  - Formulate and implement energy saving building standards.

*Examples*

- Act No. 17/2006 concerning the change on Act No.10/1055 regarding custom regulations that give free or reduced import tax for clean technology equipment
  
- Act No.30/2007 concerning Energy.

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<sup>31</sup> Indonesia, 2007a

<sup>32</sup> Indonesia, 2007a

- Presidential Instruction No. 10/2005 concerning Energy Saving.
- Presidential Instruction No. 1/2006 concerning Supply and Application of Biofuel as alternative fuel.
- Presidential regulation No. 5/2006 concerning National Energy Policy.
- Department of Energy and Mineral Resource Ministerial Regulation No. 1122K/30/MEM/2002 regarding Small Scale Power Plants using renewable energy.
- Department of Energy and Mineral Resource Ministerial Regulation No. 0002/2004 regarding policies on renewable energy development and energy conservation (green energy development).
- Department of Energy and Mineral Resource Ministerial Regulation No. 0031/2005 about guidance for the implementation of Energy Saving.
- Department of Energy and Mineral Resource Ministerial Regulation No. 002/2006 regarding Medium Scale Power Plants with renewable energy.
- Monitoring of Air Pollution emissions from industry sector that has been conducted by State Ministry of Environment through Company Performance Evaluation Programme (PROPER) and the transportation sector through Blue Sky programme on motor vehicle emission test.
- Rural Energy Self Sufficient Programme for electric energy sources such as at Subang by using hydro power. Until 2006, almost all cities/districts in South Sulawesi have built more than 3000 units of solar energy power plant.
- Implementation of Cleaner Production Programme (CPEE/Cleaner Production) and Energy Efficiency for energy intensive industry such as cement, steel, fertiliser, pulp and paper, textile, power plant etc.
- Regulate and Ban the import of environmentally unfriendly goods.
- State Ministry of Environment Minister Regulation No.7/2007 regarding static source emission standard for boiler.<sup>33</sup>

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<sup>33</sup> Indonesia, 2007a

## HEALTH

- Climate change actions related to public health are primarily the responsibility of the Department of Health, Ministry of Environment, and Local Government.<sup>34</sup>
- Communities need to establish the zones that are at highest risk of flooding and landslide and make plans for early warning systems for evacuation.
- Strengthening existing systems for primary and curative health care.
- Expanding health awareness campaigns to encourage people to pay more attention to hygiene and the storage of water.
- Combating the spread of disease will need closer surveillance of disease patterns. In floods, this will include monitoring for cholera. Over the longer term, it will mean monitoring the changing distribution of mosquito-borne diseases while ensuring that households are able to protect themselves, such as through the use of insecticide-treated mosquito nets.
- For preventing the immediate physical impact of disasters, in some cases, the risks can be reduced by reforestation.<sup>35</sup>

## EDUCATION

- Climate change actions related to education are primarily the responsibility of the Department of National Education, Ministry of Environment, Department of Communication and Information, and Local Government.
- Increase the awareness and dissemination of climate change information and adaptation information to various levels of communities, particularly vulnerable communities as early preparedness and increasing the awareness regarding the increasing of climate disaster.
- Development of climate change issue into senior high school and universities curriculum.<sup>36</sup>

### *Examples*

- Plans to establish climate field schools in 25 provinces (150 districts/cities) to increase farmers' understanding of climate information and its application. A climate field school has been established in Indramayu since 2003. The establishment of the Climate Field School is a cooperation between Department of Agriculture, Meteorological and Geophysics Agency, local government and Institute Pertanian Bogor (IPB) with funding from National

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<sup>34</sup> Indonesia, 2007a

<sup>35</sup> UNDP Indonesia, 2007

<sup>36</sup> Indonesia, 2007a

Oceanic and Atmospheric Administration.

- To encourage CDM project activities in Indonesia, CDM training activities have been conducted for key stakeholders, which are relevant government agencies, local government, communities, private sector, legislative, association, heads of companies, universities. These activities have been conducted in five regions, namely Sumatra, Java, Kalimantan, SUMAPAPUA (Sulawesi, Maluku and Papua, as well as Bali and Nusa Tenggara).<sup>37</sup>

## **CAPACITY DEVELOPMENT ON SCIENCE AND TECHNOLOGY, INCLUDING SPATIAL PLANNING**

- Climate change actions related to science and technology are involving a variety of national departments, including the National Planning Development Agency, and National Coordination Body for Survey and Mapping.
- Improve the capacity of scientific study concerning climate change and its impact, as well as the effort to control it and develop climate change projection model of short, medium and long term period for local or regional scale, which is needed for evaluation of vulnerability and climate impact as well as formulation of adaptation plan and policy strategy to address short, medium and long term climate change.
- Development of weather, climate and hydrology monitoring, particularly outside Java, and increase Meteorological and Geophysical Agency capacity for more accurate weather and climate forecasting throughout Indonesia.
- Development of resilient and perceptive infrastructure systems and spatial plans, as well as sectors, to the climate disturbance and climate change and rearrange regional spatial plans, especially in coastal areas.<sup>38</sup>
- Continuation of cooperation in research and development on climate change science, economics and policy with other countries.<sup>39</sup>
  - The shift of the negotiation from scientific to economics creates a need to analyse the macro- and micro-economic studies on the impacts of climate change, the adaptation and mitigation measures, on the Indonesian economy. Capacity to manage more advanced research - micro and macro levels- will be improved. The result of the studies will be utilised to determine Indonesia's position in international negotiation. The fields that need research and development cooperation will need to be explored further to include potential adaptation and mitigation measures. Therefore, the cooperation for Research and development should be limited to the technical research

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<sup>37</sup> Indonesia, 2007a

<sup>38</sup> Indonesia, 2007a

<sup>39</sup> Indonesia, 1994

but also development of technologies, mechanisms, strategies, and policy to cope with climate change.

