



Population Dynamics and Climate Change in Indonesia: Mobilizing for a Sustainable Future

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UNFPA, the United Nations Population Fund is an international development agency that promotes the right of every woman, man and child to enjoy a life of health and equal opportunity. UNFPA supports countries in using population data for policies and programmes to reduce poverty, and to ensure that every pregnancy is wanted, every birth is safe, every young person is free of HIV/AIDS, and every girl and woman is treated with dignity and respect.

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Population Dynamics and Climate Change in Indonesia: Mobilizing for a Sustainable Future

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September 2011

Preface

The eight UNFPA Country Programme cycle (2011-2015) in Indonesia has identified a strategy to address emerging population issues as part of priorities in the core programme area of Population and Development. Discussions with our national partners have identified population dynamics and climate change, urbanization and population ageing as the key emerging issues to be addressed in the context of the new country programme.

While some policy research have been done by national partners in Indonesia in the areas of urbanization and population ageing, very little, if any, has been done in the area of population dynamics and climate change. Much of this is due to the fact that the linkages have not been adequately addressed in the international and national policy and research agenda. It is however becoming clear, from research done in other countries, that mitigation and adaptation strategies have links to issues related to population dynamics. UNFPA, at the global level, has been working with partners to provide empirical evidence to enrich and contribute to a more comprehensive approach to climate change mitigation and adaptation.

Indonesia has taken a leadership role in the global arena related to climate change and sustainable development issues. We are confident that this leadership role will include the importance of population dynamics in climate change and we will work closely with our national partners to provide technical assistance and support to national capacity building in this newly emerging area.

We are grateful that Professor Adrian Hayes from the Australian National University has provided this initial technical support through the publication of this report that summarizes the state of the art in Indonesia on population dynamics and climate change issues. We are also grateful

for the support of our colleagues from Headquarters, particularly Mr. Jose Miguel Guzman, Chief of the Population and Development Branch of the Technical Division. We look forward working with our national partners to implement the recommendations that came out of the first Round Table Meeting on Population Dynamics and Climate Change which took place in Bogor, Indonesia on 10-11 August 2011.

Jose Ferraris

UNFPA Representative in Indonesia

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I thank José Ferraris at UNFPA for inviting me to prepare the report, and for his guidance and encouragement; and I thank his staff for their consistent support.

I also thank all the participants at the Roundtable Discussion on “Population Dynamics and Climate Change” held in Bogor, 10-11 August, sponsored by BKKBN and UNFPA. And thanks to Eddy Hasmi, Terry Hull and Tony McMichael for their comments on an earlier draft of this report.

Finally I want to acknowledge the Australian Research Council and the Australian National University, since some of the analysis presented here draws on as yet unpublished findings from research I am undertaking with support from an ARC Discovery Grant awarded to Terry Hull, Zhongwei Zhao, and myself.

The views expressed in this report are, unless otherwise stated, my own, and do not necessarily reflect those of UNFPA, or of any other stakeholder.

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I | Introduction

The Government of Indonesia has for several years been developing a national strategy to respond to climate change, and the UN has been partnering with the Government within the United Nations Framework Convention for Climate Change (UNFCCC). The Ministry of Environment (KLH), in consultation with relevant line ministries and agencies, produced the ***National Action Plan Addressing Climate Change*** in November 2007. In July 2008 the President established the National Council on Climate Change (DNPI) to help direct and coordinate the Government's response to climate change, with himself as Chair and the Minister of Environment as Executive Chair. In December 2009 the National Development Planning Agency (Bappenas), following another extensive consultation process, produced the ***Indonesia Climate Change Sectoral Roadmap*** (ICCSR), which was then incorporated in the Government's current 5-Year Development Plan (RPJMN 2010-14).

The work done to date under the leadership of President Susilo Bambang Yudhoyono on developing a national response to climate change is impressive. Indeed Indonesia is recognized internationally as a leader in this field, especially since its exemplary hosting of the 13th Conference of the Parties (COP) to the United Nations Framework Convention on

Climate Change (UNFCCC) in Bali in 2007. At the G-20 meeting in Pittsburgh in 2009 President Yudhoyono announced an ambitious target to reduce Indonesia's carbon emissions by 26 percent by 2020 (compared to a "business as usual" (BAU) scenario), and as much as 41 percent if additional international support for this purpose is forthcoming. The President re-affirmed these commitments at the COP 15 in Copenhagen in December 2009. Most of the achievements to date, however, have been preparatory. The hard work of designing detailed action plans and implementing them is still to come. In particular more analysis is needed to ensure the Government's response to climate change takes into account all the relevant key factors.

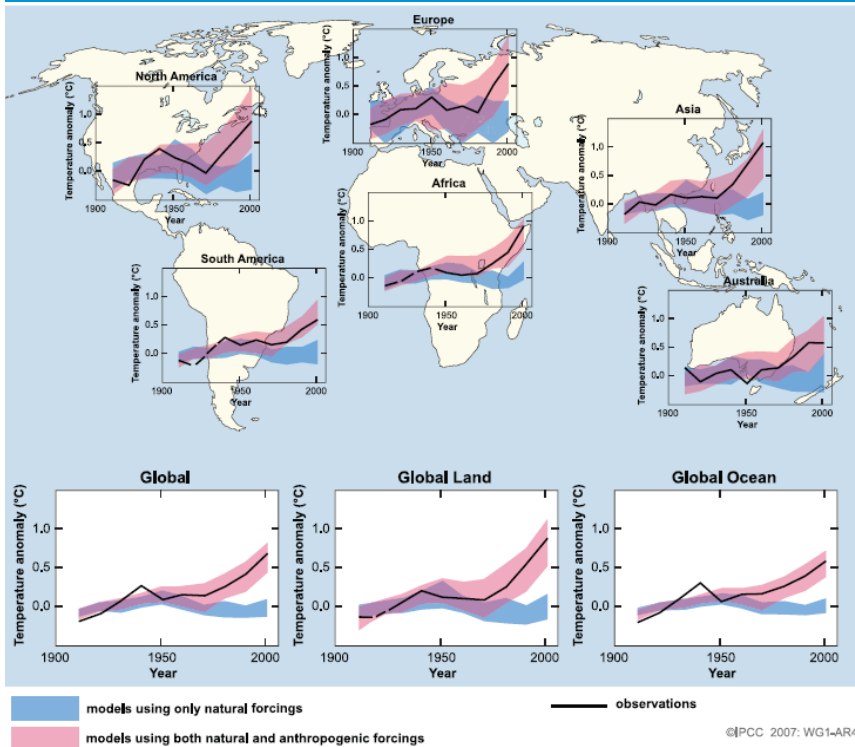
The main argument of this report is that Indonesia's national response to climate change can be strengthened significantly if more attention is paid to the role of population dynamics. The issues in developing a successful strategy involve not only changes in earth systems, but also changes in human systems. The goal is to identify ways in which population dynamics can be taken into account in Indonesia's climate change adaptation and mitigation strategies so as to improve their effectiveness and thereby contribute to overall sustainability.

I.1

Global Warming, GHG Emissions and Human Activity

By way of background we introduce some points from the work of the Intergovernmental Panel on Climate Change (IPCC). This will help situate the subsequent discussion about Indonesia within the global debate; the IPCC also contributes much to the analytical approach needed for an individual country study.

Figure 1. Global and Continental Temperature Change, 1900-2000



Source: Solomon et al. (2007b: 61).

Notes: This figure, taken from the Report of Working Group I to the IPCC 4th Assessment, compares observed continental- and global-scale changes in surface temperatures with results simulated by climate models using natural and anthropogenic radiative forcings. Decadal averages of observations are shown for the period 1906 to 2005 (black line) plotted against the centre of the decade and relative to the corresponding average for 1901 to 1950. Lines are dashed where spatial coverage is less than 50%. Blue shaded bands show the 5% to 95% range for 19 simulations from 5 climate models using only the natural forcings due to solar activity and volcanoes. Red shaded bands show the 5% to 95% range for 58 simulations from 14 climate models using both natural and anthropogenic forcings. More information on data sources and the models used can be found in Solomon et al. (2007a).

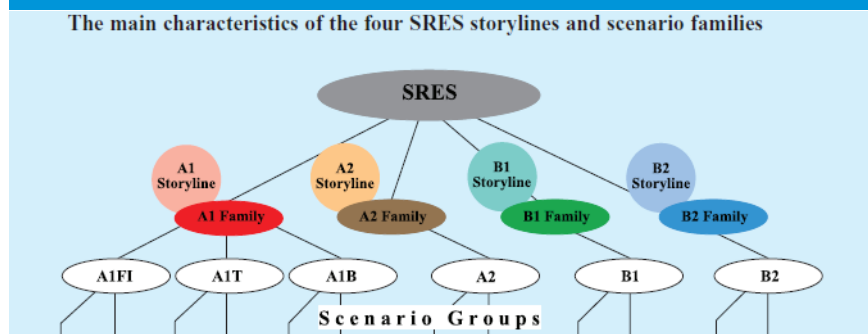
The IPCC's Fourth Assessment, published in 2007, argues that the evidence for global warming is now “unequivocal,” and that it is “very likely” that most of the observed increase in global warming – at least since the mid-20th century – is due to human activity, that is, to the observed increase in anthropogenic atmospheric greenhouse gas (GHG) concentrations (Figure 1). It follows that future trends in climate change will depend heavily on future trends in human activity. Most climate change research to date has involved natural scientists. At issue now is how to improve our scientific understanding of the links between human activity and GHG emissions. This will require more involvement by social scientists.

I.1.1 The SRES scenarios

The IPCC developed a number of emissions scenarios to explore the range of emissions (and subsequent climate change) which might result from different development paths during the present century assuming no deliberate actions are taken to avoid climate change by reducing emissions. The latest set was published in 2000 as *The Special Report on Emissions Scenarios* (SRES) (Nakićenović et al.). Future GHG (and sulfur) emissions¹ are regarded as “the product of very complex dynamic systems, determined by driving forces such as demographic development, socio-economic development, and technological change” (Nakićenović et al. 2000b: 3). Since no one knows how these drivers will evolve in the future the scenarios are developed “as alternative images of how the future might unfold”; they are used “to analyse how driving forces may influence future emission outcomes and to assess the associated uncertainties.”

¹ The complete list of anthropogenic GHG and sulfur emissions included in SRES is: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), hydrochlorofluorocarbons (HCFCs), chlorofluorocarbons (CFCs), the aerosol precursor and the chemically active gases sulfur dioxide (SO₂), carbon monoxide (CO), nitrogen oxides (NO_x), and no-methane volatile organic compounds (NMVOCs). The emissions are provided aggregated into 4 world regions. No feedback effects of future climate changes on emissions are assumed (Nakićenović et al. 2000b: 3).

Figure 2. Schematic Representation of SRES Scenarios



Source: Nakićenović et al. (2000b: 4).

Notes: There are 4 scenario “families” (one for each qualitative storyline); and 6 scenario “groups” (since the A1 family is divided into 3 groups).

Four different qualitative “narrative storylines” were developed to describe four broad paths along which the key drivers might develop over the present century (Figure 2). Each storyline represents different combinations over time of demographic, social- economic, and technological changes; the combination of drivers is internally consistent within each storyline. For each storyline several different scenarios were developed using different modeling approaches to examine the full range of emission outcomes resulting from different models using similar assumptions about the underlying drivers. In fact six models were used, chosen as representative of the best in the literature, and SRES used 6 modeling teams to produce a total of 40 scenarios: the A1 family has 17 scenarios, the A2 has 6, B1 has 9, and B2 has 8; the A1 family is divided into 3 groups, making the total number of scenario groups 6. The SRES team selected an “illustrative marker scenario” for each group (Nakićenović et al. 2000b: 3-6).

The A1 storyline and scenario family “describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions,

capacity building, and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1FI), non-fossil energy sources (A1T), or a balance across all sources (A1B).

“The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across the regions converge very slowly, which results in continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines.

“The B1 storyline and scenario family describes a convergent world with the same global population that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid changes in economic structures toward a service and information economy, with reductions in material intensity, and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social, and environmental sustainability, improved equity, but without additional climate initiatives.

“The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social, and environmental sustainability. It is a world with continuously increasing global population at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented toward environmental protection and social equity, it focuses on local and regional levels” (Nakićenović et al. 2000b:4-5).

The SRES scenarios provide a useful tool for considering how human activity can determine future levels of GHG emissions, and consequently the course of future climate change. Human activity is conceptualized in terms of three broad categories: population, social-economic development, and technology. The IPCC scientists do not make it explicit, but from a social science point of view all three categories can be seen as associated with, and interrelated by, institutional structures – the “rules of the game” by which a society lives. The SRES scenarios show us how future emissions can be expected to vary depending on the development path taken (or the rules of the game followed) by global society.

