PROCEEDINGS OF THE WORKSHOP ON POPULATION DYNAMICS AND CLIMATE CHANGE
Semarang, 17-18 October 2013
Climate change has become a serious threat in the world. The Fifth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) released on 11 November 2013 provided a comprehensive assessment of the physical science basis of climate change. Global temperature rise and sea level rise affect community activities, particularly the low and middle-income populations living in coastal areas. Yet, climate change is rarely considered together with population issues.

Now, a joint effort between UNFPA, the United Nations Population Fund, the National Population and Family Planning Board (BKKBN) and the National Council on Climate Change (DNPI) has focussed on the connections between climate change and population dynamics. This collaboration has achieved a breakthrough in raising population dynamics issues in addressing the impacts of climate change adaptation policies.

UNFPA supports activities related to sustainable development, population, climate change and environment. On 17-18 October 2013, UNFPA in collaboration with the BKKBN, DNPI, Urban and Regional Development Institute (URDI), and Semarang City Government held a workshop on Population Dynamics and Climate Change to disseminate study results on climate change vulnerability of the population in Semarang. The workshop presented the methods, findings, and implications related to population dynamics and climate change adaptation in Semarang city, which was one of the three cities in the world that was part of the global research project undertaken by UNFPA's Population and Development Branch, Technical Division, in New York and the London-based International Institute for Environment and Development (IIED). The workshop encouraged researchers, policy makers and development agencies to take population dynamics into account in climate change mitigation and adaptation initiatives.

We thank all the speakers and discussants for their contributions in presenting and sharing their ideas, the population and planning experts and policy makers who participated, and also the organizing committee for conducting the workshop and preparing these proceedings as a reference tool on population dynamics and climate change. We hope this book will provide a useful resource for advocacy and policy development in Indonesia and internationally.

Rachmat Witoelar  
Executive Chair of the National Council on Climate Change (DNPI)

Fasli Jalal  
Chairman of the National Population and Family Planning Board (BKKBN)

Jose Ferraris  
UNFPA Representative in Indonesia
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<td>ANU</td>
<td>the Australian National University</td>
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<tr>
<td>APBD</td>
<td>Regional Budget for Development</td>
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<td>APBN</td>
<td>National Budget for Development</td>
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<td>Bakornas PB</td>
<td>Board of National Coordination for Disaster Management</td>
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<td>Bappeda</td>
<td>Local Development Planning Board</td>
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<td>Bappenas</td>
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<td>BIG</td>
<td>Geographic Information Board</td>
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<td>Bintari</td>
<td>Bina Karta Lestari Foundation</td>
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<td>BLH</td>
<td>Local Environment Board</td>
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<td>BMKG</td>
<td>Board of Meteorology, Climate, and Geo-physics</td>
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<td>BNPB</td>
<td>National Disaster Management Agency</td>
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<td>BPBD</td>
<td>the Local Agency for Disaster Management</td>
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<td>BPLHD</td>
<td>Local Environment Management Board</td>
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<td>BPS</td>
<td>BPS-Statistics Indonesia</td>
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<td>BRT</td>
<td>Bus Rapid Transit</td>
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<td>CCROM-IPB</td>
<td>Center for Climate Risk and Opportunity Management – Bogor Agricultural University</td>
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<td>Dishubkominfo</td>
<td>Transportation Agency, Communication and Information</td>
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<td>DNPI</td>
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<td>GDP</td>
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<td>GHG</td>
<td>Green House Gas</td>
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<td>GIS</td>
<td>Geo-Referenced Information Systems</td>
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<td>ICCSR</td>
<td>the Indonesia Climate Change Sectoral Roadmap</td>
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<td>ICCTF</td>
<td>Indonesia Climate Change Trust Fund</td>
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<td>ICPD</td>
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<td>IIED</td>
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<td>ISET</td>
<td>Institute for Social and Environmental Transition</td>
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<td>ITB</td>
<td>Bandung Institute of Technology</td>
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<td>KLH</td>
<td>Ministry of Environment</td>
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<td>LECZ</td>
<td>Low Elevation Coastal Zone</td>
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<td>LIPI</td>
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<td>LULUCF</td>
<td>Land Use, Land Use Change and Forestry</td>
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<td>MDGs</td>
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<td>Abbreviation</td>
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<td>Perpres</td>
<td>Presidential Regulation</td>
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<td>PODES</td>
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<td>RAD-API</td>
<td>the Regional/Local Action Plan on Climate Change Adaptation</td>
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<td>RAD-GRK</td>
<td>the Regional/Local Action Planning on Green House Gas Emission Reduction</td>
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<td>RAN-MAPI</td>
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<td>RAN-PRB</td>
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<td>Renja K/L</td>
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<td>Renja SKPD</td>
<td>Development Working Plan for Local Government Unit</td>
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<td>Renstra K/L</td>
<td>Strategic Planning for Ministries/National Board</td>
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<td>Renstra SKPD</td>
<td>Strategic Planning for Local Government Unit</td>
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<td>RKPD</td>
<td>Local Government Annual Workplan</td>
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<td>RKP</td>
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<td>RPJM</td>
<td>Medium Term Development Planning</td>
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<td>RPJMN</td>
<td>National Medium Term Development Planning</td>
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<td>RPJP</td>
<td>Long-term Development Planning</td>
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<td>RTRW</td>
<td>Local/Regional Spatial Planning</td>
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<td>RWH</td>
<td>Rainwater harvesting</td>
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<td>SMA</td>
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<td>National Social Economic Survey</td>
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<td>UNDIP</td>
<td>University of Diponegoro, Semarang</td>
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<td>UNES</td>
<td>University of Semarang</td>
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<td>UNFPA</td>
<td>the United Nations Population Fund</td>
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<td>URDI</td>
<td>Urban and Regional Development Institute</td>
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UNFPA, the United Nations Population Fund, in cooperation with the National Population and Family Planning Board (BKKBN), the National Council on Climate Change (DNPI), Urban and Regional Development Institute (URDI), and Semarang City Government held a workshop in Semarang with the theme Population Dynamics and Climate Change in Indonesia on October 17-18, 2013. The purpose of this workshop was to disseminate the study on urbanization, demographic change and climate change in the Semarang metropolitan region to national and local stakeholders.

Jose Ferraris, UNFPA Representative in Indonesia, Suyono Hadinoto from BKKBN, and Hendrar Prihadi, Mayor of Semarang City opened the seminar by discussing the interaction between population dynamics and climate change issues. Farhan Helmy from DNPI provided the keynote speech on population dynamics and climate change in the Indonesian context. Climate change in Indonesia needs dynamic policy responses involving various stakeholders such as academics, investors, and other stakeholders. In addition, the investment needed to encourage green industry and green consumerism practices as well as creating new jobs.
The plenary session comprised of a presentation of the study conducted in Semarang City, by International Institute for Environment and Development (IIED) in collaboration with UNFPA and URDI.

David Dodman explained the research background and the main messages of the study:

a. The latest scientific evidence (5th IPCC Report, 2013) on climate change confirms it is important to understand more about climate change challenge;

b. Cities are increasingly vulnerable to the climate change impacts and have a very important role both through mitigation and adaptation activities;

c. Emerging policy responses can and should be strengthened through incorporating population dynamics into various areas.

Daniel Schensul presented on the importance of population dynamics in climate change vulnerability study and adaptation plans; new points of view in climate change adaptation discussion from types of activities to the role of stakeholders; and the new agenda to use population vulnerability and resilience data into adaptation plans on networking and capacity building.

Wahyu Mulyana explained climate change policy in Indonesia, both at national and local levels. There is a gap on climate change policy where most of the national policy focused to regulate specific sectors, but has not focused on population dynamics in the disaster risk management. The national policy challenge is how to address local needs contextually.

Sainan Zhang presented about the data used in the study, the census data and surveys. After compiling flood risk analysis in Semarang, Sainan integrated infrastructure data and survey data to the risk map to understand location-specific population vulnerability.

Wiwandari Handayani (UNDIP) and Heru Santoso (LIPI) provided commentary as discussants. Wiwandari explained that it is necessary to understand the urban sprawl and sub-urbanization phenomenon due to population density in Semarang for better understanding of vulnerabilities in Semarang metropolitan area. She also suggested considering the ground checking the secondary data to see the real conditions in the study area.

Heru Santoso commented on a better understanding about “risk area” and “susceptible hazard area”, how to use BNPB data, and noted that the study should take into account land use management and policy. Population dynamics in particular would explain social needs and vulnerabilities, and also determine the opportunities to develop population capacity: prosperity, education, culture and local wisdom, technology, institution. He also explained that adaptive governance is the key to manage climate change effectively.