- Initiation of research and development on new and renewable energy.
- Initiation of south-south cooperation for research and development.<sup>40</sup>
  - South-south cooperation globally, or regionally in Southeast Asia, on climate change adaptation and mitigation measures will be enhanced. This cooperation will aim at exchanging information on the impacts of climate change mitigation and adaptation policies on developing country economies, and to evaluate the existing technological standards. The South-south cooperation will include international workshops and joint efforts for key G-77 countries to reach their economic and development goals yet take actions to adapt and mitigate Climate Change on their respective countries.
- Development of coastal spatial planning and/or evaluation of existing coastal spatial planning by inclusion of:<sup>41</sup>
  - construction of coastal protection systems and flood control;
  - preparation of emergency plans for relocation in case of the occurrence of sea level rise;
  - conservation of groundwater and increase of efficiency of surface water;
  - development of early warning systems for hydro and metrological disasters;
  - protection of marine and coastal resources.
- Use of spatial planning to investigate:
  - temperature warming;
  - precipitation change;
  - investigate intensified extreme events; and
  - sea level rises.
- Use of spatial planning to show:
  - risks from climate change on population;
  - risks from climate change on natural resources;
  - risks from climate change on infrastructure and property;
  - temperatures in urban areas/islands.
  - aridity and forest fires.
  - beach and structure abrasion.
  - sea water inundations.
  - damage to properties from coastal flooding.

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<sup>40</sup> Indonesia, 1994

<sup>41</sup> Indonesia, 2007b

- Use of spatial planning for:<sup>42</sup>
  - zoning regulation implementation;
  - promotion of green open space in the urban areas;
  - relocation of people from high risk zones;
  - public awareness;
  - natural disaster management;
  - planning revetments, breakwaters, groins, floodgates, tidal barriers, beach/wetland nourishment and dune restoration.
  
- During the period of 2009-2012 it is expected that the implementation of the regulations concerning mining, agriculture and regional development will have been harmonised based on spatial plan criteria. Besides goals regarding the protection of fauna, flora and ecosystems, these also aim to prevent environmental disasters, such as floods, land slides or other impacts.<sup>43</sup>

### *Examples*

- Government Regulation N0. 47/1997 regarding National Spatial Plan and Act 27/2007 regarding Spatial Plan.
  
- Ministry of Environment has conducted an inventory and mapping of peat characteristics. This information has been presented by State Ministry of Environment to the related local government and institutions for spatial planning formulation and permit requirement.<sup>44</sup>

### **CAPACITY DEVELOPMENT ON DISASTER IMPACT MANAGEMENT**

- Climate change actions related to science and technology are involving a variety of national departments, including the National Education, Ministry of Environment, Department of Communication and Information, National Planning Development Agency, and National Coordination Body for Survey and Mapping.<sup>45</sup>
  
- Disaster management to reduce risks and prepare for disasters before they happen.<sup>46</sup> For example:<sup>47</sup>
  - early warning system.
  - public campaign on disaster preparedness.
  - flood and landslides risk maps.
  - disaster preparedness drill.
  - rehabilitation of existing flood control structures.

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<sup>42</sup> Indonesia, 2007b

<sup>43</sup> Indonesia, 2007a

<sup>44</sup> Indonesia, 2007a

<sup>45</sup> Indonesia, 2007a

<sup>46</sup> UNDP Indonesia, 2007

<sup>47</sup> Indonesia, 2007b

- The Government has passed new legislation on National Disaster Management (Risk Reduction) which should encourage communities to invest in their own safety by reducing the risk of disaster damage. The Government also initiated an intergovernmental public-private dialogue on a National Action Plan for Disaster Risk Education. Some local governments are moving even faster: those in Yogyakarta, Central Java and Maluku, for example, have leapt ahead, preparing their own Local Action Plans for Disaster Risk.
- The challenge now is to build the capacity necessary for local governments to implement these plans and strategies, and most importantly, to empower communities to take matters in their own hands to ensure that everyone in Indonesia lives within a 'culture of safety'.<sup>48</sup>

### *Examples*

- The United Nations Development Programme (UNDP), with funding from the United Kingdom's Department for International Development (DFID), is helping bring international experiences and expertise to Indonesia through a new programme called 'Safer Communities for Disaster Risk Reduction in Development'. Implemented by Indonesia's National Development Planning Agency (BAPPENAS), the programme will help strengthen and expand the growing regulatory and policy environment for disaster risk reduction actions by individuals, businesses, local governments and national government agencies. It will also help build partnerships to support decentralised decision-making while at the same time developing education and public awareness programmes. Most importantly, the programme will provide local government and communities with opportunities to implement a range innovative disaster risk reduction demonstration project throughout the county. These demonstrations will include:<sup>49</sup>
  - carrying out community-based risk assessments and risk reduction programmes;
  - teaching masons how to build flood-resistant houses;
  - developing and implementing local building regulations;
  - introducing credit programmes for people who want to strengthen their houses;
  - supporting people who want to move away from flood-prone areas;
  - helping communities prepare for disasters and plan for evacuation; and
  - reviving and capitalising on traditional wisdom, knowledge and practices.

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<sup>48</sup> UNDP Indonesia, 2007

<sup>49</sup> UNDP Indonesia, 2007

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