Figure 3a. Global CO₂ Emissions related to Energy and Industry, 1900-2100

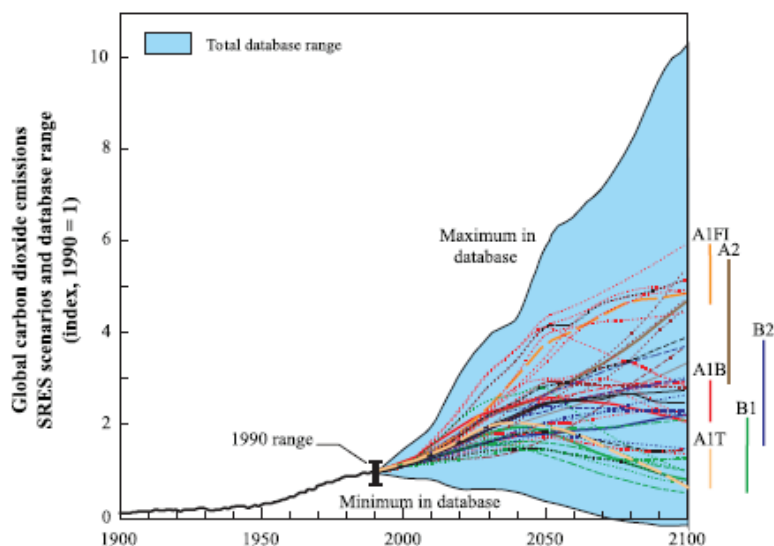
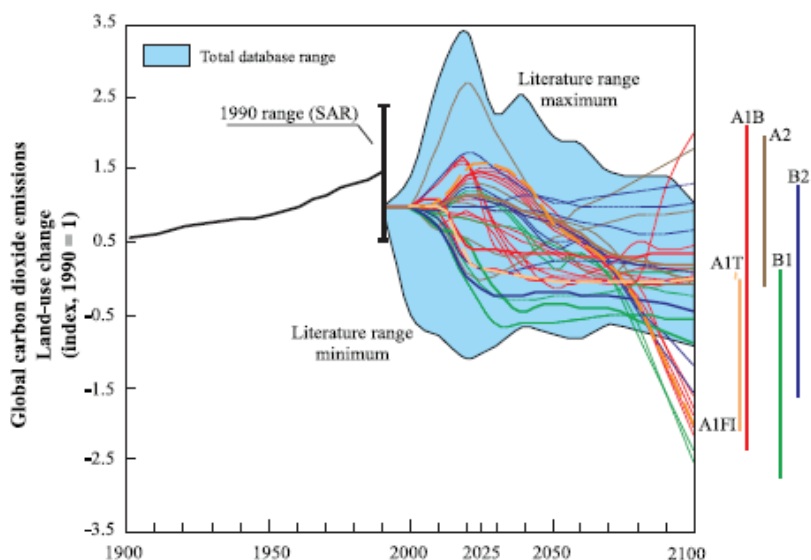


Figure 3b. Global CO₂ Emissions related to Land-use Change, 1900-2100



Source: Nakićenović et al. (2000b: 7).

Notes: The dashed time-paths depict individual SRES scenarios and the area shaded in blue represents the range of scenarios from the literature as documented in the SRES database. The coloured vertical bars on the right-hand side indicate the range of emissions in 2100.

Figure 3a illustrates the value of these scenarios.² It shows, for example, that if global development follows the A1FI path then annual emissions from fossil fuels can be expected to reach 5 or 6 times their 1990 level by 2100. Alternatively, if the A1T path is followed, emissions will double before mid-century, and then fall back to around their 1990 level by 2100. The B1 family of scenarios results in similarly low emission outcomes by the end of the century. Of the 40 scenarios, only a handful from among the A1T and B1 groups are likely to result in annual emissions in 2100 at or below 1990 levels.

² Although admittedly this graph (taken from a SRES report) is not easy to read! For an alternative presentation plotting emissions against SRES scenarios using IIASA's MESSAGE climate model (i.e. just 1 of the 6 modeling approaches used by SRES), see Jiang and Hardee (2009: 8).

Figure 3b shows how emissions from deforestation and land-use change can be expected to change under different development paths. Most experts argue that since the total area of forest in the world is limited current rates of deforestation cannot be sustained indefinitely and are likely to slow well before the end of the present century. Figure 4 contains more scenarios which result in emissions significantly below 1990 levels than Figure 3, although the significance of many of these projections, given they are outside the “literature range,” needs to be clarified.³

It is important to note that the SRES team developed these scenarios as consistent and possible images of the future, based on the relevant research literature: there is no attempt to estimate the likelihood of any of them actually occurring. It is also important to note that all 40 scenarios are constructed on the assumption that no policy interventions explicitly designed to mitigate climate change are introduced, although the continued introduction of other policies, for example clean-air policies, which to some extent have this effect (although their primary aim is elsewhere) are included in the modeling. Thus for analytical purposes each scenario represents an equally plausible image of future emissions under “business as usual.”

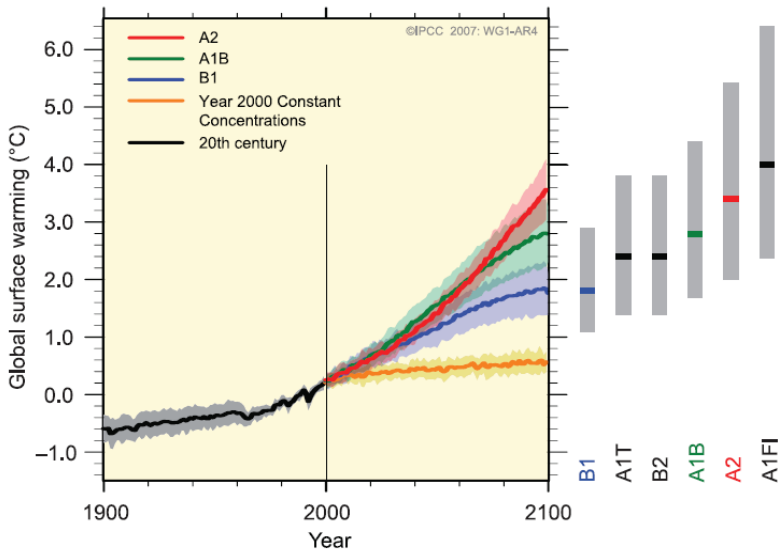
After the SRES team estimated the emissions associated with the different scenarios the climate scientists then translated the cumulative emissions into radiative forcings, and finally (using climate models) into projected climate changes. Figure 4 shows estimated average surface temperature change during 2000-2100 for each scenario group. Of the 6 SRES marker scenarios only B1 results in a best estimate of average global surface warming by 2100 within the 2°C threshold (relative to global surface temperature circa 1990); the best estimates for the other 5 all exceed the 2 degree limit agreed to in Copenhagen.

Research findings which have been published since the IPCC 4th Assessment suggest the climate system may be changing faster than earlier thought likely; the rate of accumulation of CO₂ appears to be tracking at (or even

3 Estimates of emissions from deforestation and changes in land use are far less precise than those for emissions from fossil fuels.

slightly higher than) than the A1FI marker scenario in Figure 4 (Steffen 2009). Possible explanations lie with feedback mechanisms in the climate system on the one hand, and the fact that China, and to some extent India, Indonesia and Brazil, are showing higher rates of economic growth than considered likely when the SRES scenarios were developed.

Figure 4. Multi-Model Averages and Assessed and Assessed Ranges for Surface Warming



Source: IPCC 2007a: 41.

Notes: In this figure, taken from the Report of Working Group I to the IPCC 4th Assessment, the solid lines are multi-model averages of surface warming (relative to 1980-1999) for the scenarios A2, A1B and B1, shown as continuations of the 20th century simulations. Shading denotes the ± 1 standard deviation range of individual model annual averages. The orange line is for the experiment where concentrations are held constant at year 2000 values. The grey bars on the right-hand side indicate the best estimate (solid line within each bar) and the likely range assessed for the 6 SRES marker scenarios.

I.1.2

Population dynamics and other climate change drivers

How do population dynamics enter into the work of the IPCC and the SRES scenarios? The well-known “IPAT identity”⁴ is acknowledged in SRES as an important starting point in organizing the discussion of drivers of GHG emissions, and population projections are described as “among the most commonly cited indicators of the future state of the world” and “arguably the backbone of GHG emissions scenarios” (Nakićenović et al. 2000a: section 3.2.1). The specification of IPAT most appropriate to an analysis of emissions is often called the “Kaya identity”:

$$\text{CO}_2 \text{ emissions} = \text{Population} \times (\text{GDP/Population}) \times (\text{Energy/GDP}) \times (\text{CO}_2/\text{Energy})$$

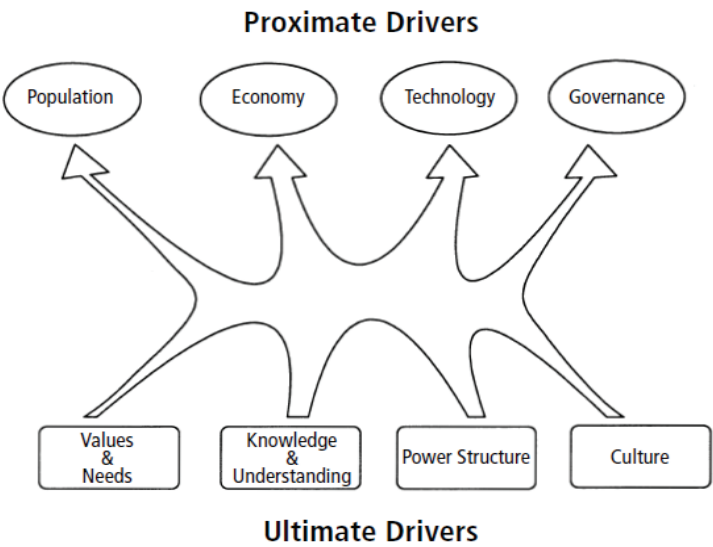
The technology driver in this formulation is broken down into a measure of how much energy the technology uses to produce each unit of affluence (GDP), and a measure of how much emissions are released by the technology in the production and consumption of each unit of energy.

The main limitation when this conceptualization is applied to the development of emissions scenarios – as it is in SRES – is that it only allows analysis of the effects of population dynamics on emissions to the extent that those dynamics affect population size and the population growth rate. There is a growing body of research showing the independent effects of other aspects of population dynamics on emissions rates (Jiang and Hardee 2009), especially household size (Mackellar et al. 1995), population aging, and urbanization (Parikh and Shukla 1995). The SRES team was aware of these new research efforts but the results could not

4 This identity asserts that *Impact* (on environment) is equal to *Population* size times *Affluence* (usually measured as GDP per capita) times *Technology* (environmental impact of the technology used to produce per unit of GDP), and derives from the early work of Ehrlich and Holdren (1971) on assessing the environmental impact of population growth.

readily be integrated into the existing modeling approaches. The IPCC is currently working on a new generation of scenarios (Moss et al. 2010) which will hopefully be open to a more discriminating treatment of population dynamics and emissions.

Much recent discussion about the political response to climate change addresses issues of governance. It is interesting that one of the leading authors and editors of SRES, Nebojša Nakićenović, included “governance” among the proximate drivers of climate change in a 2010 presentation (Nakićenović 2010. See Figure 5 below). Issues of power and authority are central to understanding and responding to climate change; whether they can be quantified and incorporated in the development of scenarios remains to be seen.⁵



Source: Raskin et al. (2002: 50); used in Nakićenović (2010).

5 See World Bank (2009) for an important attempt at measuring governance.

Aims of this Report

As already indicated the main goal of this report is to identify ways in which population dynamics can be taken into account in Indonesia's climate change adaptation and mitigation strategies so as to improve their effectiveness and thereby contribute to overall sustainability. Specific objectives include:

- an analysis of current trends in Indonesia relating population dynamics and climate change;
- an assessment of these trends relative to the country's values and development goals;
- a list of recommended activities to be considered, by the GOI-UN partnership, for their potential to bring about a more effective and synergistic use of population factors in the country's responses to climate change.

It is hoped that in meeting these objectives the report will "make the case" that a project is needed addressing population dynamics and climate change in Indonesia.

The outline of the report is as follows. Part II summarizes what we know about GHG emissions trends in Indonesia and the likely impacts of climate change on the country's natural environment and human population. Part III reviews the Government's response to date to climate change. Part IV examines the relations between the country's population dynamics and its mitigation strategies. Part V looks at relationships between population dynamics and adaptation strategies. Part VI lists and explains some recommendations.

II | Climate Change in Indonesia

Section II.1 gives an overview of Indonesia's GHG emissions. Section II.2 describes the kinds of climate change impacts experts say we can expect in the country.

II.1

Trends in Indonesia's GHG Emissions

People are sometime surprised to learn that among the top GHG emitting nations of the world Indonesia may rank as high as number three. Most published "league tables" showing the different amounts of GHGs emitted by countries confine themselves to emissions from burning fossil fuels (and cement production). It is these emissions which are the main cause of the increase in anthropogenic atmospheric concentrations during the last 200 years, and most of these emissions to date have been contributed by the advanced industrialized nations. However for a few developing countries, like Indonesia and Brazil, emissions from deforestation and other land-use change far outweigh emissions from fossil fuels. Estimates of non-fossil fuel emissions (including from

agriculture and peat, as well as deforestation and land-use change) are far less certain than those for fossil fuels. This is especially true in the case of emissions from forest and peat fires where both the quantity and quality of combustion can vary considerably from time to time and place to place. Consequently if we combine estimates of fossil fuel (FF) emissions and estimates of non-FF emissions to provide an estimate of a country's total GHG emissions, the results are often unsatisfactory because of the vastly different levels of uncertainty associated with the different subtotals. Nonetheless the LULUCF and peat emissions cannot be ignored, especially for those countries like Indonesia where even if they cannot be measured precisely we know their magnitude is huge.

Table 1 presents the GOI's GHG inventory for the year 2000 as reported in the *Second National Communication under The United Nations Framework Convention on Climate Change* (MOE 2010). There are inconsistencies in the table, which perhaps belie the difficulties in constructing such an inventory.⁶

Table 1. GHG emissions estimates, Indonesia, 2000 (SNC under UNFCCC)

Source	CO ₂ Mt	CH ₄ Kt	N ₂ O Kt	CO Kt	NO _x Kt
1 Energy (without biomass)	247.52	1,436.89	10.45	n.e.	n.e.
Fuel combustion activity	240.88	455.51	10.40	n.e.	n.e.
Energy production	84.01	1.89	0.64	n.e.	n.e.
Manufacturing	63.03	7.39	1.10	n.e.	n.e.
Transportation	55.69	14.32	2.68	n.e.	n.e.
Commercial/institutional	3.32	2.14	0.03	n.e.	n.e.
Residential	23.88	428.26	5.86	n.e.	n.e.