The panel session had the theme Understanding Population Dynamics in Climate Change and Policy Responses. Purnomo Dwi Sasongko (Semarang Planning Board) explained that Semarang land use changed due to population growth and economic activity. Semarang also had climate change effects such as floods, tidal flood, drought, erosion, and abrasion. To counter the climate change effects, Semarang had developed several policies integrated with development planning programs. However, there was still need to include mainstream climate change issues in the development sectors and develop city networks to address climate change impacts.
Tri Dewi Virgiyanti (Bappenas) explained that the Medium Long Term Development Plan RPJMN 2010-2014 policies had contained climate change mitigation efforts in the sectors of food security, energy, environment and disaster management. Bappenas was involved in formulating the National Action Plan on Climate Change Adaptation (RAN-API) to strengthen mitigation action implemented through National Action Planning on Green House Gas (RAN-GRK). The local/regional climate change adaptation strategies in the RAD-API should be integrated into local development planning to mainstream climate change issues.

Prof. Adrian C. Hayes (Australian Demographic and Social Research Institute, Australian National University [ADSRI-ANU]) explained that policy makers must consider population growth, population aging structure, urbanization, and consumption. Population dynamics have to be considered to develop mitigation and adaptation strategies relevant to the areas and the governance level.

There were parallel discussions with three main topics in the second day of the workshop:

a. Implication of Population Dynamics for Reducing Risks to Disasters and Climate Change, which discussed about its members’ views and experiences on population dynamics including vulnerability and disaster risk reduction; the perspectives of education, health, social capital, and economic differentiation; and spatial policy to control population growth and productivity in order to deliver climate change adaptation.

b. Implications of Population Dynamics for Achieving Low Emission Climate Resilient Development explored issues related to population and emissions from fossil fuel for energy consumption, and discussed how low emissions targets should be set out in the spatial planning (RTRW) and development planning (RPJM and RPJP) policies at every government level to ensure its implementation and sustainability.

c. Integrating Population and Other Data to Support Climate Responses at National and Local Level discussed the data and database availability to support climate change and population data needs. Institutions need to work together in building an integrated population database related to climate change. Other data needs to be considered was GIS data because the capacity of the users’ needs to be improved for utilizing updated technology and data visualization analysis. Development of GIS data platform would be realized in developing a “One Map” concept.
WORKSHOP ON POPULATION DYNAMICS AND CLIMATE CHANGE
in Semarang, 17th - 18th October 2013
In his opening remarks, Jose Ferraris of UNFPA noted that Indonesia is experiencing major demographic changes, namely:
1) Population growth, which will continue for several decades;
2) Changes in population age structure with numbers in youth and working ages increasing;
3) Rapid urbanization; and
4) Changing socio-economic composition with a steadily growing middle class.

UNFPA's work focuses on what demographic changes mean for Indonesia in the future and helps the Government of Indonesia in facing the challenges and the opportunities arising from these changes.

The study of climate change vulnerabilities in Semarang is part of UNFPA's work on the links between sustainable development, population, climate change and the environment. In the first half of 2012, UNFPA commissioned a study that looked at the ways in which population dynamics may be contributing to climate change in Indonesia. Demographic factors such as urbanization, population growth, age structure, and the growth of the middle class are all interrelated to the causes of human-caused climate change. That study developed population-based policy options for the Government of Indonesia to consider as part of its strategy to reduce greenhouse gas emissions from the combustion of fossil fuels.
In the second half of 2012, UNFPA Headquarters and the International Institute for Environment and Development (IIED) collaborated with URDI on the present study. The study uses a fresh approach in considering climate change risks in the context of particular urban demographic trends such as population structure and geographical distribution, as well as size and growth rate. It also looks at how policy makers should consider population factors such as population density, education, employment, and household structure in the design of adaptation and mitigation strategies.

The results show some variations in the aggregated risk of exposure to the risks related to the climate change (such as flooding, landslide, and drought) with respect to demographic characteristics that influence the potential for communities to adapt to these risks (such as employment, education, and population density) in Semarang. The use of Geo-Referenced Information Systems (GIS) provides clear information will support coordinated efforts for policy makers and programme planners from various stakeholders, including the national and local governments, to address these identified vulnerabilities.

Access to data and information disaster risks due to natural hazards is a prerequisite for climate change adaptation planning. Using information on disaster risk, as captured in local and national disaster and population dynamic data, allows effective planning and prioritizing of adaptation action. In addition, National Disaster Management Agency (BNPB) head regulation No. 2 Year 2012 regarding risk assessment mentions the need to use population data in the vulnerability component of implementing the risk assessment. By linking population dynamics such as changes in age structure, migration and urbanization patterns to climate change mitigation and adaptation strategies, the effectiveness and efficiency of such measures will be strengthened.

Jose Ferraris noted that the next step is to replicate the study in other areas in order to develop local disaster risk reduction and management strategies. It is important to note that the Semarang case study has been developed from data collected as part of the 2010 Indonesian Population Census. What this means is that the raw data is ready for analysis and the study can be replicated for any area across Indonesia at low cost, providing significant benefits for existing vulnerability assessments and adaptation planning.
Suyono Hadinoto from BKKBN explained that the population dynamics and climate change has been considered in various international forums such as the United Nations Conference on Sustainable Development in Rio de Janeiro, Brazil. However, the role of population dynamics is not fully considered in policy direction on climate change at the international and national levels.

As the fourth most populous country, Indonesia had faced various challenges on population. Population growth rate above 1% over the last five years has led to significant impact on regional development as well as natural degradation, which is more difficult to control. In term of the climate change context, it is important to pay more attention on fast-growing areas such as urban areas and vulnerable areas on climate change impacts such as coastal areas and high slope areas.

The 2010 Indonesia Population Census showed that more than half of the Indonesia population (± 130 million) lived in urban areas; it is projected to increase by 50 millions for ten years, with 67% of Indonesia’s population living in urban areas by 2025. This could lead climate change due to higher emissions of greenhouse gases. Urban areas are also highly vulnerable to climate change because of its density and the various socio-economic conditions, which may reduce the adaptation capacity.
BKKBN according to the mandate given in the Law No. 52 Year 2009 on Population Development and Family Planning is expected to accommodate the strategic issues of global change on population and economic development, which had been agreed by the Government of Indonesia in the International Conference on Population and Development (ICPD) and the Millennium Development Goals (MDGs). These issues include:

a. Population and sustainable development linkage;
b. Population quality and preparation for the next generation;
c. Decentralization on population development;
d. Participation and stakeholder awareness in the population and family planning development; and
e. Partnership between Central Government, Local Government, NGO and Civil Society Organization

Sunyoto stated that population could become one of the key factors to climate change. Therefore, there is a need for efforts to strengthen the policy, planning and population control programs in line with the climate change framework, particularly in highly vulnerable areas. The results from the study and the workshop are expected to support the formulation of population and family planning policies and strategies in the framework of the RPJMN III 2015-2019.
The Mayor of Semarang City, Hendrar Prihadi, said that Semarang had experienced impacts of climate change, including:

a. Sea level rise causing abrasion, flooding, and tidal flood in coastal areas and low elevation in urban areas; causing fishermen and fish farmers to lose their livelihood.

b. Limited adaptability to face climate change had disrupted population welfare, especially for the poor, particularly for women and children;

c. Urban infrastructure has been damaged and industrial activities have been paralyzed because of floods and sea level rise that affected city investment;

d. Lack of clean water because of tropical drought, but had flooding because of heavy rain.

Semarang has made various efforts to deal with climate change impact by formulating Vulnerability Assessment of Climate Change Impacts and establishing the City Resilience Strategy since 2009. The City Resilience Strategy is strategic planning in order to carry out climate change adaptation. The document has been synergized with local development planning (RPJMD) and spatial planning (RTRW), and gradually would be implemented into development programs. Recently, the document has become one of best practices for other cities in Indonesia and cities abroad to deal with climate change. Through the document, Semarang also received funding commitment from central government and international donor agencies.

Prihadi also mentioned several programs related to climate change, including:

a. Water resource management programs, such as building reservoirs, canals normalization, building polder, urban drainage normalization, building ponds, rainwater harvesting;

b. Capacity building programs, through poverty alleviation, improving community qualities, economy empowerment;

c. Energy efficiency programs, through using solar cell and LED for streetlights, energy-saving building regulations, car free day, mass transit transportation (BRT), and emissions evaluation for vehicles;

d. Green open space program through increasing gardens, developing critical land, and mangrove planting;

e. Integrated waste management program, through improving Jatibarang landfill quality, and development of an integrated waste treatment facility; and

f. Urban environment management program, through urban renewal, slum alleviation development; and

g. Other programs related to climate change mitigation and adaptation.
Farhan Helmy from DNPI replaced Rachmat Witoelar (Chair of DNPI) who could not attend the workshop but provided the following remarks on strategies to face climate change in Indonesia, which include:

a. building an open platform and transparent process, which involves universities, funding agencies, communities, and some institutions in decision-making process.
b. promoting “One Map Initiative” coordinated by BIG to supply the data and information needed, so that with data and information in one format, the decisions taken would be effective.
c. encouraging “Open Platform” policy to access all the data and information.

In his presentation, Farhan Helmy mentioned his framework on 4 topics. First, he stressed the challenge to cope with climate change impact in Indonesia by adapting the climate change based on the 5th IPCC report. Implications of population dynamics in the climate change could be described by the equation of GHG emission affected by population parameters, economic output (GDP per population), energy intensity per economic output, and emissions arose from energy used.

Based on UNFPA projections, Indonesia’s population trend in 2020-2030 would be dominated by those in productive age (15-64). The productive age composition would be meaningful if it can drive significant economic growth. In relation to climate change:

a. There is a long-term dimension to climate change impacts, adaptation, mitigation which needs a comprehensive and systemic approach with coherent and consistent implementation stages supported by the robust institutional arrangement (technology, institutional capacity and financial sources).
b. Transformation towards green economy based on the lowest carbon-footprint but highest economic benefit and co-benefit for the community.
c. Stakeholder engagement was important in every level of governance (national, sub-national)
Secondly, the integration of adaptation and mitigation policies must be supported with:

a. Policy development supported with scientific data for building appropriate scenarios in order to be better prepared, and policy development processes that establish a facilitative environment for dialogue and enabling conditions;

b. Economic integration and internalization in every development sector; and

c. Effective and efficient actions to be measured, reported and verified.

In the context of climate change adaptation and mitigation, Government of Indonesia had proceed the three important stages, namely:

a. Action: effective, efficient low carbon development scenarios through National Action Plan (RAN/RAD GRK, RAN-API)

b. Governance: evaluation and monitoring through a robust MRV system and key stakeholders engagement in inclusive manner through National GHG Inventory System

c. Market and non-Market Approaches: finding the effective and efficient mechanisms and a robust institutional arrangement.

The stages required a solid interaction of science, policy and investment into consideration of policy development framework.

The National Action Plan focuses on emission reduction, forest and peat lands as the top priorities. However, if economic contribution was the main focus, then other sectors need to be considered giving emission levels are influenced by population dynamics.
TABLE 1.
Proposed National Action Plan on GHG Emission Reduction (RAN-GRK)

**NATIONAL ACTION PLAN.** Indonesian emission is expected to increase from 1.72 to 2.95 GtCO2e (2000-2020). Proposed National Action Plan on GHG Emission Reduction(RAN-GRK) consist of 70 programs distributed among various sectors.

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Emission Reduction Plan (Giga ton CO2e)</th>
<th>Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26%</td>
<td>15% (total 41%)</td>
</tr>
<tr>
<td>Forestry and Peat</td>
<td>0.572</td>
<td>Ministry of Forestry, Ministry of Environment, Ministry of Public Works, Ministry of Agriculture</td>
</tr>
<tr>
<td>Waste</td>
<td>0.048</td>
<td>Ministry of Public Works, Ministry of Environment</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.008</td>
<td>Ministry of Agriculture, Ministry of Environment</td>
</tr>
<tr>
<td>Industry</td>
<td>0.001</td>
<td>Ministry of Environment, Ministry of Industry</td>
</tr>
<tr>
<td>Energy and Transportation</td>
<td>0.038</td>
<td>Ministry of Transportation, Ministry of Energy and Mining, Ministry of Public Works</td>
</tr>
<tr>
<td></td>
<td>0.767</td>
<td>0.422</td>
</tr>
</tbody>
</table>

Thirdly, he presented research findings on modalities implemented at national and local level. The findings from DNPI research proposed energy efficiency and redefined the importance of the family planning program. DNPI had identified some economic activities which increase additional value for the community with low emissions. Exercises that have been undertaken in developing low-carbon growth plan in three provincial governments show that low carbon growth has not been reflected in the traditional spatial planning process.

Declining forest in Borneo since 1990 was one of population dynamic example. It needs to be reviewed whether the declining had implications for the economic growth or not.

There are a lot of projects could be mobilized as potential funding on climate change.
Fourthly, he encouraged the effort to mainstream the population dynamic and climate change policy at the national and local level because there are many challenges ahead, namely:

1. The agendas of the next Indonesian presidential election in 2014 and the International Agreement in 2015 need to be translated into national and sub-national policies to keep climate change issues linked with population dynamics and it will be necessary to develop strategic policy measures and capacity building to respond on-going institutional dynamics (including to broaden stakeholder engagement in decision-making process i.e. public-private schemes).

2. Indonesia should give a long-term signal on policy directions through commitment as well as public and private engagement to deal with climate change in addition to the NAP on GHG.

3. Investment certainty to drive a green economy and create new opportunities for highest value sectors such as green jobs, green industry, and green consumerism.
SEMARANG CASE STUDY
This session was moderated by David Dodman (IIED) with presentations from Daniel Schensul (UNFPA), Wahyu Mulyana (URDI), and Sainan Zhang (UNFPA) on the results of the study on population dynamics and spatial analysis to climate change vulnerability in Semarang Metropolitan Area. The purpose of this session was to explain and discuss the methodology, findings, and implications of the research on demographic and climate change adaptation in Semarang.

Recent Insights on Climate Change – The Importance of Population Dynamics and of Cities

Mr. David Dodman
International Institute of Environment and Development (IIED)

David Dodman began his presentation by explaining three main messages of the research background to understand population dynamics and climate change, and how the findings of the research results were obtained. The messages are:

a. The newest scientific evidence on climate change confirms the continued importance of furthering understanding of climate change as a challenge faced by the world in the 21st century;

b. Cities are increasingly recognized as vulnerable and have vital roles as key responders to tackle the climate change both with adaptation and mitigation; and

c. Emerging policy responses can (and should) be strengthened through incorporating population growth and population dynamics.

The 5th IPCC report in 2013 showed a new perspective on climate change what was previously thought. Dodman compared the projected global temperature rise with low emission scenarios based on the IPCC reports in 2007 (AR4) and the 2013 (AR5). IPCC report on 2007 showed unexpected temperature rise between 1.5°C to 4°C in global average temperature by 2100. In the high emission scenario, the 2013 report had increased certainty and continued to show a high anticipated temperature rise (with only a slightly downward reduction in the previous estimate) (See Figure 4).

The IPCC report used four different scenarios on projecting high temperature rise and showed, based on the current state of negotiations and level of global political commitments, that climate change is indeed a reality that must be addressed.
Another consideration is the worst scenario is the sea level rise. In the 2007 report the assessment was already between 18 and 59 cm of sea level rise globally by 2100. But in the 2013, the estimation increased significantly. Therefore, there need to revise climate change policies referring to the 5th IPCC report. This topic will be explained further in the next presentation about vulnerabilities on low elevation coastal zone.

FIGURE 4
Projected Global Sea-Level Rise

Source: Dodman’s slide presentation on the workshop
In his presentation, Daniel Schensul mentioned the importance of incorporating population dynamics in climate change vulnerability assessment and adaptation planning. Viewpoint changes in climate change adaptation must include discussion of what types of activities are required, which stakeholders can play a role, and plans for the use of vulnerability and resilience data of the population as an adaptation plan to build networks and capacity.

Definition of population dynamic discussed in this workshop is change in total population, dispersion based on age, spatial dispersion (including urbanization), density, household composition, and other variables including fertility, mortality, migration and family formation.

Definition of vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity. [Intergovernmental Panel on Climate Change (2007)].

Incorporating population dynamics into adaptation can help in understanding who is the most vulnerable, why, and how to target policies to decrease that vulnerability.

The key to population adaptation is understanding population dynamics and linking changing vulnerability to changing population size, composition and characteristics. We already know that cities are constantly changing, so we have to deal with it through adaptation. The first is “Indirect adaptation”: a broad intervention to build resilience at the intersection of population dynamics and development, because the world is growing to 2.5 billion new urban residents in the next 40 years, we have to think about where they live, what they do will conduct adaptation, mitigation, and development. The second is “Direct adaptation”: age structure, migration, and spatial distribution/urbanization are at the core of vulnerability and efforts to reduce it. On direct adaptation we need to know the size, density, composition and characteristics, current and projected of populations in climate-exposed areas.