6 The numbers in the CO₂ emissions column do not add up correctly: (i) Re totals in the CO₂ emissions column: The grand total obtained by adding the subtotals for items 1 through 7 is 1,701,237.36 GgCO₂, not 1,352,471.68 GgCO₂ as given as the total at the top of the column. (Even if we subtract 296,794.38 GgCO₂ for CO₂ removal – a value included in the source table in SNC – the total still does not equal the total as given in the table.) (ii) Re item 5, Land Use Change and Forestry: the three sub-subtotals given do not add up to the sub-total of 1,232,766.22 GtCO₂. (And why no entry for forest burning?) In addition the numbers given in the text of MOE (2010: II.3-4) do not always correspond to the statistics in the accompanying table.

Other	10.94	1.50	0.09	n.e.	n.e.
Fugitive emissions	6.64	981.38	0.05	n.e.	n.e.
2 Industrial processes	40.34	104.44	0.43	n.e.	n.e.
Mineral (incl. cement)	28.92	n.r.	n.r.	n.e.	n.e.
Chemical	9.94	9.54	n.r.	n.e.	n.e.
Metal	1.15	94.90	n.r.	n.e.	n.e.
Other	3.27	n.e.	n.r.	n.e.	n.e.
3 Solvent (& other product use)	n.e.	n.r.	n.e.	n.e.	n.e.
4 Agriculture	2.18	2,419.06	72.37	2,294.68	84.67
5 Land-use change & forestry	1,232.77	2.68	0.08	41.04	0.99
Changes in forest and other woody biomass stocks	--	n.r.	n.r.	n.r.	n.r.
Forest and grassland conversion	729.66	n.e.	n.e.	n.e.	n.e.
Abandonment of croplands, pastures, plantation forests, or other managed lands	--	n.r.	n.r.	n.r.	n.r.
CO2 emissions and removals from soils	216.31	n.r.	n.r.	n.r.	n.r.
Others					
Forest burning	--	2.68	0.08	41.04	0.99
Peat fire	172.00	n.e.	n.e.	n.e.	n.e.
6 Waste	1.66	7,293.52	8.07	n.e.	n.e.
7 Other	176.77	n.e.	n.e.	n.e.	n.e.
Total	1,352.47	11,256.59	91.42	2,335.71	85.66

Source: MOE (2010: II.4-5).

Notes: n.r. means no estimate is required for the cell under the UN guidelines provided for constructing the inventory. n.e. means no estimate has been reported. -- means the cell is empty in the original table, with no explanation.

Table 2 gives a somewhat different emissions profile, in this case for the year 2005, using estimates published by the DNPI (2010). These estimates are for total emissions (i.e. all the main GHGs combined) expressed as billions of tonnes of CO₂-equivalent (GtCO₂e); they are based on a “GHG abatement cost curve analysis” commissioned by the DNPI,

which in turn builds on the proprietary global GHG abatement database constructed by McKinsey and Company. The DNPI Executive Chair notes that the purpose of the exercise was “not to come up with the most nearly perfect estimates” but “to create a framework for analysis” (DNPI 2010: 2). The differences between the two profiles (aside from the specific measurement units employed) can be ascribed mainly to the different methodologies used to estimate subtotals for each source, and the different time periods over which available data has been averaged.

Table 2. GHG emissions estimates and BAU projections, Indonesia, 2005-2030 (DNPI)

Source	2005 MtCO ₂ e	2020 MtCO ₂ e	2030 MtCO ₂ e
Peat	772	902	972
Land use, land-use change, and forestry (LULUCF) (net emissions)	838	728	668
Agriculture	132	151	164
Power	110	369	810
Transportation	60	223	443
Petroleum and gas	122	135	137
Cement	26	51	86
Buildings	71	138	215
Total	2,131	2,697	3,495

Source: Data from DNPI (2010: 14-36).

Table 2 also includes emissions projections for 2020 and 2030 based on a single business-as-usual scenario for each sector.⁷ We draw on these projections in Part IV. In the subsections that follow we comment further, first on peat and LULUCF emissions, and then on FF emissions.

⁷ Details on the assumptions used for the projections in each sector are given in DNPI (2010).

II.1.1 Peat and LULUCF emissions

The lack of accurate data on CO₂ and other GHG emissions from LULUCF (Land Use, Land-Use Change and Forestry) means it is impossible to plot national trends in non-FF emissions with much reliability. There are new satellite data, however, which suggest that the rate of deforestation in Indonesia during 2000-2005 is significantly lower than the rate for the late 1990s (Leitman et al.: 23).

II.1.2 Fossil fuel emissions

To provide some international context, Table 3 gives estimates of CO₂ emissions (in thousands of tonnes of carbon⁸) from fossil fuels for the top 20 countries. Indonesia ranks 15 in terms of total national FF CO₂ emissions, but is nineteenth among those countries in terms of emissions per capita.⁹

- 8 CO₂ emissions are estimated differently by different authorities, and sometimes measured in metric tonnes of carbon (tC, as in Table 3), and sometimes in metric tonnes of carbon dioxide (tCO₂, as in Figures 6-8). We can convert from one scale to the other by applying the ratio of atomic weights: 1 tC = 3.67 tCO₂. Thus 108,302,000 tC for fossil fuel emissions in Indonesia in 2007 (Table 3, taken from CDIAC) converts to 397,468,000 tCO₂, which corresponds closely to the value of 385,400,000 tCO₂ given by IEA for 2008 (reflected in Figure 6).
- 9 We can see from this table how Indonesia shoots up the rankings if peat and LULUCF emissions are included in the calculations. If Indonesia's non-FF CO₂ emissions are 80% of total emissions (some estimates put the figure as high as 85%), then this means total CO₂ emissions must be around 541,510 KtC. This places Indonesia 3rd in the rankings: no other country in the list has a similarly large amounts of deforestation and peat which, when added to its FF emissions, could produce a higher figure for total CO₂ that would cause it to "overtake" Indonesia.

Table 3. List of countries by total fossil fuel CO₂ emissions, 2007

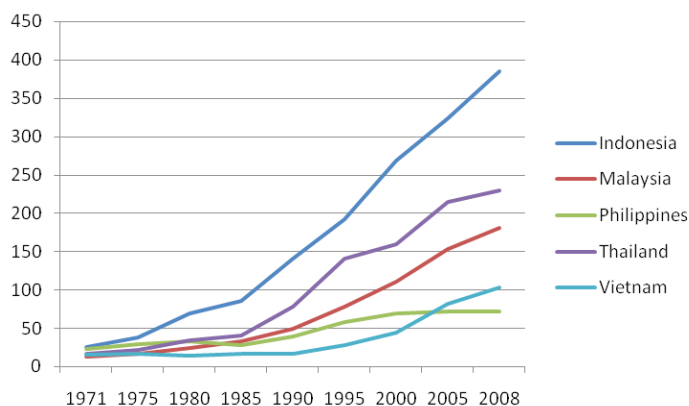
Rank	Country	Annual CO ₂ emissions KtC	Percent capita emissions tC
1	China (mainland)	1,783,029	1.35
2	USA	1,591,756	5.20
3	India	439,695	0.39
4	Russian Federation	419,241	2.95
5	Japan	342,117	2.71
6	Germany	214,872	2.61
7	Canada	151,988	4.61
8	UK	147,155	2.41
9	South Korea	137,257	2.82
10	Iran	135,257	1.88
11	Mexico	128,568	1.20
12	Italy	124,469	2.10
13	South Africa	118,224	2.44
14	Saudi Arabia	109,749	4.62
15	Indonesia	108,302	0.48
16	Australia	102,003	4.84
17	France	101,379	1.64
18	Brazil	100,441	0.52
19	Spain	97,971	2.18
20	Ukraine	86,593	1.87

Source: CDIAC.

Figure 6 shows the trend in Indonesia's fossil fuel emissions, compared to 4 other Southeast Asian countries. All the countries shown have increased their fossil fuel emissions dramatically during the last 40 years, with Indonesia's increase being the most dramatic of all – from 25.1 MtCO₂ in 1971 to 385.4 MtCO₂ in 2008, a more than 15-fold increase in 37 years – and the Philippines increase having leveled off during the last decade. The rise for Vietnam only dates from the 1990s.

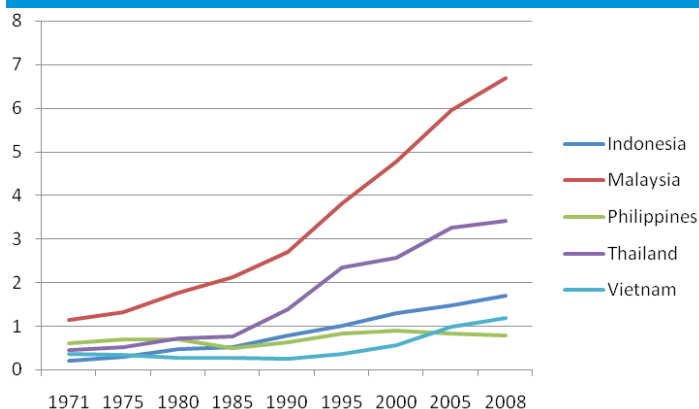
Figure 7 shows the increase in fossil fuel CO₂ emissions on a per capita basis. Although there is an increase in per capita emissions for all countries shown – again with plateauing in the case of the Philippines – the rise is far more pronounced for Malaysia and Thailand than it is for Indonesia. Per capita FF emissions for Indonesia increase from 0.21 tonnes of CO₂ in 1971 to 1.69 tonnes in 2008.

Figure 6. Fossil fuel CO₂ emissions (MtCO₂), Indonesia and selected SE Asian countries, 1971-2008



Source of data: IEA (2010: 46).

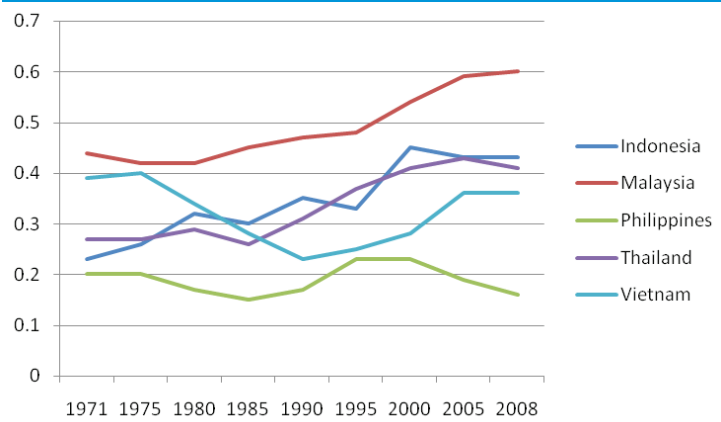
Figure 7. Fossil fuel CO₂ emissions per capita (tCO₂ per capita), Indonesia and selected SE Asian countries, 1971-2008



Source of data: IEA (2010: 97).

Figure 8 gives a measure of CO₂ pollution per unit of GDP. Here the picture is a little less regular, and the change in magnitude is never more than a doubling for any of the countries shown. The CO₂ FF emissions per US dollar of GDP (in 2000 prices) rises for Indonesia from 0.23 kilogrammes in 1971 to 0.43 kilogrammes in 2008.

Figure 8. Fossil fuel CO₂ emissions per unit of GDP (KgCO₂ per US dollar of GDP, using 2000 prices), Indonesia and selected SE Asian countries, 1971-2008



Source of data: IEA (2010: 94).

A variation of the equation presented in Section I.1.2 is:

$$\text{CO}_2 \text{ emissions} = \text{Population} \times (\text{GDP/Population}) \times (\text{CO}_2/\text{GDP})$$

Since population size and CO₂/GDP have both only approximately doubled during 1971-2008 the 15-fold increase in the country's total FF CO₂ emissions during this period must have a lot to do with a proportionally larger increase in GDP per capita (see Figure 11). In fact GDP per capita has increased more than fourfold, from \$890 in 1971 to \$3,930 in 2008 (in 2000 prices). Population growth, economic development, and technology are all driving the increase in FF emissions, but the one that no one wants to compromise – economic development – appears to be contributing the most. We explore these dynamics and their implications in more detail in Section IV.2.

Likely Impacts of Climate Change on Indonesia's Environment and Population

Climate change is already with us, and according to climate scientists much more is on the way. It is worth noting that there is a substantial time-lag between a rise in concentration of GHG in the atmosphere and the rise in temperature due to the associated increase in radiative forcing. Even if global GHG emissions could be miraculously stopped today, global warming would still continue for several decades because of momentum in the system. Today, we have not yet experienced all the global warming which will result from the unprecedented levels of GHG emissions of the last half century, let alone prepared for the additional warming which will result from future emissions. Some of the initial impacts of climate change are already apparent in Indonesia. The conclusion is inescapable: adaptation is now an urgent imperative.

We do not have perfect knowledge of how the climate will change in response to different emissions scenarios, or how this climate change will impact precisely on natural and human systems, but the relevant knowledge base is improving rapidly. The IPCC Fourth Assessment summarized the situation in Asia in broad brush strokes under 6 headings (Parry et al. 2007a: Chapter 10):

- Agriculture and food security
- Hydrology and water resources
- Coastal and low lying areas
- Natural ecosystems and biodiversity
- Human health
- Human dimensions.