In discussing urbanization and climate vulnerability, we are facing a population phenomenon in which people are becoming vulnerable. About 360 million people in urban area live in Low Elevation Coastal Zones in 2000 (Mcgranahan, Balk and Anderson
Coastal cities continue to attract people. This causes the increase in inequality; enormous variations in vulnerability and impacts within cities, within exposed areas. Most people live in secondary and tertiary cities that may have more limited capacity and resources for climate change solutions. This phenomenon could be challenges of governance to anticipate people who have not yet come to the city besides facing the impact of climate (See Figure 5).

Definition of exposure from Hardoy and Pandiella (2009) is: who lives or works in the locations are most exposed to hazards related to the direct or indirect impacts of climate change; who lives or works in locations with lack of infrastructure that reduces the risk; and whose homes and neighborhoods face greatest risks when impacts occur?

Adaptive capacity looks the knowledge, capacity and opportunities to take immediate short-term measures to limit impacts, people who are least able to cope with impacts, and people who are least able to adapt to avoid impact (Hardoy and Pandiella, 2009).

The data and methodology used for adaptation is census mapping data. Spatial analysis is crucial to harmonize geographic impact. The census is used because it is universal and it provides a high-resolution data set on the population and its characteristics. The data available in the census includes: population size and density, age by sex, household structure, education, occupation/employment, housing quality, service access, migration status which is vital for adaptation planning. The analytical method used is basic but powerful and replicable instantly across the country (and in other countries).

**FIGURE 5.**
Urbanization and Megacities

![Source: Schensul’s slide presentation on the workshop](image-url)
The approach taken is quite simple, but provides maximum results. The study was conducted by comparing the data layer of population, geography, disaster maps and other spatial data. In addition there are supporting data such as the distribution infrastructure, land use patterns and satellite image data.

**FIGURE 6.**
Layering Data

Source: Schensul’s slide presentation on the workshop
Demographic trends in Indonesia include urbanization and the urban population growth as a result of rural-urban migration patterns.

Indonesia has a high vulnerability to climate change as indicated by amount of coastal area, the number of natural disasters, and agricultural production systems.

Indicators of climate change include rising surface temperatures, changes in precipitation patterns, rising sea surface temperatures, rising sea levels, and extreme climate events. In addition, Indonesia has experienced an increase in the frequency of severe climatic hazards include: floods and tornados being about 70% of all disasters with drought, landslides, forest fires, heat waves, storms and other weather events accounting for 30% (ISET, 2010). Between 2003 and 2005, there were 1,429 disasters in Indonesia, with approximately 53% hydro-meteorological disasters (BAPPENAS and Bakornas PB, 2006).

FIGURE 7.
Indonesia Population Trend
Like the general conditions in Indonesia, Semarang is also experiencing a similar phenomenon. Semarang is vulnerable to the hazards associated with climate change because it has a low coastal plain, seawater intrusion, land subsidence, landslides, and tornados. The focus of this research is the area of Semarang City and Semarang Municipality.

The population character for the research are about 2.5 million people; high population concentrations (more than 23,000 people per km²). About 1 million people live in rural district, which lies in the south of Semarang city. Rural population densities tend to decline. Most of the population is still relatively young (42.55% under 25 years old) and the average age was 29 years (BPS-Statistics Indonesia, 2010). Approximately 8% of the population aged is over 60 years old. Recent migration from Central Java has been limited (1.74% had been living outside Central Java 5 years ago). Most of the migration in Semarang City is regional migration, i.e. migration into cities from rural areas close to the city (22%). In terms of livelihood, of the working-age population, more than 57% work for one week before the 2010 census BPS-Statistics Indonesia, 2010) and about 83 % work in non-agricultural industries.

**FIGURE 8.**
SMA Population Growth

Location-based local adaptation planning is very important because Indonesia has risk from climate change, from east to the west and from island to island. It is also important due to the differences in geography, culture, and environment, social, economic, and political context between regions. Decentralization also provides a challenge and an opportunity for local governments to respond to climate change. In the local scope, location-based adaptation planning is very important to consider.

Climate change in Semarang leads to the changes in air temperature and precipitation trends (CCROM - IPB, 2010). The increase in the average monthly surface air temperature over the last 100 years is based on the extracts data from the Climate Research Unit (CRU) for the period between 1901 and 2002. There were significant changes in rainfall at the beginning and the end of the season, as well as changes in the frequency of extreme events. Between 1985 and 1998, Semarang coastal areas experienced the rising of sea levels (Government of Semarang, 2010), with the increasing rise between
0.4 m and 0.8 m projected for the next 100 years. Average sea level rise inundation area will expand between 1.7 km and 3 km inland.

The most vulnerable community groups and areas in Semarang are: the low-lying areas exposed to floods; coastal areas that are exposed to sea-level rise; residential areas located on the river banks exposed to catastrophic flooding; hilly areas exposed to high winds; disaster areas exposed by landslides; settlements on the suburbs with shortage of water resources and transportation (i.e. airports, ports, railway stations, and terminals; business center (in the field of trade and industry), as well as historical and cultural assets of the region (i.e. Kawasan Kota Tua Semarang)

**TABLE 2.**
Climate Hazard and Vulnerability in Semarang

<table>
<thead>
<tr>
<th>Climate hazard</th>
<th>Tidal flooding</th>
<th>Coastal erosion</th>
<th>Drought</th>
<th>Landslide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vulnerable areas</td>
<td>Coastal areas and river banks: Tugu, Kemijen, Banderanjo, Panggung Lor, Dadeepati, Gunungpati, Gayamseri, Genuk, Pedurungan</td>
<td>Coastal areas: Tapak, Sukorejo</td>
<td>Upper area of Semarang (hilly): Tandang and West Semarang</td>
<td></td>
</tr>
<tr>
<td>Affected sectors</td>
<td>Fisheries and fishery ports; small industries; transportation; housing; tourism; agriculture; public service</td>
<td>Fisheries; energy delivery infrastructure (electricity towers); tourism; ecosystem (mangroves); coastal residences</td>
<td>Agriculture; health; industry; forestry; housing</td>
<td>Housing; transportation</td>
</tr>
<tr>
<td>Most vulnerable groups</td>
<td>Slum settlements; fishermen; women; entrepreneurs; farmers</td>
<td>Fishermen; those dependent on tourism</td>
<td>Poor residents; entrepreneurs; farmers</td>
<td>Poor residents</td>
</tr>
<tr>
<td>Key issues that worsen impact</td>
<td>Poor waste management; inadequate drainage; unemployment; insecure tenure; destructive fishing practices; salinization; lack of clean water supply; lack of early warning system</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Mulyana’s slide presentation on the workshop

The research in the vulnerability assessment is:

a. Completing the previous research to set a comprehensive spatial vulnerability assessment of all of Semarang and highlight those areas with relatively high risk in conjunction with relatively high vulnerability.

b. Using geographic data to examine the spatial distribution of hazard exposure, demographic and infrastructural factors.

c. Understanding the spatial overlap between these dynamics to identify vulnerable areas and factors shaping that vulnerability.

d. Providing important information for determining the target efforts at increasing adaptive capacity, and the types of resources needed by the communities to reduce vulnerability.

Climate change has become a major issue of concern for the Government of Indonesia. The national government still needs to play a significant role in increasing adaptive capacity. Some policy documents have been developed to guide the effort on addressing climate change issues in Indonesia: RAN MAPI (2007); Yellow Book (2007); ICCSR (2010); RAN GRK (2011); Draft RAN API (2013). Most policy documents generally focus on the needs of specific sectors, and have not yet examined population dynamics in relation to hazard risks. Significant challenge for national policy is overcoming the local need contextually.
The local government has important role in handling the climate change issue. There is a problem of coordination in the government at all levels, especially in planning and executing climate change adaptation policy. Co-operation among local governments in Semarang is limited in terms of planning and development, especially to handle consequences of climate change by considering the high number of commuters in Semarang. Co-ordination is necessary not only across levels of government but also between governments and other stakeholders. Establishment of the City Team of Semarang will strengthen capacity local stakeholders and improve coordination around climate change issues.

The City Team of Semarang is responsible for managing and coordinating climate change-related activities of several agencies that can be seen in the table below.

**TABLE 3.**
The Semarang City Team

<table>
<thead>
<tr>
<th>Local Government</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Local Development Planning Board (Bappeda)</td>
<td>• Universitas Negeri Semarang (UNES)</td>
</tr>
<tr>
<td>• Environmental Protection Agency (BLH)</td>
<td>• University of Sugiyapranata, Human and Building Institution</td>
</tr>
<tr>
<td>• Health Agency</td>
<td>• Urban and Spatial Planning, Diponegoro University</td>
</tr>
<tr>
<td>• Water Management, Energy and Mineral Agency</td>
<td></td>
</tr>
<tr>
<td>• Fire Rescue Agency</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NGOs</th>
<th>Private Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bintari (Bina Karta Lestari Foundation)</td>
<td>• PT Aqua Farm</td>
</tr>
<tr>
<td>• Care Environmental Organization (CEO)</td>
<td>• PT Djarum Peduli Lingkungan</td>
</tr>
<tr>
<td>• Semarang Climate Change Forum (FPPI)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Mulyana’s slide presentation on the workshop

The example case studies in the vulnerability study are the village of Tanjung Mas, located in the northern part of the research area overlooking the Java Sea, and Tugurejo village, which is located slightly to the west of Tanjung Mas. Tugurejo and Tanjung Mas are considered potentially vulnerable to the impacts of climate change (low STI and medium levels of risk for flood and drought). These two villages have very similar population structures, but their housing conditions are quite different. In Tugurejo, a higher proportion of households use charcoal or wood for cooking and lack piped water. In Tanjung Mas, a higher proportion of households lack improved toilet and have an earthen floor. Tugurejo also faces a medium-high risk of drought, and a lack of piped water may exacerbate vulnerability to the impacts of droughts. Efforts to address the vulnerability of these villages have had significant impacts.

Examples of mitigation projects include pilot projects to plant mangroves and construct breakwaters to reduce the local impacts of climate change in Tugurejo. More than 20,000 mangrove seeds have been planted, and 120 meters of breakwater have been constructed from used tires in the coastal areas of Tugurejo. This project has increased attention on climate change impacts, and improved the local community’s capacity to organize through community groups, co-operate with city stakeholders, and preserve mangrove conservation.
Lessons learned from Tanjung Mas Village and Tugurejo are:

a. Social relationships and kinship networks among communities are important in adapting to climate change hazards in vulnerable areas.
b. Residents are able to work together to address the impacts of large-scale disasters, and to protect, care for, and preserve the existing environment to mitigate the impacts of future disasters.
c. The availability of resources can at times constrain individual and community-based efforts at adaptation.

The cases described above highlight the importance of a community-level analysis of vulnerability; and of supplementing hazard, demographic and infrastructure data with fieldwork or additional data collection that explores the additional social dimensions of vulnerability and adaptation that are not collected in currently available secondary data sources.

**TABLE 4.**

Vulnerability in Tugurejo and Tanjung Mas Village

<table>
<thead>
<tr>
<th>Climate change risks</th>
<th>Tugurejo village</th>
<th>Tanjung Mas village</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low elevation coastal zone (LECC)</td>
<td>Within</td>
<td>Within</td>
</tr>
<tr>
<td>Flood risk level</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Drought level</td>
<td>Med-high</td>
<td>Medium</td>
</tr>
<tr>
<td>Landslide risk level</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Population indicators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total population</td>
<td>6560</td>
<td>27,801</td>
</tr>
<tr>
<td>Population density</td>
<td>1085.0</td>
<td>7742.2</td>
</tr>
<tr>
<td>Female-headed households (%)</td>
<td>13.8</td>
<td>16.1</td>
</tr>
<tr>
<td>Children aged 0-9 (%)</td>
<td>15.0</td>
<td>14.8</td>
</tr>
<tr>
<td>Population aged 10-14 (%)</td>
<td>8.5</td>
<td>8.0</td>
</tr>
<tr>
<td>Population aged 60+ (%)</td>
<td>5.4</td>
<td>6.1</td>
</tr>
<tr>
<td>Population that has never/not yet attended school (%)</td>
<td>3.8</td>
<td>3.6</td>
</tr>
<tr>
<td>Population currently attending school (%)</td>
<td>25.0</td>
<td>22.7</td>
</tr>
<tr>
<td>Population no longer attending school (%)</td>
<td>71.2</td>
<td>73.8</td>
</tr>
<tr>
<td>Population who have completed junior high (%)</td>
<td>61.1</td>
<td>55.3</td>
</tr>
<tr>
<td>Migrants (%)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Dependency ratio</td>
<td>42.2</td>
<td>42.7</td>
</tr>
<tr>
<td>Household indicators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total households</td>
<td>1569</td>
<td>7233</td>
</tr>
<tr>
<td>Households with earthen floor (%)</td>
<td>3.6</td>
<td>8.5</td>
</tr>
<tr>
<td>Households with charcoal/wood for cooking (%)</td>
<td>3.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Households without bottled/piped water (%)</td>
<td>60.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Households without an improved toilet (%)</td>
<td>13.0</td>
<td>41.0</td>
</tr>
<tr>
<td>Households without a phone (%)</td>
<td>7.9</td>
<td>10.0</td>
</tr>
<tr>
<td>Households without internet (%)</td>
<td>73.2</td>
<td>81.9</td>
</tr>
<tr>
<td>STI</td>
<td>75.4</td>
<td>85.3</td>
</tr>
</tbody>
</table>

Source: Mulyana’s slide presentation on the workshop
In her presentation, Sainan Zhang said that research on urbanization, demographics, and Adaptation to Climate Change in Semarang used population census data and surveys to make a climate change adaptation plan. The indicator used is specific hazard vulnerability to climate change and common indicators of vulnerability to climate change at the state level, city/agglomeration, communities’ households and individual.

In this study, the team identified some areas that are exposed to the risks of climate change; made sensitivity analysis - indicators of population census data; integrate data and survey infrastructure; determined the villages most vulnerable and create a complete profile of the village to improve adaptive capacity.

FIGURE 9.
Layers of Vulnerability / Adaptive Capacity

Source: Zhang’s slide presentation on the workshop.
After creating a flood risk analysis in Semarang, the team performed the integration phase between the data infrastructure with survey data. Survey data obtained from the study area includes population density and flood risk data, the average proportion of adolescents aged 10-14 years, the proportion of people aged 60+, the dependency ratio, the proportion of female-headed households, and security index. Data about infrastructure facilities included hospitals, schools and spatial distribution.

Infrastructure data and survey data were integrated to obtain the information about the vulnerable villages. Map of the vulnerable village can be seen in the figure below.
After determining the vulnerable villages, the next step is to create a profile of each village using data that had been collected and layered. As an example, the profile is in the Tanjung Mas and Tugurejo village. Village profiles can be seen in the table below.

TABLE 5.
Full Profiles of Tugurejo Village and Tanjung Mas Village
The lesson learned from this study is that including population dynamics in climate change adaptation can help to understand who the most vulnerable, why, and how to set up policies to reduce the vulnerability.
The discussion presented by Wiwandari Handayani focuses on:

1. Spatial perspective on urban sprawl phenomenon in Semarang Metropolitan Area (SMA),
2. Demographic perspective, how spatial perspective implicated to demography in SMA and surrounding areas, and
3. Linking the two contexts on vulnerability context to climate change in SMA.

Wiwandari started discussion about selection of study area in the SMA that should consist of Semarang City, Kendal, Demak, and Semarang Municipality. But the study area in the previous presentation only consists of Semarang City and Semarang Municipality. She said she understands that the selection of study area has been considered by the team of researchers within the constraints of time and research resources.

From the spatial perspective, when discussing SMA, it cannot be separated from the urbanization process (urban sprawl) with a diffuse pattern, not compact. Many land conversions occurred to the east direction, Demak. If vulnerability is also visible in the urbanization process, then it will be the case not only from the administration area as done in this study, so the research results will be different.

From a demographic perspective, which took population density and urbanization as indicators, SMA experienced the urban sprawl with low-density characteristics in central city and experienced the suburbanization with the highest concentrations in suburbs. If it is not seen with the administration approach, SMA population actually had been declining. Conversely, if viewed from administrative data, Semarang City and Semarang Regency are the city with the highest population amount. However, it doesn’t represent all SMA.
On vulnerability, the phenomenon of urban sprawl and sub-urbanization should be considered as an important input in analyzing vulnerabilities in SMA. This study will be very interesting if it could combine based data administration with sub-urbanization phenomenon since the urbanization process in the urban already occurred as a result of migration to suburbs.

For disaster cases, the disaster-prone areas are in urban fringe areas, with a growing population dynamics and a high rate of urbanization. The dynamics need to be understood more deeply related to the adaptive capacity facing the climate change.

Related with the data used in this study, Wiwandari proposed to combine secondary data with ground checking, so it can represent the real conditions on the ground with the verification of the primary data. So many studies have been conducted in Semarang, which will enrich and provide relevant input data on climate change in Semarang.
Heru Santoso explained the importance of understanding the population dynamics and climate change. The population dynamics (not limited to total population and its growth) has an important role in mitigation and climate change adaptation. Understanding the relationship between population dynamics and climate change will sharpen the response to climate change in terms of mitigation and adaptation. Related stakeholders need to also understand policy options for responding climate change. Some options are: energy efficiency and decreasing the intensity of carbon emissions; preventing encroachment; family planning programs; investment for sustainable development for the younger generation; promoting development to alleviate the poverty (basic needs, health, education, etc.) for adaptation capacity.