Indonesian scientists and officials, together with their international collaborators, are working hard to provide more detailed understanding of climate change impacts in Indonesia. Much of the latest research is employed in the Government's *Second National Communication*

under the United Nations Framework Convention on Climate Change (MOE 2010). The GOI organizes its discussion of climate change impacts under 5 main headings:

- Agriculture
- Water resources
- Forestry
- Coastal and marine
- Health.

Weather stations in Indonesia have already registered a significant rise in maximum and minimum temperatures since 1980. Significant changes in rainfall patterns are also apparent. Climate in Indonesia is largely determined by the annual monsoons from the West, and the more irregular El Niño Southern Oscillation (ENSO) in the East. Changes have already been detected in both systems and climate modeling indicates more changes are likely in the future.

The onset of the monsoon has been increasingly delayed in many parts of Indonesia, especially in Java. The modeling used by the Ministry of Environment makes particular use of the SRES A2 and B1 scenarios. Overall the results suggest that under the A2 scenario “the wet seasonal rainfall [December-February] in Java, Bali, NTB, NTT and Papua will increase, while in other parts of Indonesia [it] will decrease. By 2050 and 2080, most of the Indonesian region will experience higher rainfall than under the current condition, with exceptions in the northern parts of Sumatra and Kalimantan. Furthermore, dry season rainfall [June-August] in most parts of Java might decrease by 2025, increase again by 2050, and then decrease by 2080, particularly in West Java and South Sumatra. Under low emission scenarios [i.e. B1], the pattern of change is similar to that of high emissions scenarios, but the magnitude of change is slightly lower” (MOE 2010: IV-4). Meanwhile the extremes of the ENSO are likely to become more pronounced, resulting in more serious droughts during El Niño years, especially in some eastern islands.

II.2.1 Agriculture

If the expected changes in climate eventuate they will have major impacts on agriculture. The delay in the onset of the monsoon decreases the cumulative cropping area during the wet season. This can be compensated to some extent by an increase in the cropping area during the dry season, but this is subject to a high risk of drought. The severity and frequency of long dry seasons are expected to increase. Changes in temperature and rainfall are expected on balance to impact rice and other food crops negatively, and also to have adverse effects, directly and indirectly, on dairy cattle production. Incursion of coastal farmlands due to sea level rise will also reduce agricultural production.

These impacts will affect the livelihoods of farmers locally, and at the national level have major implications for food security, especially since Indonesia's population is still growing. One possible solution under discussion is to cultivate more rice (and other crops) in the outer islands to compensate for loss of production in Java. To put this in a broader development perspective, however, the projections used by the Government suggest that the decrease in rice production due to climate change through to mid-century is still significantly less than the decrease due to conversion of agricultural land for non-climate reasons.

II.2.2 Water resources

Water supply in a river catchment area is a function of rainfall and forest cover; an increase in deforestation increases the fraction of rainwater that cannot be harvested. Projections used by the Ministry of Environment (taking into account growing demand, deforestation, and climate change) suggest that while today 14 percent of districts in Indonesia have no months with surplus water, under B1 scenarios this will increase to 18 percent by 2025 and 26 percent by 2050; under A2 scenarios it will increase to 21 percent by 2025 and 30 percent by 2050.¹⁰

¹⁰ These percentages are based on data given in MOE (2010: Table 4.6); the figures given in the text (on page IV-21) appear to be incorrect.

In short, the expected climate changes will contribute to more areas experiencing water scarcity problems. Possible solutions under discussion include more efficient use of water and the introduction of more inter-river basin technology (as used already in NTB).

II.2.3 Forestry

Changes in temperature and precipitation have consequences for forest growth but the expected impact of climate change that receives more attention in Indonesia is the effect of hotter and longer El Niño periods on forest fires, especially in Kalimantan and Sumatra. “During El Niño years 1991/92, 1994/95 and 1997/98 the dry season was extended and carbon emissions from fires measured in 97 monitoring stations across Southeast Asian countries increased significantly. For Indonesia in particular, the strongest El Niño (1997) caused land and forest fire on approximately 11.698 million ha. Areas most affected by the fire were Kalimantan and Sumatra while the impacts in other provinces were not as severe. The economic loss caused by the fire was tremendous. OFDA/CRED stated that these fires were one of the top 10 natural hazards [in the world] during 1997 and 2007” (MOE 2010: IV-24; omitting citations listed in original text). The value of damages and economic losses due directly and indirectly to the 1997/98 fires has been estimated at up to around 1 billion US dollars (MOE 2010: IV-25).¹¹

The increased risk of forest fires also translates into loss of biodiversity and possible extinction of some rare species.

Possible solutions under discussion include a raft of new policies and regulations (aimed at reducing deforestation more broadly), and establishing community-based fire management systems.

¹¹ According to table 4.8 in MOE (2010: IV-25) the loss was estimated at \$662.4 million by MOE and UNDP, and \$1,055.6 million by WWF and EEPSEA. The estimate of \$17,000 million given in the text in MOE (2010: IV-24) appears to be a mistake made by inadvertently adding the two independent estimates instead of averaging them.

II.2.4 Coastal and marine

As an archipelagic country straddling the equator Indonesia is especially vulnerable to climate change which impacts marine and coastal areas, such as seawater temperature rise, more frequent and intense floods, increased erosion, reduced phytoplankton growth and primary production, saltwater intrusion into estuaries and aquifers, changes in surface and groundwater characteristics, and so forth (MOE 2010: IV-29). It is already clear from recent experience, for example, that higher sea temperature during peak El Niño years in 1982/83 and 1997/98 caused serious coral bleaching (notably in the Sunda Straits and Thousand Islands in the former and in East Sumatra, Java, Bali and Lombok in the latter). Further warming and sea level rise due to climate change will further exacerbate these processes.

The expected ecological impacts have major implications for coastal areas and fisheries, and for the tourist industry. The northern coast of Java is already highly eroded as a result of natural processes and poor coastal management practices. The likely impacts also have special significance for Indonesia's major coastal cities such as Jakarta, Surabaya, Semarang and Medan. The likely impacts here could affect the livelihoods of millions of Indonesians and seriously impact the national economy. The ***Second National Communication*** includes the results of a preliminary study of climate change impacts on the 4 cities mentioned using 3 scenarios: the first looks at the impact of sea level rise, the second sea level rise combined with high tides, and the third assesses the impacts resulting from sea level rise combined with land subsistence (MOE 2010: IV-30-44). Jakarta is widely regarded by experts as one of the most vulnerable megacities in Asia, if not the most. The results reported in the ***Second National Communication*** show 74,000 people in Jakarta (based on today's population distribution) effectively displaced by a 25 cm sea level rise. Some settled areas of Jakarta are already below sea level. The study also notes that land subsistence (due to ground water extraction, settlement on high compressibility soil, natural consolidation of alluvial soil, and tectonic subsidence (Abidin et al. 2009)) may affect land inundation in Jakarta more than climate change (MOE 2010: IV-36).

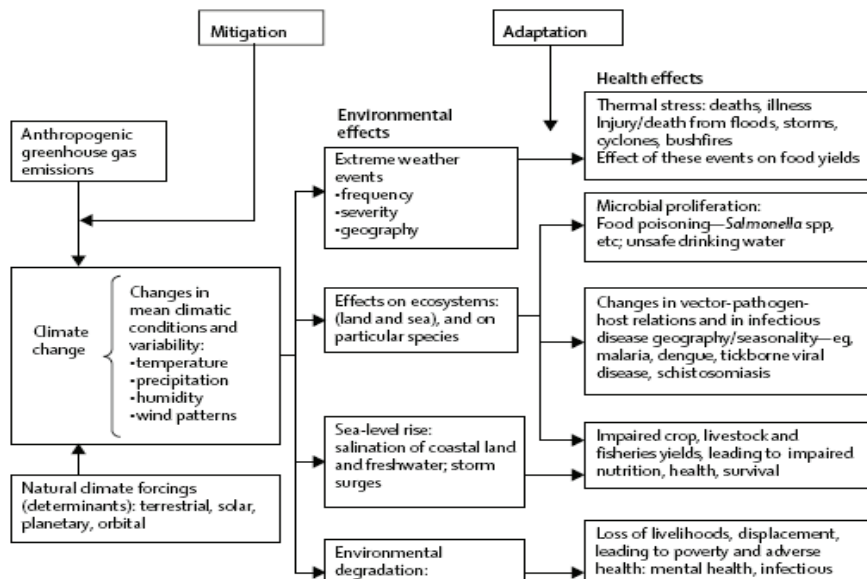
II.2.5 Health

Health experts around the world are increasingly giving attention to the likely effects of climate change on population health (Ebi et al. 2006). Figure 9 outlines some of the main pathways involved.¹² Health service statistics in Indonesia show that incidence rates for several of the major communicable diseases (diarrhea and gastroenteritis, dengue fever malaria, pneumonia) increase during extreme weather events; this pattern is expected to grow even more marked in the future. The results from some preliminary modeling done for the Ministry of Health, however, and reported briefly in the *Second National Communication*, need further clarification: According to the SNC the increase in “transmission potential” for malaria and dengue will increase in coming decades under both the SRES A2 scenario and the B1 scenario, but considerably more so under B1 (the low emissions scenario).¹³ This is possibly because population density (which affects transmission rates) will be higher under B1 than A2, but this point needs to be clarified. The SNC chooses to compare the A2 and B1 scenarios because they differ in terms of their emissions outcomes (the first high, the second low) but fails to mention that A2 is also characterized by low population growth and B1 by higher population growth.

12 Those shown are aside from those that might result from climate change impacts on health infrastructure and services.

13 Under either scenario the proportional increases in transmission potential are far larger for malaria than dengue; but at present there are far more reported cases of dengue.

Figure 9. Main pathways by which climate change can affect population health



Source: McMichael et al. (2006: 860).

The Ministry of Health has developed a short-term climate change adaptation program for 2010-2014 which includes: (i) building a response system for climate change impacts on the health sector; (ii) increasing community access to health services; (iii) training programs on community health services; (iv) establishing an emergency response system for natural disasters and extreme weather events; and (v) strengthening existing disease prevention and control programs (MOE 2010: IV-50).

III | Overview of Government's Climate Change Strategy and Plans

III.1

The Key Players

Developing and implementing climate change adaptation and mitigation strategies are major multi-sectoral undertakings. Among the “key players” on the Government’s side (at the central level) are:

- The Ministry of Environment (MOE)¹⁴: This is the key ministry responsible for developing and maintaining the overall conceptual framework needed to design, implement and monitor an effective national response to climate change and meet relevant international obligations (MOE 2007a). The MOE maintains regular contact with other key players in order to accomplish this. It is responsible for the GOI’s periodic reports to the UNFCCC (MOE 2010), and has also taken a lead in explaining the need to respond to climate change to a wider national audience (e.g. MOE 2007b, 2007c).
- Multiple line ministries: These include the Ministries of Agriculture; Energy and Resources; Forestry; Health; Industry; Marine and

14 Usually known by its Indonesian acronym, KLH (*Kementerian Lingkungan Hidup*).

Fisheries; Public Works; and Transportation. Line ministries are responsible for developing and implementing adaptation and/or mitigation plans as appropriate within their respective sectors. The Ministry of Forestry (MOFOR) has an especially high-profile role because of current high expectations placed on reducing the rate of deforestation in Indonesia as a mitigation strategy and the potentially large amounts of money this involves.

- The Ministry of Finance (MOF): The MOF is taking a leading role in the GOI's efforts to reform economic and fiscal policy so as to meet climate change objectives; and in the GOI's international negotiations regarding new global and bilateral climate financing mechanisms (MOF 2008, 2009).
- The National Council on Climate Change (known by its Indonesian acronym, DNPI¹⁵). This institution was established by the President in July 2008 to help formulate and coordinate the Government's response to climate change, including international negotiations.¹⁶ The President is Chair of the Council, and the Coordinating Minister of Social Welfare is Vice-chair. The current Executive Chair is Prof. Rachmat Witoelar, a former Minister of Environment. Members include key cabinet ministers. The DNPI also has a number of Task Forces (currently totaling 8) which include academics, non-government experts, and other stakeholder representatives. The TFs conduct and sponsor specific studies and collectively serve some of the functions of a state-supported "think tank."
- The National Development Planning Agency (Bappenas): This agency is responsible for integrating sectoral plans into the annual, 5-year, and long-term development plans (Bappenas 2008).
- A number of technical agencies which provide data, analysis and technical support. The list includes the Agency for Meteorology, Climatology and Geophysics; National Institute of Aeronautics and

¹⁵ *Dewan Nasional Perubahan Iklim.*

¹⁶ The DNPI website describes five main tasks: to formulate national policies, strategies, programs and activities in response to climate change; coordinate activities in the implementation of adaptation, mitigation, technology transfer and financing; formulate policies and mechanisms for carbon trading; implement monitoring and evaluation; and strengthen Indonesia's position to encourage developed countries to take more responsibility in curbing climate change.

Space; Research and Implementation of Technology Board; National Coordinating Agency for Surveys and Mapping. The Government also makes extensive use of experts from state universities.

- The Ministry of Home Affairs (MOHA): MOHA is responsible for monitoring the policies of local governments and ensuring they are consistent with national policy.
- The REDD+ Task Force: This is a special TF established by the President in 2010 to work with the MOFOR and other stakeholders to design an appropriate overarching framework for REDD+ programs in Indonesia (see Section III.3 below). The current chairperson is Kuntoro Mangkusubroto.

One agency which has not been involved with the GOI's climate change plans before now is the National Population and Family Planning Board (BKKBN),¹⁷ but this may soon change (see Part VI). Before 2009 BKKBN stood for *Badan Koordinasi Keluarga Berencana Nasional* (National Coordinating Board for Family Planning), but with the new Population Law passed in 2009 BKKBN's mandate now includes population policy beyond family planning and the agency's title has been revised to *Badan Kependudukan dan Keluarga Berencana Nasional*. A new directorate in the agency which focuses on broad population and development issues could provide a suitable institutional home for officials concerned to ensure that population factors are adequately integrated into the Government's adaptation and mitigation efforts.

III.2

Sectoral Plans

Sectoral plans for responding to climate change are designed by the corresponding line ministry. Most ministries involved now have a section dedicated to climate change activities; the technical capacity of most of these units is very limited, given that climate change is very complex and at the same time a relatively new topic for their consideration.

¹⁷ In the long lists of agencies consulted in both MOE (2007a) and Bappenas (2009), BKKBN is notably absent.

An overview of activities planned in each sector can be obtained by consulting the *Climate Change Sectoral Roadmap* prepared by Bappenas (2009). We list some of the key sectoral activities planned for 2010-14 in the two subsections below.

III.2.1 Mitigation activities, 2010-14

Forestry and peat

Increasing the carbon sink and creating conditions for preventing further deforestation through:

- Better development and management of industrial plantations (on dry land) where forest management units (KPHs) have been established
- Initial REDD activities (to be expanded after 2015)
- Improve peat land management practices (on peat land currently classified under forestry and agricultural land use), especially through (i) enforcement of zero burning policy for land clearance and (ii) best practices for water management to reduce subsidence and carbon emission from oxidation

Energy

- Introduction of geothermal and hydropower plants

Transportation

- Improved public transportation in urban areas
- Promotion of non-motorized transportation in urban areas
- Improved carbon efficiency of transportation operations and facilities

Industry and cement

- Review national building codes
- Develop local institutional capacity in policy development and program implementation for eco-efficiency, energy audits, and energy services

- Review and set new cement performance standards
- Reduce the clinker content in produced cement
- Eco-label cement products
- Encourage use of blended cements

Waste

- Conversion of 30 open dumping sites to sanitary landfill sites each year
- Development and enforcement of environmentally friendly infrastructure policies for the sector
- Capacity development and PPPs at local level

III.2.2 Adaptation activities, 2010-14

Agriculture

- Development of crop varieties tolerant against drought, flood, salinity, and peat
- Impact analysis of climate anomaly to planting season shifting
- Development of clean water safeguarding, handling, and storage systems during post-harvest activities and production
- Further development of integrated crop management systems
- Extend estate crops on mineral, non-peat and non-forest land
- Reduction of harvest-failure areas
- Development of food independence village program (for food security)
- Acceleration of food consumption diversity (for food security)
- Increase storage capacity in areas at risk of food scarcity

Water resources

- Regional and strategic zone risk assessments
- Revitalization of local wisdom and capacity building for local adaptation
- Enhancement of water conservation

- Enlarged water supply
- Improved storage facilities and infrastructure

Coastal and marine

- Inventory of data, information system and research
- Integration of adaptation into coastal planning
- Adjustment of elevation and enhancement of building structures and vital facilities in coastal areas
- Development and management of coastal conservation areas
- Special attention to management of small islands
- Adjustment of fisheries management

Health

- Analysis of climate change risks to health at sub-national levels
- Establish database, surveillance, and information systems
- Establish early warning systems for climate change impact areas
- Strengthen health services

Even a cursory glance at these tentative lists suggests that population factors do not figure largely in the Government's preliminary plans for climate change adaptation and mitigation. It is clear from interviews with officials at a number of government agencies, however, that this does not reflect any bias against "population" on the part of those drawing up the plans, but simply reflects the fact that no one among those involved had a specific responsibility for population, and furthermore there was no adequate analysis of the role of population in climate change for planners to draw on at the time. Officials in all agencies visited during the preparation of this report were positive towards the idea of including population factors more meaningfully in plans in the future, and several mentioned they had already noted the small role given to population factors in current plans is a weakness.

REDD+

REDD+ initiatives in Indonesia deserve a section of their own; the Government and its partners are focusing a lot of attention, and pinning a lot of hope, on the scheme. REDD+ stands for reducing emissions from deforestation and forest degradation, and enhancing forest carbon stocks in developing countries. The scheme started as an international initiative under the UNFCCC and rests on three basic premises:

- A global solution to climate change requires that GHG emissions be reduced from all major sources, including from the deforestation and forest degradation which is taking place today mainly in developing countries.
- Developing countries cannot reduce their emissions from deforestation and forest degradation under existing conditions without seriously compromising their opportunities for development.
- This dilemma can be resolved, or at least alleviated, by a massive transfer of funds, technology, and associated assistance from the so-called developed countries to the developing.

There is no agreement yet on what the scheme's "global architecture" will look like in detail.¹⁸ Indonesia meanwhile, like many other tropical developing countries, is working hard on developing a national REDD+ strategy and policies. The emphasis is on "readiness" activities so that Indonesia is well placed to take advantage of the scheme when it goes into effect after the Kyoto Protocol expires at the end of 2012.

18 Uncertainty (and controversy) surrounds each of the three premises. For example, it is still not clear whether "enhancing forest carbon stocks" in the first should cover only existing forests or (as Indonesia would like) include afforestation and reforestation (A/R) as well; whether the second entails re-ordering of incentives according to payments for environmental (or ecosystem) services (PES), or whether "polluter pays" is the more fundamental principle which has to be implemented first; and the third premise raises numerous thorny issues of social equity, verification and governance. All these issues and more are discussed with exemplary clarity in Angelsen (2009).

The UN is partnering with the Government to support readiness activities through the UN-REDD National Programme, launched in March 2009. In May 2009 Indonesia became the first country in the world to enact regulations for a national REDD program. UN agencies are currently gearing up to support capacity development in four main areas: (i) institutions and governance; (ii) policy development and implementation; (iii) technical issues; and (iv) social issues. We comment briefly on how population dynamics are relevant for strategic thinking in these areas in Parts IV and V below. Central Sulawesi has been selected as a pilot province for testing REDD+ readiness programs.

III.4

Coordination of Sectoral Plans

Developing and implementing adaptation and mitigation strategies involves multiple government and non-government agencies and stakeholders operating across all administrative levels. Establishing horizontal and vertical coordination is widely acknowledged among stakeholders as a major challenge (Leitman et al.: 20-28). The tendency is for each sector to work with its own assumptions and scenarios.

Building the individual sectoral scenarios on a common set of population projections (through to the year 2050) would help achieve a higher level of integration.

IV

Population Dynamics and Reducing Emissions:

Avoiding the Unmanageable¹

IV.1

Linking Population Policies and Mitigation Strategies

There are two main themes explored in this chapter: First, how population dynamics interact with the main drivers of GHG emissions, and second, how some mitigation plans currently under discussion – especially REDD+ – have consequences for population dynamics. Both themes point to a need for integration of population policies and mitigation efforts.

As noted earlier most of Indonesia's GHG emissions are due to deforestation and land-use change, but fossil fuel emissions are also rising steeply and can no longer be ignored (Section II.1.2).

¹ I have borrowed the apt expressions “avoiding the unmanageable” and “managing the unavoidable” from Bierbaum et al. (2007).

Reducing Emissions from Burning Fossil Fuels

In this section we explore the relations between population dynamics and fossil fuel emissions through the lens of the Kaya identity (introduced in Section I.1.2):

$$\text{CO}_2 \text{ emissions} = \text{Population} \times (\text{GDP/Population}) \times (\text{Energy/GDP}) \times (\text{CO}_2/\text{Energy})$$

Simple arithmetic dictates that if we want to reduce the value of the variable on the left-hand side (or the rate at which it is growing) then we must reduce the value of at least one of the variable on the right-hand side (or the rate at which it is growing). The objectives are to understand how population dynamics relate to the drivers on the right-hand side of the equation, and to use this understanding to assess how population policies may (or may not) contribute to reducing CO₂ emissions. The first driver (“Population”) covers population size and growth, and for many people that is all there is to the concept of population. When we include the underlying demographic processes (primarily fertility, mortality, migration and social mobility) which result in changes in the structure and composition of populations we see that “population” (in the more technical sense) can affect the other three drivers as well.¹⁹

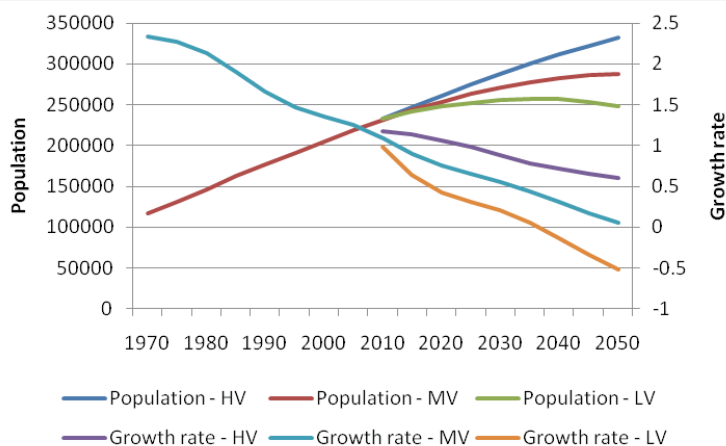
Trends in each of the four emissions drivers are displayed in Figures 10, 12, 14, and 16, respectively.

19 Demographers are well aware of the limitations of IPAT-like equations (Bongaarts 2002; Preston 1994; Hayes 1996). An increase in population by 20 percent does not mean that CO₂ emissions will necessarily increase by 20 percent, as a simple reading of the equation would suggest; in the real world the variables on the right-hand side of the equation are likely to be interdependent. Nonetheless the Kaya identity is a useful accounting tool and is helpful tool for organizing the discussion; and it also facilitates instructive “thought experiments” of the kind, “What would emissions look like if factor A increases by 10 percent and factor B by 30 percent while the others stayed the same?”

IV.2.1 Population growth and mitigation

Rapid population growth is the main population issue which the GOI has addressed over the last 30 years. Figure 10 shows the trends in population size and annual population growth rate over the last 40 years; it also includes the UN Population Division's low, medium and high variant projections until 2050. Overall the GOI's policies have been effective: as a result of broad-based social and economic development on the one hand and government-supported family planning (FP) and reproductive health (RH) programs on the other, the growth rate for Indonesia's population has declined from 2.35 percent per annum 40 years ago (1965-70) to 1.18 percent today (UN 2008).²⁰

Figure 10. Population size (thousands) and growth rate (percent per annum), estimates and projections, Indonesia, 1970-2050



Source: Data from UN (2008).

Note: HV means High Variant; MV means Medium Variant; LV means Low Variant.

²⁰ These figures come from the UN Population Division database and were compiled before the 2010 Indonesia Population Census. There has been much discussion of the preliminary results from the 2010 Census released so far (Hull 2010); regardless of the final figures arrived at for population size and growth rate they are not likely to change significantly the general picture discussed in this section.

Despite the success of the family planning movement the country's population is still growing, adding close to 2.9 million additional people to the population every year. It is important to appreciate that most of this growth is due to "population momentum" (the fact that there are today large numbers of people in their childbearing ages due to high fertility in the past), not because of high fertility (in terms of the number of births per couple). The 2007 Indonesia Demographic and Health Survey (DHS) measured a total fertility rate (TFR) of 2.6 live births per woman (15-49 years old) averaged over the previous 5 years (BPS and Macro International 2008); Hartanto and Hull (2009) argue on technical grounds that this measure is probably biased upwards and that the true value is closer to 2.3.²¹ Although fertility has come down and is now close to replacement the DHS data also show that the national contraceptive prevalence rate (CPR) has plateaued at just over 60 percent, there is considerable variation in CPR and TFR across provinces, and that there is still significant "unmet need" for FP.

Whether a revitalized FP program can successfully meet the remaining unmet need for FP sooner rather than later (Hull and Mosley 2009; Hayes 2010) will therefore make a significant difference to whether the growth in population during the next 40 years veers more towards the HV or LV projection in Figure 10. The MV projection assumes Indonesia reaches replacement level fertility around 2010 (which is probably a little "over-optimistic") and remains stable at around 1.85 from 2020 onwards; even so population size increases by 56 million during 2010-50. The HV assumes TFR dips to just under 2.3 for a while and then settles at 2.35 after 2020; this leads to a population increase of 100 million by 2050. The LV assumes TFR continues to decline until it reaches 1.35 around 2020 and then stay at that level; this produces a population increase of just 16 million over the same 40-year time period.

The Kaya identity suggests that a lower trajectory rather than a higher will, other things being equal, help restrain Indonesia's rapidly rising FF emissions. If we take the MV projection as a "mean" of expected

21 The UN estimate in UN (2008) is 2.19.

population growth, then a range of population outcomes of ± 25 million around this value would be associated with a range of annual CO₂ emissions of roughly ± 8 percent around a central value.

We are not suggesting that the FP program in Indonesia should be revitalized *because* of climate change; the FP program should be revitalized because Indonesians have a basic right to access a full range of FP/RH information and services (as agreed in the *Programme of Action* adopted at the UN International Conference in Cairo, 1994) and reducing unmet need to a minimum helps people exercise that right. Rather, we are pointing out that if and when the FP program is revitalized this will not only lead to all the usual well-known benefits in health and social development (Hayes 2005), but *in addition* it will contribute to the GOI's stated goal of reducing emissions from burning fossil fuels.