The research discussed at the workshop systematically emphasized a community vulnerability identification process, discussion on factors of vulnerability, and accomplish some goals in vulnerability assessment. Demographic data and other census data were used to find information that builds sensitivity, individual and communal adaptive capacity to overcome the vulnerability effectively.

The key message from Sainan Zhang’s presentation is that policy should look at the “hazard susceptible” area rather than “risk” area. We should clarify the difference of using that term in the research.

In this research, there is a need to differ whether to focus on climate change or to climate variability (climate change sensu stricto, or general climate). The research had used the data from BNPB, which is not based on climate change projections. The result will be different on project budgeting. Some donors will only support to finance climate change adaptation project, therefore there is a need to clarify the issue of data sources used.
What is missing in this research is how management and policy on land could cause the vulnerability. This aspect has not been discussed thoroughly.

The approach used is the layer model as the figure below.

**FIGURE 13**
Layer Model of Landscape System

This layer model is the conceptual approach to understand how leaders changed the condition and landscape system pressure. If it is not carefully managed, the increase of economic activity demands on land will cause the changing of base layer, for example land conversion. The policy (on the network layer) is able to realize or to limit the changing of base layer.

The increase of basic needs on land resources (for example occupation layer) generates pressure on the base layer, which can affect ecosystem performance. The government is obliged to control the change in minimizing impact on the base layer, or to use the opportunity of changes.

Climate change will accelerate the change of the base layer and other layers. The stakeholders at the occupation layer should have enough capacity to adapt to negative impact, or to take the advantage of the situation. The stakeholders on the network layer (the government) should have the capacity to assist the occupation layer in adaptation.

Some examples of policies/regulation to control ecosystem performance and green house emission: intensification of land resources, preventing deforestation, urban planning and design for energy efficiency, sustainable development, and eliminating development impact (to the environment and ecosystem).

The second approach is the inter-correlation of social economic systems to understand the emergence of supporting factors for vulnerability caused by a changing environment and ecosystem performance.
Principles or Scope Area – should look at:

P1: Changes in the environment and/ ecosystem performance, to assess the vulnerability of ecosystem performance on climate change and climate variability.

P2: Suburban community as individuals and as a group that depends on the ecosystem, to assess the community vulnerability on the changing of ecosystem performance or climate threat.

P3: Management capacity to overcome the hydro-meteorological threats, to assess adaptation capacity of the community system and the management of the government to minimize the loss or the change of ecosystem performance or meteorological threat.

Variation in population dynamics affects sensitivity and adaptive capacity system on P2 and P3. The vulnerability of the community gives affects the change of ecosystem performance and meteorological threat. The adaptive capacity of the community system and the governmental management could be improved to minimize the loss or change of ecosystem performance or meteorological threat.

The conclusion of the discussion is that population dynamics explains the condition in the site, especially on the pressure of need and social vulnerability and the availability of opportunity (population capacity: welfare, education, culture and local wisdom, technology, institutions). The second conclusion is that adaptive government is the key to execute the improvement to make climate change effort more effective.
Questions and Comments

Sumaryono (BiG)
1. The map used in the study must be national standard in order to avoid any mistakes and could be synchronized with other planning maps. The research approach had used disaster and adaptation approach, which in one side vulnerability is a dependent factor and the other, independent. How to respond those different approaches and combine them?
2. Sometimes social analysis using regional administrative approach has misleading results. Therefore, the data must be verified and the social map needs to be clarified to make it clear in relation to urban sprawl. Statistic data conversion has been widely used in many studies. But how to convert the social map with the administrative boundary into field verification must be reviewed.

Ani (Bappenas)
1. Are there any findings to identify social aspect e.g. from the trend of population growth, we could justify their family planning program? This could be useful for local government in formulating the population planning and vulnerability planning for disaster.
2. Based on climate conditions in Semarang and surrounding areas, the research team could also identify and give linkages between economic activities and population dynamics. By knowing social profile such as livelihood, it could be possible to identify economic background and its impact to climate conditions, so that we could determine preventive action plans to deal with climate change impact.
3. In the future, UNFPA programs should focus on the population dynamics and concerns more on strategic aspects in national or local level, in order to use the inputs for the national development plan (RPJMN).

Farhan Helmy (DNPI)
1. This study had limitations with data collection. By using administrative approach, its analysis had less accurate results. GIS remote sensing method has new improvements to link people and pixels. This technology could be used to identify land use and its characteristics, and the results could be more accurate.
2. This study should be enriched with an analysis of what causes population and spatial dynamics and needs to determine more about climate change threats in the future.
3. Adaptive government was one of the findings in the policy aspect - what factors could be used by Semarang City to build adaptive governance to address climate change?
4. This study needs to mention the data used and its source to determine the quality of the data.
Answers

Wahyu Mulyana (URDI)
About the study area, there was some discussion to include all Kedungsepur as study areas, but the scope was limited by resources and time frame, so Semarang city and Semarang district were selected as study areas. Discussing metropolitan area related to urbanization had many constraints because it is difficult to define urban as functional areas. The challenge was how to convert census data to describe the functional area.

Related to climate change policies and strategies, Wahyu explained that adaptation policy at local level still needs to be encouraged. This depends on the initiative and capacity of the city. The approaches used in the study could become a driving factor for the cities to integrate climate change approach in their development policy and strategy.

Daniel Schensul (UNFPA)
Daniel explained that the climate change adaptation capacity at the national level had strong position, but it had not been explained into local and household level. The concept to link between population with pixels and also governance would become an input for the next study. Daniel also agreed with the limitation on administrative approach in the study. In the further study, Daniel will try to identify the social conditions.

Sainan Zhang (UNFPA)
Responding of the questions and suggestions for the study, Zhang stressed that the study focused on how to identify important indicators on population and climate change and was used to identify which villages are the most vulnerable to climate change with high density.

Zhang explained that there are many differences in the village data so that the study used administrative approach. The best solution was using primary data. But it would be difficult to measure climate change vulnerability for each person.

David Doman (IIED)
David summarized the plenary discussion. He mentioned that the data was dynamic, both for climate change and population dynamics. He summarized the plenary in 3 main points:
1. It is important to measure population dynamic due to climate change impact
2. It is important to identify driving factors of population dynamics and climate change. The study had used land tenure data, governance, and household quality, to clarify the results.
3. The data collected in the study was used as much as possible. It used climate change data, not the climate variability

David expressed that using remote sensing data was another alternative that can be used to provide detailed and accurate information. In addition, coordination and collaboration of the institutions that collect the data need to be strengthened to obtain complete information.

The important message from the plenary session was how to use and implement the result study in local planning (particularly at sub-district level). As a follow up, the government should formulate the integration of the study result into their development planning.
POLICY RESPONSE TO CLIMATE CHANGE
Semarang City Resilience Strategy: Increasing Community Resilience on Climate Change Impact

Mr. Purnomo Dwi Sasongko
Semarang Local Government Board

Semarang as the capital city of Central Java Province is strategic because its location in the middle of north coastal area. The high mobility of Jakarta city and West Java to East Java and the other way around passing Semarang city is the good opportunity for Semarang city to grow. The potential of seaport, airport, train, railway and primary artery road give the possibility for Semarang city to be a world trade node and national service.

Topography of Semarang city consists of coastal area and flat area on the north and hilly area on the south. The distance between coastal area and the hilly area is about 20 km. The flat area in Semarang city is 0.6m below sea level, and the hilly area is about 328m above sea level.

To review the condition of Semarang city in 30 years, Semarang city has experienced the transforming of land use from green area to high density settlement areas. Semarang city was dominated by green area in the era of 70s. As the development of the urban area in 1990s, the settlement area (housing) in the city center became congested. Later in the era of 2000s, the built area has expanded to the north, west, east and south. This caused the decreasing of green area in Semarang city. (See Figure 15)

Purnomo said that Semarang city has experienced impacts of climate change such as flooding, tidal floods, erosion and abrasion. The direct impact of flooding is damage and loss of property, crop failure, and the disruption of transportation. The direct impact
of tidal flood is increase of salinity, water well pollution, disruption of the business sector, and damage to buildings. The direct impacts of drought are crop failure, lack of water, and loss of lives. The direct impact of erosion and abrasion threat is the damage of houses and buildings, the damage of urban infrastructure, and loss of lives. The abrasion threat is very bad in Semarang city because 1.6 km of the coastal area was eroded by seawater. There are also some indirect impacts of climate change such as unemployment, the inflation, epidemic diseases, migration, increase of crime, decrease of urban investment and changing of livelihood.