IV.2.2 Population aging and mitigation

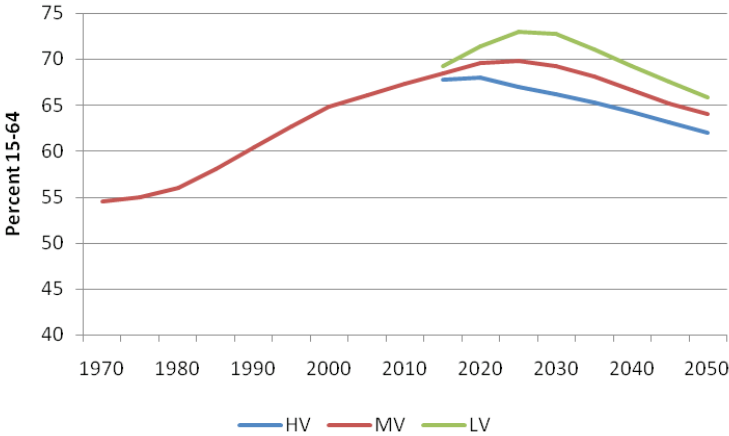
A second major demographic change underway in Indonesia with implications for climate change is population aging. As a country goes through its demographic transition, the resulting changes in age structure provide a one-time "window of opportunity," usually lasting several decades, when dependency ratios are most favourable for investment in development and poverty reduction. Population dynamics are related to economic development in numerous ways and the topic has been studied extensively (Kelley and Schmidt 2001). "What matters most in identifying the impact of demographic change on economic performance," according to Williamson (2001: 111), "is the changing age distribution."

In the first stage of a population's demographic transition mortality declines, usually especially for infants and children, with the result the dependency ratio of youth-to-working-age population increases.²² This is the period of rapid population growth, when the number of births

22 This paragraph borrows from Hayes (2005: 13).

significantly exceeds the number of deaths and the population grows rapidly. During the second stage fertility begins to fall, and the ratio of working-age to dependent-youth increases, and the dependency ratio gradually becomes more favourable for development. Eventually the “baby-boom generation,” born at the time of declining mortality but high fertility, passes through the working years and the population ages. The working-age population finally stops growing, and although the youth dependency ratio remains low the old-age-dependency ratio begins to increase. The window of opportunity, or “demographic bonus,” when the ratio of working-age people to dependents is high, passes.

Figure 11. Percent of population 15-64, estimates and projections, Indonesia, 1970-2050



Source: Data from UN (2008).

Note: HV means High Variant; MV means Medium Variant; LV means Low Variant.

Total age dependency in Indonesia has been declining for 40 years, providing conditions favourable for economic development, but the window of opportunity will pass. Figure 11 shows the population 15-64 years old has been growing as a percentage of total population since the 1970s and is expected to peak at around 70 percent (under the UN medium variant projection) sometime during the 2020s (or a

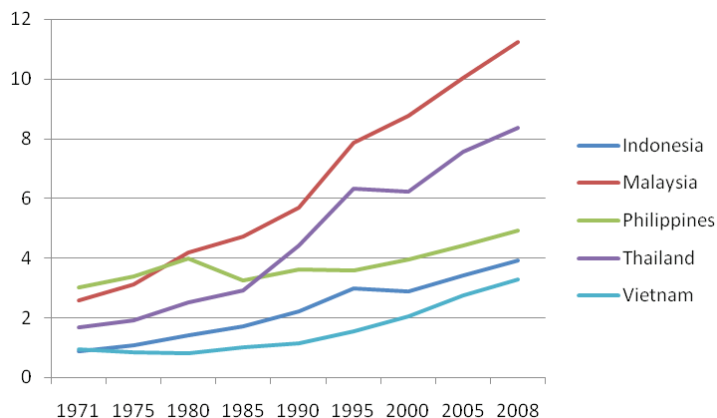
little lower and earlier under the LV, or a little higher and later under the HV). Age dependency will reach an all-time low during 2020-30, and then it will slowly rise again as the population ages. After 2030 the changing age structure will, other things being equal, tend to constrain economic development. According to the Kaya identity these constraints, acting primarily through the second driver on the right-hand side of the equation, must have a flow-on effect on emissions, other things being equal.

Figure 12 shows GDP/capita in Indonesia has increased from \$890 per capita in 1971 to \$3,930 per capita in 2008 (in 2000 prices), an increase of 341 percent. Malaysia, Thailand and the Philippines have higher GDP/capita but the average rate of growth since 1971 is highest for Indonesia among the countries shown. People in Indonesia, as everywhere, do not want to reduce emissions by slowing development or reducing their standard of living, so GDP per capita is not normally regarded as a policy lever for mitigation.²³ Nonetheless if population dynamics, acting through age structure, have an effect of GDP/capita, it is important to take this into account. It matters, for example, in calculating future emissions scenarios. The changing age structure of Indonesia's population is another example of demographic change which, after 2030 or so, will help restrain rising emissions, albeit modestly.²⁴

23 However there is an increasingly prominent group of economists and social critics who argue that GDP is not a good measure of "development," and who point out that above a certain level of prosperity self-reported measures of happiness and wellbeing are not strongly correlated with income at either the group or individual level. Amartya Sen's work (1999) and the annual UNDP *Human Development Reports* build on these insights. In principle emissions *could* be reduced by reducing GDP/capita, which in turn could be accomplished by reducing consumption per capita. Alternatively the same end could be reached, as we suggest in section IV.2.4, by substituting for those goods currently consumed whose production and consumption produce high emissions goods associated with low emissions. This is a big topic which needs to be pursued in depth as Indonesia seeks a low-carbon development path.

24 Population aging will also affect emissions in other ways too, since the elderly have different living arrangements and consumption patterns from the young. These patterns need to be studied in Indonesia: Government policy towards the elderly could have a small but significant effect on future emissions.

Figure 12. GDP per capita (thousand 2000 US dollars), Indonesia and selected SE Asian countries, 1971-2008



Source of data: IEA (2010: 82, 85).

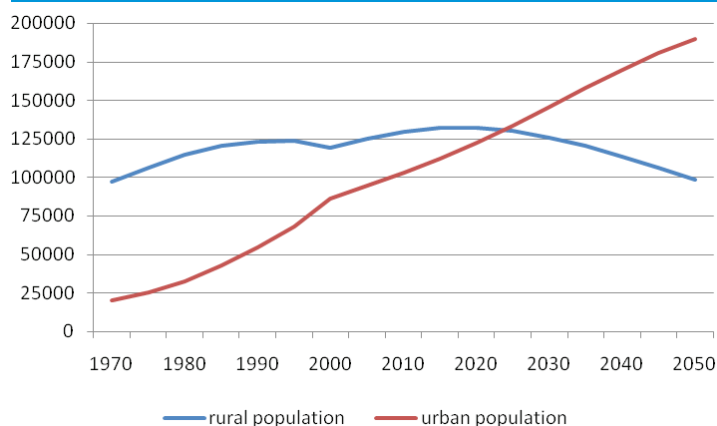
IV.2.3 Urbanization and mitigation

Another dramatic demographic change underway at present is urbanization. The current annual rate of growth of the urban population (1.73 percent) is far above that of the population as a whole (1.08 percent), and sometime during the early 2020s the urban population will for the first time exceed the size of the rural (Figure 13). The rural population will already have started a secular decline by then in absolute numbers; even if the annual growth rate of the total population is only 0.1 percent per annum by mid-century the urban population is still likely to be growing by about 1.0 percent per year (or about 8 or 9 million persons a year) (UN 2009).

Urbanization influences FF emissions in a number of ways. Urbanization is related to economic development as both cause and effect and so it is closely associated with the second driver on the right-hand side of the Kaya identity. The stated policy of the GOI is that mitigation efforts

should not be undertaken at the expense of development,²⁵ so no one is seriously entertaining a population policy of slowing urbanization in order to reduce emissions. Urbanization also influences emissions through the third driver, however, and this is an area where policy interventions could have multiple benefits, including contributing to climate change mitigation.²⁶

Figure 13. Rural and urban population (thousands), estimates and projections, Indonesia, 1970-2050



Source: Data from UN (2009).

The third driver is the energy intensity of the economy, represented by the amount of energy used (in the production and consumption of goods and services) per unit of GDP. Using energy more efficiently in the production and consumption of goods and services can be a relatively painless way of reducing emissions, sometimes even at negative cost. Most countries improve the energy efficiency of their economies as they develop. In Indonesia, in 1971 it took 14.1 million joules to produce US\$1 of GDP (in 2000 prices), in 2008 it took only 9.3 million joules (Figure

²⁵ As mentioned before, although no one advocates slowing development in order to reduce emissions there is serious attention internationally being given to whether development necessarily requires economic growth in the conventional sense (Jackson 2009).

²⁶ And also climate change adaptation, as we discuss in Part V.

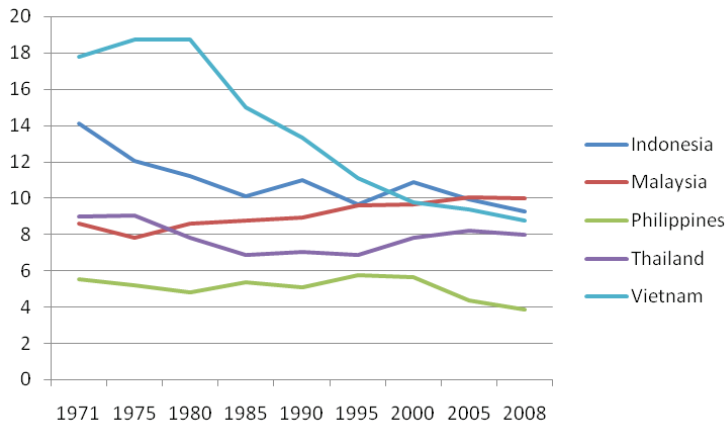
14).²⁷ Malaysia is one of the few countries where energy intensity is on the rise. Many industrialized countries have performed better in terms of energy efficiency; for example, the US has improved its energy efficiency from 17.2 to 8.1 joules per dollar of GDP over the same time period, France from 9.1 to 6.4, and the UK from 11.3 to 4.7.²⁸

The demographic process whereby millions of people are joining the urban population every year (either through migration or annexation) means the urban building stock and infrastructure are expanding rapidly. Tables 1 and 2 showed that power, transportation, and buildings are major sources of GHGs. If policymakers could ensure that new urban areas are built to be much more energy efficient than the old this would contribute in a major way to reducing future emissions. This can be done by introducing new building codes; more energy efficient use of space for work, living and recreation; and developing more options for personal movement that do not depend on private cars. It is important to stress there are many co-benefits from such policies in terms of population health, amenities and quality of life (for example, reducing GHG emissions from burning fossil fuels also leads to cleaner air and less sickness due to air pollution). If this is not done as new urban areas are designed and expanded it will be far more difficult and expensive to do it later (through “retrofitting”).

27 To put this in some perspective, a million joules is approximately equivalent to the kinetic energy of a 1 tonne vehicle moving at 160 kph. 1 joule is about the energy needed to raise 1 small apple 1 meter. The units in Figure 14 are (following IEA) petajoules ($1 \text{ joule} \times 10^{15}$) per billion dollars; this is equivalent to million joules per dollar.

28 A lot of these “improvements” are related to structural changes in the economy and “de-industrialization.”

Figure 14. Energy/GDP (petajoules per billion 2000 US dollars), Indonesia and selected SE Asian countries, 1971-2008



Source of data: IEA (2010: 73, 82).

IV.2.4 Population composition and mitigation

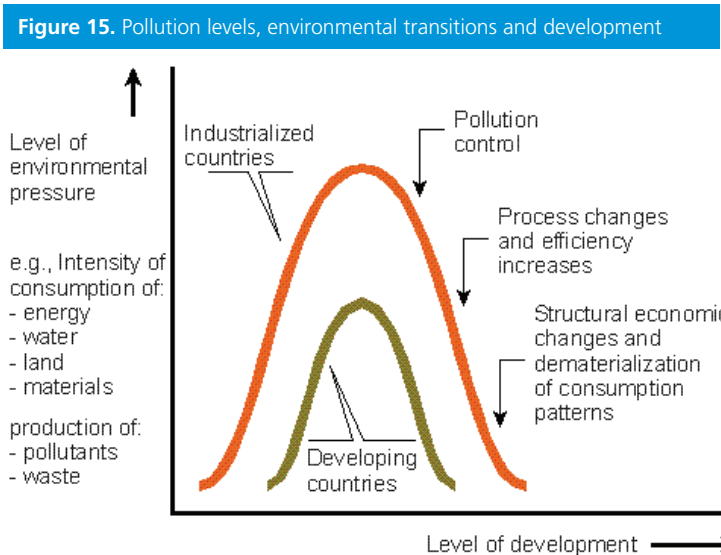
A fourth major demographic change underway is a change in population structure in terms of the socioeconomic characteristics of its members; in particular the “middle classes” are rising in size and influence (Robinson 1996; Gerke 2000).²⁹

The fourth emissions driver is the carbon intensity of the energy used in the economy, measured by the International Energy Association in tonnes of CO₂ emitted per trillion joules of energy produced. Many industrialized societies have lowered their carbon intensity in recent decades: in 1971 the US emitted 64.6 tonnes of CO₂ for every terajoule of total primary energy supply, in 2008 it emitted 58.5; for France the decline is from 65.1 tonnes to 33.0; for the UK it is from 71.4 tonnes to 58.5 (IEA 2010: 86). For most developing countries the trend is in the other direction.

²⁹ There is still surprisingly little good data and analysis on Indonesia’s changing class structure.