**FIGURE 15.**
Land Use Change in Semarang City, 1972 - 2005

Based on the climate change impact in Semarang city, some policies implemented by the local government of Semarang include managing critical land, greening the city, managing coastal areas through mangrove planting along the beach, car free day as the campaign to reduce motor vehicle in order to eliminate carbon emission from transportation, using energy efficient street lighting, and motor vehicle emission testing.

The policy of greening the city tries to transform the agriculture pattern of the community, especially for rice farming in the hilly area, which should be combined with fruit plantation, with the aim to expand the catchment area in the headwaters. The basic consideration in changing rice farm to become fruit plantations is the vulnerability of rice farm to climate change, caused by erratic rainfall and because the fruit market is more promising.

There is also integrated waste management. The service of waste transportation until the year 2011 only reached 135 villages out of 177. The amount of waste which could be transported in 2011 was 4,679m$^3$ or 79% of the total waste + 5,923m$^3$ per day. Normally the capacity of final shelter is + 4.15 million m$^3$, but the volume has reached + 5.75 million m$^3$. The 3R system (Reduce, Reuse, and Recycle) is required to be more intensely implemented.

Some housing areas have executed integrated solid waste management with the aid from LSM Bintari. The private sector company that has cooperated with the local government of Semarang city is PT. Narpati Karya Agung Persada Lestari (Jakarta), which conducts the waste management in TPA (final shelter) Jatibarang.

The local government of Semarang city has also Land Conservation Program and Poverty Alleviation Program in Semarang with the aid from JSDF (Japan). Some activities have been implemented in the program are increasing land conservation management and increasing production and planting social agriculture forestry, a sub district grant
for land and water conservation, improvement the capability for agriculture business and marketing, and supporting the operational of the program. This program has been executed in five districts in Semarang city.

FIGURE 16. Location of Land Conservation and Poverty Reduction Program in Highland of Semarang

Source: Purnomo’s slide presentation on the workshop.

Some programs of the local government of Semarang city in handling the flooding and tidal flooding in cooperation with foreign donors such as JICA include:

1. The development of Jatibarang Dam
2. The development of Banger Polder
3. The handling of flooding through ponds, which has been done in the headwaters and downstream.

For headwaters, it consists of:
(1) The development of pond in UNDIP and BSB (Bukit Semarang Baru);
(2) Rainwater harvesting and infiltration with the target of 1 infiltration well per house; and
(3) Maintaining open and greens area through critical land conservation at Tembalang District, Banyumanik, Gunung Pati, Mijen and Nyaliyan.

For handling the flood in downstream area, there is a development of polder systems, which consists of beach dyke and retention pool, as well as rainwater harvesting.

Besides car free day, the local government of Semarang City has also implemented a public transportation system with the Bus Rapid Transit (BRT). There are 6 BRT corridors in Semarang and construction was completed in just 3 corridors. The SKPD responsible for the operation and management is Transportation Agency, Communication and Information (Dishubkominfo).
The program of Semarang Local Government to handle abrasion in coastal areas include building beach dyke and land procurement in the coastal area. The aim of the construction of dykes is to stop the flow of seawater to the mainland. This plan has been adapted into Semarang Spatial Planning (Rencana Tata Ruang Wilayah Kota Semarang) for 2011-2031. The land procurement program in the coastal area also aims to conduct Mangrove Eco Education Tourism in Tugu Sub District.

Starting from the selection of city partners, Semarang city became one city that joined the ACCCRN (Asian Cities Climate Change Resilience Network) in Indonesia, besides Bandar Lampung. There are 10 cities in the world that joined the ACCCRN. Country partner for ACCCRN in Indonesia is Mercy Corps and URDI. ACCCRN aims to get attention, financing and activities around the climate change to build the resilience of poor and vulnerable community in Indonesia. The activities of ACCCRN were started in 2009 to 2014. The activities of ACCCRN in Semarang City can be seen in the following figure.

Some ACCCRN activities until 2011 were pilot projects to handle landslide and drought in Sukorejo, the construction of a breakwater made from car tires which are packed to be a dyke retaining the sea waves, vetiver grass planting to decrease landslide in Tandang, sanitation credit in Kemijen Village to improve community sanitation, and piloting rainwater permanent system.

Pilot project activity for handling landslide and drought in Sukorejo consists of the construction of 520 bio pores, construction of 4 infiltration wells and 1 infiltration well from self-financing, planting of 1,309 trees of wood and fruit, making demonstration plot terracing. From this pilot project, there are 49 people from the community who received capacity improvement about climate change impact and the methods for
handling the drought. Piloting project in rainwater harvesting (RWH) in 2011 provided 15 installations of RWH in the household level and 1 installation of RWH in the communal level, which can distribute water for 581 student and 20 teacher toilets, and to supply clean water for 50-60 households. In the year 2012, there were 23 installations of RWH for household level.

**FIGURE 18.**
ACCCRN Activities in Semarang City

Ongoing projects until 2014 include early warning system for flooding in Sungai Bringin Watershed. The headwaters of Sungai Bringin Watershed are located in Mijen Sub District and the downstream is towards Java Sea in the north of Tugu Sub District. The area of Sungai Bringin Watershed is ± 29 km² or 2,963 hectares with 19.6 km length.

After 2014, the local government of Semarang city has other plans to support climate change resilience, including coastal community capacity building in the mangrove conservation program, handling community health caused by climate change impact (urban health), integrated mitigation strategy and climate change adaptation of Semarang City to get the aid from GIZ, and making a 100 year proposal for Rockefeller Foundation.

Although there are many projects had been done to handle the impact of climate change in Semarang City, Semarang City still needs the financial support for other programs, such as handling of downstream of river in Semarang City with the pro-gram of agriculture forestry, handling of coastal area abrasion, handling of land subsidence for the urban infrastructure, the construction of ponds in the downstream area handle flooding and water supply, the construction of dykes, flood prevention infrastructure, increasing the supply and distribution of clean water.

To maintain ongoing projects, there are few things which Semarang city needs, such as mainstreaming of climate change in all sectors, optimizing the role of Climate Change National Board (DNPI), emphasizing climate change issues from the central government, elaborating on local wisdom, developing networking, and support from the central government for the local government to get access to the donor countries.
As an archipelago and with economic activities based on natural resources, Indonesia is highly vulnerable to climate change impacts. The climate change threat is characterized by: (1) the increasing of sea surface temperature, estimated to 3 degrees Celsius by the year 2100 compared with the average temperature in 1990; changes in the intensity and pattern of high intensity rainfall during the rainy season and low intensity during the dry season; (3) sea level rises by 175 cm by the year 2100 compared to the average sea level in 2000.

The change of global temperature implied to the change of the Earth’s surface temperature pattern, changes in climate patterns, and other impacts threaten the success of the development. The impacts that can occur include long drought, flooding, and increased frequency of extreme climate, which increases the risk of health, life and biodiversity.

Most of the natural disasters that have occurred in Indonesia are meteorological disasters, amounting to 79% of the total disasters in Indonesia (see Figure 19). It proves that the impact of climate change is very huge in Indonesia. In the period 2000 - 2010, hydrological disasters caused 4,936 deaths, impact on 17.7 million residents, and 2.5 million homes were flooded.

Climate change can be addressed through mitigation and adaptation. Mitigation is anthropogenic intervention to reduce the sources of greenhouse gases. Adaptation is the adjustment in natural or human systems in response to climate change impacts, meaning that residents should be able to adjust the economic activities that are in vulnerable sectors. The purpose of adaptation is to implement better planning taking into account the climatic conditions as well as reducing the likelihood of catastrophic climate change. The Indonesian Government has made efforts to mitigate and adapt to climate change, including the preparation of documents policy direction in the face of climate change. To mitigate climate change, there is a Presidential Regulation (Perpres) No. 61 Year 2011 about the National Action Plan for Greenhouse Gas Emission Reduction (RAN GRK), whereas adaptation to climate change has been set in the National Action Plan for Climate Change Adaptation (RAN API). Climate change mitigation arrangements were made with regulation because the prevention of climate change causes has to be executed firmly so that all parties obey the rules. The adaptation setting has no legal protection because it just wants to increase the capacity and resilience in facing the climate change for all parties, including government, public and private sector.
Climate change policy is also included in RPJMN 2010-2014, which is described in more detail in the annual RKP, so that every year there is always a program related to climate change. There is a mainstreaming of sustainable development in RKP 2010 for some sectors that have to be noticed in the formulation of policy. Climate change policy is strengthened with the issuance of Perpres 61/2011 and Perpres 71/2011, which were executed at the same time as RKP 2011. RKP 2012 is to prepare the RAD GRK at provincial and RAN API at national level. The RKP 2013 focused on monitoring and evaluation of the condition of Indonesia’s greenhouse gases, climate change-related training, and socialization of RAN-API.