Indonesia only emitted 16.6 tonnes of CO₂ for every tetrajoule of energy in 1971 but the figure rises to 46.3 tonnes by 2008 (Figure 16).

It is sometimes noted that as countries industrialize pollution levels follow a “Kuznets curve” (UNEP 1997; Hunter 2000). In the early stages of industrialization pollution increases rapidly; once a country reaches a certain level of prosperity its citizens demand a cleaner environment and its new wealth means it can afford to put some environmental quality controls in place; as the society gets riches pollution levels begin to come down again (Figure 15).

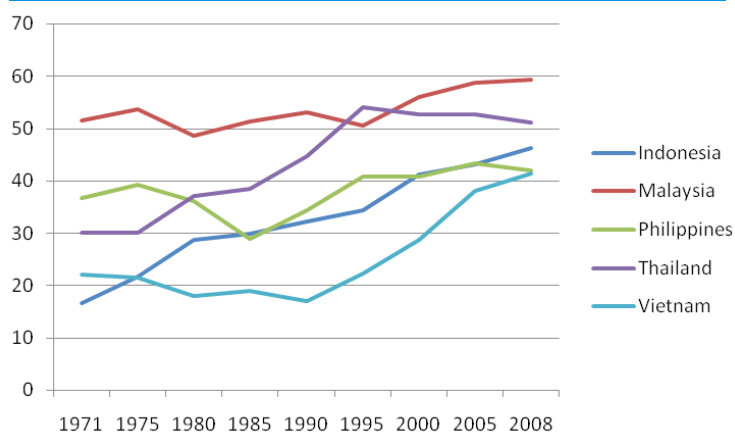


Source: UNEP (1997).

According to UNEP (1997) the rate of pollution and environmental degradation is slower in some developing countries today than it was in Western industrialized countries when they were at a similar level of economic development. In Indonesia we already see NGOs working to raise public awareness about pollution and lobbying for reform. It is not unrealistic therefore to consider how policy interventions can be developed which foster environmentally-friendly consumption patterns among the rising middle classes, primarily in urban areas.

Simple examples of such policies which can be introduced relatively quickly are banning plastic bags (at least the non-biodegradable and non-recycled ones), making sure that new planning approvals require far more access to shops and amenities by dedicated walkways and bicycle paths, and fast-tracking development of public transportation. Public education campaigns aimed at reducing the ecological footprint through changing lifestyle and consumption values need to take demographics into account and aim at facilitating a generational change.

Figure 16. CO₂/Energy (tonnes CO₂ per terajoule), Indonesia and selected SE Asian countries, 1971-2008



Source of data: IEA (2010: 88).

IV.3

Reducing Emissions from Land-Use Change and Agriculture

The programs being discussed for reducing emissions by protecting and managing Indonesia's forests have major implications for local communities living in the affected areas. It will be important to monitor these social impacts of the REDD+ programs as well as their environmental

impacts, and most stakeholders acknowledge this. One of the four major areas for support under the UN-REDD National Programme is “social development.”

In working with local communities to ensure their tenure rights and livelihoods are respected it is important to understand their complex and varied population dynamics; that is an essential part of understanding who they are and what their needs are. Most areas where REDD+ programs are likely to be implemented are inhabited not only by indigenous peoples; there are many migrant groups too. Some of the latter have been officially sponsored by the state under the former transmigration program, others are “spontaneous migrants” seeking land to exploit, often temporarily, once the forest is “opened” by loggers (Hidayati et al.: 1999). It requires careful field study to distinguish the different groups and understand their respective livelihood strategies (Suyanto et al.: 2009).

REDD+ readiness activities are still analyzing potential incentive structures inherent in proposed REDD+ schemes. Unless this is done carefully with detailed attention to the rights and needs of local communities, and with adequate financial governance and oversight mechanisms put in place, REDD+ revenues could be spent on activities which reduce deforestation at the expense of the well-being and livelihood security of forest-dependent communities (Barr et al: 2009).³⁰

30 This is not exclusively an Indonesian challenge, of course: “International and national planning for REDD+ has so far failed to show how the political and economic drivers of deforestation, such as corruption and other governance factors, are going to be successfully overcome. The full meaning of the forest transition is not yet being addressed in REDD+. By and large people in forests tend to be rights-deprived and this bodes badly for the success of REDD+” (Sunderlin and Atmadja 2009). The news in Indonesia that the Rimba Raya project in Central Kalimantan – which has been negotiated with support from the Norway Agency for Development and the Clinton Climate Initiative to be a prominent part of the UN-REDD National Programme – is now challenged by the Ministry of Forestry is disturbing. In the news story produced by David Fogarty of Reuter’s, Kuntoro Mangkusubroto is quoted as saying, “The core concern is the trust in government statements of readiness, and responsibility. ... I can surmise that the case of Rimba Raya is a case of a business idea that is ahead of its time. The government infrastructure is insufficiently ready for it.” (See *Jakarta Post*, 18 August 2011.)

Conclusion to Part IV

Major demographic changes, currently underway in Indonesia and expected to continue for most of the present century, interact with the key proximate drivers responsible for rising fossil fuel emissions. The major demographic changes we have looked at in Part IV are (i) population growth, which will continue for several decades at least, but at a progressively slower rate; (ii) changing age structure of the population, which in recent decades has produced a growing bulge in the working ages but in future will lead to a growing proportion of elderly; (iii) rapid urbanization, which may result in 65 percent of the population living in urban areas by 2050; and (iv) the changing socioeconomic composition of the population with a steadily growing “middle class.”

In our discussion we highlighted how each demographic process can influence a particular emissions driver – the effects of population growth on the first driver, age structure on the second, etc. – but this is a simplification. In reality the situation is much more complex: the four demographic changes are in fact interdependent, as are the four key drivers, and there are multiple paths relating the former set of factors to the latter. Further data collection is needed for a more comprehensive analysis, but we hope enough has been said to convince the reader that population dynamics influence FF emissions significantly via multiple paths, and that “population dynamics” here does not only refer to changes in population size.

Whether this means population policies should be employed in mitigation strategies needs to be considered carefully on a case-by-case basis. Population dynamics clearly influence the first two drivers, but there is surprisingly little scope here for population policies to be employed as direct components of mitigation strategies aimed at reducing emissions via these two drivers: in the case of the first the international consensus is that FP/RH programs should **not** be designed primarily to “control” population growth; regarding the second driver, no one seriously

advocates reducing emissions by reducing economic development. The implication is that although Indonesia's population policies regarding FP/RH and age structure may help reduce emissions by virtue of their co-benefits, these reductions will have to be counted under in the GOI's GHG inventories for the UNFCCC under BAU, not as the result of the nation's explicit mitigation strategies.

Our analysis suggests the main uses of population policies as direct components of mitigation strategies may be with regard to the last two "technological" drivers. This may seem paradoxical at first glance but social scientists have long argued there is no such thing as a pure "technological fix" for social problems and that the introduction of new technologies always presupposes certain social preconditions are in place (Merton 1957: Part V; Ellul 1964). Population dynamics are transforming the social forces which determine consumption patterns and the social construction of technology. It is important therefore that policy analysts in Indonesia examine these social and demographic trends from the point of view of introducing more reliance on technologies that are as energy efficient and as non-polluting as possible. The mere "transfer of technology" cannot work alone; it requires careful attention to, and preparation in, the social environment where the technology will be employed, and demographic change is a key driver of change in this environment. Population-related policies influencing the characteristics of urbanization and social mobility can potentially contribute significantly to Indonesia's mitigation strategies. This is an important area which needs further investigation.

V

Population Dynamics and Strengthening Adaptation: Managing the Unavoidable

V.1

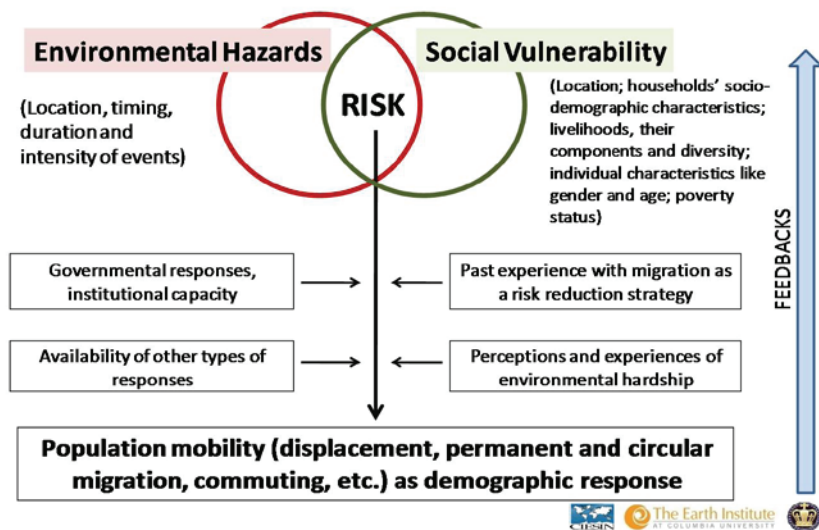
Linking Population Policies and Adaptation Strategies

The threats posed by climate change to human systems and their natural support systems are expressed in the research literature in terms of probabilities: extreme floods, for example, which in a given location were previously experienced once every 50 years or so might now occur once every 4 or 5 years.³¹ It is convenient to express the risk to population as a function of the environmental hazard on the one hand, and the vulnerability of the population (or its converse, resilience) on the other (Figure 10). To reduce the risk we must either reduce the hazard (through mitigation) or the vulnerability (through adaptation). Mitigation and adaptation are complementary activities, and this perspective makes it clear why we need both.

31 Part V builds on Hayes (2010).

Figure 17. Environmental hazards, social vulnerability, and managing risk

How do environmental factors affect migration decisions? Multiplicity and Complexity



Source: Adamo (2009).

There is a significant asymmetry between mitigation and adaptation. Mitigation requires many countries must drastically reduce their GHG emissions. This will require developing new technologies to provide clean energy, and for many population groups it may require significant shifts in values and lifestyle (either those they currently live by or aspire to). Mitigation, in other words, requires major technical and social innovation. Adaptation does not. With adaptation it is not the problems themselves which are new but rather their *frequency, scale and location*. Many human populations have long histories of reducing their vulnerability to high temperature, low temperature, high rainfall, low rainfall, changing coastlines, etc.; over the centuries they have improved their resilience and learned to deal quite successfully with these hazards. The heightened risks associated with climate change are due to the changing frequency, scale and location of these hazards; some populations risk being overwhelmed

by the novel scale and frequency of otherwise-familiar hazards, others risk being overwhelmed by hazards which are novel *to them* and for which therefore they are unprepared.

That is the kind of situation which national adaptation strategies have to deal with: problems which in themselves are not new to humankind and which we know how to solve, but which will be occurring with new intensity and in new locations where local expertise and other resources are not enough on their own to deal with them. Adaptation will require myriads of adjustments to behaviour and organization at the local level as well as national policy interventions. The fact that the environmental hazards projected to be brought about by climate change are not in themselves new is the reason national adaptation strategies can to a large degree build on, or borrow from, many existing development policies. Development, especially sustainable development, is the best adaptation strategy.

This is certainly true in the case of population policy in Indonesia. Many policy interventions implemented in the country over the past 40 years to respond to a range of population issues can be seen, on inspection, to contribute to the kind of population resilience which is needed to adapt to climate change.

An adaptation strategy needs to do four things:

- Identify the kinds of environmental hazards expected in specific locations
- Identify the most vulnerable population groups in those same locations
- Assess precisely what it is about specific locations and specific groups which accounts for the heightened risk
- Develop a strategy to help specific groups manage their risks effectively

The last point means developing a group's access to resources so they can improve their resilience (or "adaptive capacity") and reduce their

social vulnerability. The most vulnerable population groups are invariably the poor and near poor because they lack resources they can invest in an effective strategy. Consequently any of the usual poverty reduction strategies are likely, other things being equal, to enhance resilience because they give the poor access to additional resources. An adaptation strategy for a vulnerable group can include improved management of ecological systems in their environment and on which they depend, so those systems themselves become more resilient in the face of environmental hazards. This point is important because the poor in Indonesia live increasingly in fragile and degraded environments (Hayes 2001).

V.1.1

Family planning, reproductive health and adaptation

For vulnerable groups access to family planning and reproductive health services will be a vital part of any successful adaptation strategy. FP/RH services alone cannot make vulnerable groups resilient or lead them out of poverty, but without such services the chances are they will remain vulnerable. This is because there are several paths, documented in the literature and summarized in Table 4, connecting lack of access to RH on the one hand to increased likelihood of poverty on the other (Greene and Merrick 2005; Hayes 2005).

Table 4. Some reproductive health outcomes and potential paths to vulnerability and poverty

High/excess fertility

- High fertility reduces investment in individual children, contributing to poverty
- Household demographic composition mediates fertility and investment in children
- High fertility reduces girls' schooling by increasing gender discrimination
- High fertility increases morbidity and therefore reduces schooling, decreasing human capital of children
- High fertility increases poverty by reducing women's ability to work for pay
- High fertility increases poverty by reducing family's ability to save and protect itself from unexpected dips in income

Unintended fertility (mistimed or unwanted)

- Early childbearing causes poverty by disrupting schooling and employment opportunities
- Unwantedness affects the way pregnancies/children are cared for and invested in
- Induced abortion performed illegally contributes hugely to young women's morbidity and may have lasting effects on their health and wellbeing

Early (adolescent) childbearing

- Early childbearing causes poverty by disrupting schooling and employment opportunities
- Being born to an adolescent mother has long-term implications for child development, and therefore the inter-generational transfer of poverty
- Adolescent mothers have poorer health, through less use of health care services and biological constraints

Poorly managed obstetric complications

- Maternal mortality has lasting effects on the household
- Serious maternal morbidities have lasting effects on women's productivity and household wellbeing

Source: Greene and Merrick (2005: rearranged).

Vulnerable groups need to be assessed carefully to determine precisely in which respects they are resource poor. If access to RH is one aspect then this needs to be addressed in the group's adaptation strategy.

In sum, improving RH contributes to climate change adaptation because unhealthy people will be especially vulnerable to new health risks brought about by climate change; healthy people are better able to cope with the non-health-related problems brought about by climate change in everyday life; and because good RH of parents (especially mothers) has many flow-on effects for family welfare and the wellbeing of the next generation.

V.1.2 Education and adaptation

If health builds resilience of a generalized kind education builds resilience in terms of skills. As one of the UN reports on climate change (WHO 2009) emphasizes, "In general, countries with more 'human capital' or knowledge have greater adaptive capacity. Illiteracy increases a population's vulnerability to many problems." Adaptation will require countless decisions by Indonesians in their everyday lives over the coming decades; decisions will have to be made to adjust to new conditions and improve adaptive capacity at all levels, including individuals and their families and local communities. Government at all levels will need to intervene as appropriate and establish the right kind of policy environment. Command and control strategies are unlikely to be optimal;

it is important that local populations be empowered as well as resourced to adapt to changing local conditions. An educated population will be better able to rise to this challenge than an undereducated population.

Moreover, schools are an important channel for educating the next generation about climate change and sustainable development and for getting the message out into the population at large. Education is a long-term investment in a population's adaptive capacity (Lutz 2009³²). Social organization and social capital will be important too, but communities with good human capital will be better able to develop social capital.

In short, improving education levels contributes to climate change adaptation because people with knowledge, cognitive skills, and an open mind, are more likely to innovate and discover successful ways of coping with problems brought about by climate change in everyday life; because illiterate people are especially vulnerable to the hazards of unpredictable change; and because investing in education today has a positive impact on adaptive capacity for decades to come.

V.1.3 Gender and adaptation

Proponents of sustainable development have since the beginning understood the importance of social justice; sustainable development requires removing at least the most egregious forms of social inequity. Removing all forms of discrimination based on gender is one such imperative. Indonesia has already removed most of the more blatant forms of sex discrimination but most experts agree there is still more to be done, especially among the more vulnerable population groups.

Removing gender discrimination is not only morally the right thing to do, it has practical benefits too, and these need to be emphasized. Most countries prosper because of the hard work and ingenuity of their populations. Sex discrimination means women cannot participate in

32 Lutz (2009) presents an especially insightful way of looking at the education level of successive age cohorts in the age pyramid which helps the policymaker forecast future vulnerabilities in the population, and so plan accordingly.

the development process on equal terms with men, and so the society cannot run at full capacity. Development runs best when the talents of everyone are cultivated and can contribute to the overall effort.

In vulnerable parts of the population with more gender inequality females will be more vulnerable to the stresses and strains brought about by climate change than males. This is especially the case where gender inequality is compounded by other social and economic disadvantages. As Naila Kabeer (1996) has pointed out, it is in the context of poverty that women are often most disadvantaged: they often work harder than men, but find it more difficult to convert that labour into money income; if they do earn an income they are often not given the choice as to how to spend or invest it; and if they do have the choice they are more likely than men to spend it on others – their children, their family, their relatives – rather than on increasing their own welfare.

Reducing gender inequality and reducing poverty contribute to climate change adaptation because gender inequality and poverty both result in some people and some communities being especially vulnerable to climate change by virtue of the fact they are not empowered to mobilize the resources they need to take pre-emptive action to enhance their own resilience (UNFPA 2009); an added irony is that these kinds of inequity in a population mean that the people who are most likely to be among the first to experience the adverse effects of climate change in their daily lives are not able to contribute lessons from their experience to the political decision-making processes designing adaptation strategies for the population as a whole. Renewed efforts at reducing gender inequality and reducing poverty can serve as important pillars of a climate change adaptation strategy since these efforts increase the resilience of the most vulnerable sections of the population.

V.1.4 Migration, urbanization and adaptation

Migration will be a major adaptation strategy of human populations (and other species). Some commentators in the West are fueling fears that

climate change could produce a tidal wave of “climate change refugees” from the developing world which threatens to flood into developed countries. These fears are exaggerated, at least for the immediate future. Experience shows that the vast majority of people forced to move for environmental reasons choose to move short distances whenever possible. Most migration will be local.

The big story here is urbanization. Indonesia's current policy responses to urbanization are clearly woefully inadequate. Flooding in Jakarta and other major Indonesian cities is symptomatic of the policy failures: we know how to build cities so they do not flood but the Government has allowed the country's cities to develop in response to other priorities (Dick and Rimmer 1998). Indonesian urban areas have been allowed to grow and “develop” according to plans which give only low priority (at best) to environmental and climate change considerations.

Cities need to become “climate smart,” with resilience embedded in their infrastructure and built environment. They need to reflect an urban design which is both people-friendly and environment-friendly. Birkland (2008) suggests we need to think of “virtuous cycles” connecting human populations and living ecological systems (i.e. not simply of reducing our ecological footprint; see also Rees 2009). A good way to do this is to use principles which mimic nature.

Making Indonesian cities climate smart needs to be seen as an essential component of the country's climate change adaptation (and mitigation) strategies because the cities – especially Jakarta – are the country's principal “engines of economic growth,” and to allow them to become more dysfunctional would undermine development. Furthermore an ever-larger proportion of the population lives in areas designated as urban; if the population is to adapt to climate change then its cities must become climate smart. This requires a redesign of the urban built environment, and a rethink of urban values and lifestyles.

Conclusion to Part V

There is an emerging consensus that for developing countries more development is the best adaptation to climate change. That is not to say that “business as usual” is sufficient: climate change gives an added imperative to make sure that *all* development is sustainable, which is far from the case at present. Indeed if development in the past – in both developed and developing countries – had been implemented in sustainable ways then we would not be facing the challenge of climate change today. All population-based policies need to be reviewed to assess their status vis-à-vis climate change and sustainability.

VI | Recommendations

BKKBN and UNFPA sponsored a Roundtable Discussion on Population Dynamics and Climate Change at the Novotel Hotel in Bogor, 10-11 August 2011. Senior officials participated from Bappenas, KLH, and the DNPI, as well as representatives from a number of sectors including Forestry and Agriculture. Some NGOs participated (including CIFOR), and some researchers from LIPI.³³

A significant result of the discussion was a preliminary consensus among participants that population dynamics are indeed involved in the causes and consequences of climate change, and that efforts should therefore be made to incorporate this understanding in the design of Indonesia's mitigation and adaptation strategies. This preliminary consensus still needs to be strengthened, clarified, tested, extended, and put into practice, but the sense that an important first step had been taken was palpable, and the mood of the meeting was overwhelmingly positive.

Furthermore BKKBN indicated its willingness to take the lead among Government agencies, consistent with its responsibilities mandated in Population Law 52/2009, to ensure that population factors are

33 The draft version of this report served as background material for the roundtable discussion, and José Miguel Guzmán (UNFPA HQ) and Adrian Hayes (ANU) served as resource persons.

appropriately factored into the Government's policies and programs on climate change.

The recommendations below include insights and suggestions from the Bogor meeting.³⁴

VI.1

Research Linking Population Dynamics and Climate Change in Indonesia

It is recommended that stakeholders, especially BKKBN and UNFPA, find ways to stimulate further policy-relevant research on population dynamics and climate change in Indonesia.

The preliminary situation analysis presented in this report finds a complex web of causal linkages between population dynamics and climate change, which at present is only poorly understood. To recognize this is a first step in a new area; further study is needed to clarify these relationships, and most importantly to identify which of the linkages can be exploited by the policymaker in developing Indonesia's mitigation and adaptation strategies, and which are best not manipulated but rather left alone and therefore need to be adapted to. Such analysis is essential if population dynamics are to be factored into climate change strategies in ways that improve their effectiveness and efficiency, and which represent "no-regrets" interventions.

The complex web of links between urbanization and climate change has been identified as especially important for further study.

The Population Studies Center at LIPI reported that they are undertaking some qualitative research on population and climate change, especially looking at people's understanding of, and attitudes towards, climate

34 And from a follow-up meeting with the Executive Chair of DNPI and some of his staff.

change (e.g. Cahyadi et al. 2010; Miranda et al. 2010; Romdiati et al. 2010; Situmorang et al. 2010).

It is recommended that an organization – perhaps LIPI, or BKKBN – should maintain a mailing list of those interested in research on population dynamics and climate change in Indonesia and an up-to-date inventory of research projects in this area so that those actively researching or otherwise interested in the topic can have easy access to the results.

VI.2

Integrating Population Dynamics into the GOI Sectoral Roadmap

It is recommended that special attention be given in policy analysis to the use of a population perspective to better harmonize climate change policies and programs across sectors and across administrative levels.

The GOI's work on mitigation and adaptation so far is mostly sectoral. There is a need for more harmonization among the sectoral plans. With its mandate to formulate national climate change policies and programs DNPI is in the best position to undertake such policy analysis, working closely with Bappenas.

Using a population perspective to harmonize climate change policies and programs across sectors is especially important for adaptation plans at regional and local level. "Strategies for adaptation should reflect a multisectoral approach that recognizes that people's lives are not lived in single sectors" (Mutunga and Hardee 2009). Taking a population perspective and developing adaptation strategies for specific population groups can help with this. Ultimately it is households and families that have to adjust their behavior to accommodate climate change; age and gender considerations should be mainstreamed in the necessary policy analysis.

Grounding the strategies in the measured needs of specific population groups also mitigates against a situation where there are “winner” and “loser” sectors (Mutunga and Hardee 2009). The aim here is not simply to incorporate population dynamics into Indonesia’s mitigation and adaptation strategies but to do this in a way that represents genuine sustainable development. This also requires some innovations in monitoring and evaluation.

It is recommended that a number of short, focused policy briefs be prepared as soon as possible.

VI.3

Recommendations for Future GOI-UN Project Activities

It is recommended that a proposal be prepared describing a project within the United Nations Partnership for Development Framework with BKKBN, the Ministry of Environment, the National Council on Climate Change, Bappenas, and the UNFPA as principal partners. Other partners could be the Ministry of Forestry, Ministry of Agriculture, or the Ministry of Public Works. The aim of the project is to make sure that population dynamics are taken into account and optimally incorporated in all adaptation and mitigation strategies in the country, and at all the main administrative levels.

This requires that the proposed project supports:

- Further *detailed studies of specific population-climate change linkages*, at least to the level of detail and comprehensiveness considered necessary by stakeholders and independent experts for developing sound adaptation and mitigation strategies across all regions of the country and across all administrative levels.
- *Capacity building at selected Indonesian universities* so that much of the required data collection and analysis can be done by

Indonesian experts with access to international best practice; and so that a new generation of professional expertise is trained.

- ***Capacity building in relevant government offices*** so Indonesia becomes a recognized international leader in its use of convergence and synergy between population policy and climate change policy, and so Indonesia can promote more South-South cooperation in this area. Capacity building should begin with BKKBN and the Ministry of Environment, but should soon extend as soon as possible to the province and district levels, and to other parts of the Central Government as needed. It is also important that DNPI has the resources it needs to incorporate population dynamics in its policy functions and to champion these innovations in Indonesia and on the international stage. Capacity building for government agencies is needed for both short-term and long-term.
- ***Advocacy and public education campaigns*** aimed at mobilizing public support for effective mitigation and adaptation strategies and at changing behaviors. Climate change policies and programs by their nature require wide public support if they are to be successful, but the scientific evidence on which they are based is not always easy to understand. Meanwhile there is growing international recognition that if the targets of the Copenhagen Accord are to be met then action on climate change should be treated as an urgent priority, especially for large emitting countries like Indonesia, and the normal pace at which reforms are implemented may be too slow. Well-targeted advocacy campaigns can help accelerate the process; it is extremely important to get parliamentarians on-side. Meanwhile BKKBN has a good track record in communication for behavioral change at the local level.³⁵

35 Although success in promoting behavioral change in Indonesia today requires a completely different mind-set from that used so effectively in the 1970s and 80s. Nonetheless some former BKKBN field workers (PLKB) could possibly be trained to promote grass-roots understanding of how everyday life and changes in climate affect one another.

Within its own sphere of manageable concerns the project will aspire to be a model of good governance and transparency. Indonesia has a well-deserved reputation for leadership in the field of climate change. The proposed project would seek to consolidate and advance that reputation by strengthening its policy response to climate change through the introduction of innovative links to population dynamics.

VII | References

VII.1

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Abbreviations

Bappenas	National Development Planning Agency
BAU	Business as usual
BKKBN	National Population and Family Planning Board (formerly the National Family Planning Coordination Board)
CIFOR	Center for International Forestry Research
COP	Conference of the Parties
DHS	Demographic and Health Survey
DNPI	National Council on Climate Change
FF	Fossil fuels
FP/RH	Reproductive health and family planning
GHG	Greenhouse gas
GOI	Government of Indonesia
ICRAF	World Agroforestry Center
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
KLH	Ministry of Environment
LIPI	Indonesian Institute of Sciences
LULUCF	Land use, land-use change, and forestry
MOE	Ministry of Environment

MOF	Ministry of Finance
PSK	Population Studies Center
REDD	Reducing Emissions from Deforestation and Forest Degradation
REDD+	Same as REDD with the addition of conservation, sustainable management, and enhancement of forest carbon stocks
SRES	IPCC Special Report on Emissions Scenarios
t	tone (metric)
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund



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