Mitigation and adaptation to climate change in development policies are associated with several sectors, so the sectors have programs for mitigation and adaptation to climate change. The national development priorities in RPJMN 2010-2014 emphasizes the food security, energy, and environment and disaster management sectors. Each of these sectors have priority programs for adaptation and mitigation of climate change. In the food security sector, there are priority programs for adaptation to climate change. In the energy sector, there are priority programs of renewable energy and gas conversion. In the environmental sector and disaster management, there are priority programs to control pollution and environmental damage, early warning systems and capacity building in the face of disaster.
FIGURE 20.
Climate Change Policies in National Development Plan

Source: Virgiyanti’s slide presentation on the workshop.

FIGURE 21.
National Priorities in RPJMN 2010 - 2014

Source: Virgiyanti’s slide presentation on the workshop.
The following are adaptation strategy frameworks in the marine and fisheries, agriculture, health, water resources, and disaster sectors (See Table 6).

Bappenas together with KLH, DNPI and BMKG (Core Team) plus the other related Ministries/Institutions formulated the RAN-API to strengthen mitigation efforts that have been declared through RAN-GRK. RAN-API is not determined in a particular legal product, but become the input for the preparation of National Development Plan 2015-2019. Formulation and implementation of the RAN-API coordinated under the Climate Change Management Coordination Team was established by the Letter Decree from Minister of National Development Planning/Head of Bappenas No.Kep.38/M.PPN/HK/03/2012. Coordination Team is comprised of the Steering Committee, and six Working Groups, namely (1) Agriculture, (2) Forest and Peat land; Energy, Transport, and Industry; (4) Waste Management, (5) Other Supporting and Cross field; and (6) Adaptation.

**TABLE 6.**
Adaptation Strategy Framework

<table>
<thead>
<tr>
<th>Sector</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine and Fishery</td>
<td>• Spatial Planning and Coastal Zoning</td>
</tr>
<tr>
<td></td>
<td>• Norms and guidelines standards and criteria for adaptation</td>
</tr>
<tr>
<td></td>
<td>• Strengthening of vital structures facilities in coastal areas</td>
</tr>
<tr>
<td></td>
<td>• Ecosystem management and integrated coastal resource</td>
</tr>
<tr>
<td></td>
<td>• Strengthening of data, information, and policy framework</td>
</tr>
<tr>
<td>Agriculture</td>
<td>• Local commodity enhancement and promotion of consumption diversification, balanced distribution and accessibility of food</td>
</tr>
<tr>
<td></td>
<td>• Construction and rehabilitation of agricultural infrastructure</td>
</tr>
<tr>
<td></td>
<td>• Optimization of land use and water resources</td>
</tr>
<tr>
<td></td>
<td>• Fiscal incentives for agricultural development</td>
</tr>
<tr>
<td></td>
<td>• Promotion of research and development</td>
</tr>
<tr>
<td>Health</td>
<td>• Increased access to equitable, affordable and quality health services</td>
</tr>
<tr>
<td></td>
<td>• Increase the availability of health workers, especially for basic health</td>
</tr>
<tr>
<td></td>
<td>• Prevention of disease transmission → monitoring, management etc.</td>
</tr>
<tr>
<td></td>
<td>• Monitoring and control of infectious disease patients related to climate change</td>
</tr>
<tr>
<td></td>
<td>• Prevention of malnutrition, especially in the case of pregnant women, infants and toddlers</td>
</tr>
<tr>
<td>Water Resource</td>
<td>• Fulfillment of basic needs for clean water, especially in dry and strategic areas</td>
</tr>
<tr>
<td></td>
<td>• Management of water use to meet the needs of clean water</td>
</tr>
<tr>
<td></td>
<td>• Development of water reservoir and optimization of maintenance and monitoring water resource infrastructure</td>
</tr>
<tr>
<td></td>
<td>• Fulfillment of UU 7/2004</td>
</tr>
<tr>
<td>Disaster</td>
<td>• Policy framework for disaster risk reduction and climate change</td>
</tr>
<tr>
<td></td>
<td>• Capacity development in the field of DRR and climate change</td>
</tr>
<tr>
<td></td>
<td>• Development of science and technology</td>
</tr>
<tr>
<td></td>
<td>• Increased awareness through media and disaster risk management forums, increased participation</td>
</tr>
</tbody>
</table>

Source: Virgiyanti’s slide presentation on the workshop.

The tasks of Working Group VI on Climate Change Adaptation Sector include:

1) To coordinate the implementation of climate change adaptation program and activities;
2) Synchronize the work plans of each Ministry and Agency;
3) Prepare National Action Plan for Climate Change Adaptation;
4) Compile quarterly and yearly report of the Working Group, and report the implementation of programs and activities to the Chairman of the Climate Change Handling Steering Committee; and
5) Carry out other relevant duties as directed by the Chairman of the Climate Change Handling Steering Committee.
The objectives of RAN API preparation are:
1) Provide direction for mainstreaming climate change adaptation issues in the national development planning process;
2) Provide direction for climate change adaptation action sector, as well as an integrated climate change adaptation actions (across sectors) in short-term planning (2013-2014) and medium term planning (2015-2019);
3) Provide guidance for short-term priorities adaptation action steps to be proposed in order to receive special attention and support of international funding; and
4) As a direction for the sector and regional in developing a synergic adaptation action, communication systems and build more effective coordination.

The main target of RAN-API was sustainable development and adaptation to climate change. Targets that must be taken to achieve the main goal are the realization of economic resilience (food security and energy independence), endurance of life (health, housing, and infrastructure), and endurance specific areas (urban, coastal and small islands), where the three aspects will realize the resilience of the eco-systems. Strengthen the system requires knowledge management, planning and budgeting, capacity building, monitoring and evaluation.

FIGURE 22.
RAN-API Targets Framework

RAN API noticed the importance of the following population-related aspects:
1) Development of food security of farmers and communities;
2) Energy independence through the use of renewable energy and sustainable energy supply;
3) Public health through risk control infectious and noninfectious diseases due to climate change;
4) Worthy, adaptive and affordable settlements; and
5) Access to infrastructure.
Adaptation to climate change at the local level is very important, because:
1) Climate change impacts occur at local/regional which affects the economy and the environment on local level;
2) Vulnerability and adaptive capacity occur at the local level as a result of the interaction of various factors and social-ecological processes, and vulnerability of the region is the result of vulnerability variation occurring at the local level; and
3) Adaptation action is done at the local level because adaptation responses at the level of the individual and the family show the real adaptation.

The generic steps in the preparation of adaptation strategy/RAD-API are:
- to identify current and future climate risks and vulnerabilities,
- to identify the adaptation action/response,
- to evaluate and select the adaptation action options, and
- to monitor and evaluate the implementation of adaptation strategies and action.

The principles of RAD-API preparation are:
1) Needs to complete vulnerability assessments of the impacts of climate change (action plan on targets, both activity and location);
2) Needs efforts to continually supplement the data and information resulting from projected climate change and its impact more accurately;
3) Increase the capacity of all stakeholders, including awareness and preparedness;
4) Clear authority and responsibility of adaptation at national and local levels, between government and non-government, and the clarity of funding; and
5) The importance of this adaptation to be mainstreamed into existing national development planning, and in the Strategic Plan in their respective Ministries/Institutions and regions.

FIGURE 23.
RAD-API Integrated to the Regional Development Planning

Source: Virgiyanti's slide presentation on the workshop.
The things that need to be considered in the preparation of the Regional Strategy Adaptation Measures / RAD-API are:

1) Notice to its association with the National Action Plan for Climate Change Adaptation (RAN-API), RAN/ RAD-GRK, RAN/ RAD-PI, and Disaster Risk Reduction Policy;
2) Notice the Spatial Plan (RTRW) as the spatial dimension of regional development;
3) Integrating in the RPJMD preparation, start from RPJMD Initial Draft, RPJMD Draft, and RPJMD Final Draft; and
4) Incorporating adaptation actions in the preparation of the yearly Regional Development Working Plan (RKPD).

The next steps will be carried out by National Government, such as RAN-API as a reference/ guide to preparation of Regional Strategy Adaptation Measures (RAD-API), ensure RAN-API activities listed in RKP/ RKA-KL in 2013 and 2014, mainstreaming RAN-API in preparation of RPJMN draft 2015-2019 (starting from preparation of background study), selection of the pilot projects in the priority areas based on existing vulnerability assessment, dissemination and facilitating the preparation of the Regional Strategy Adaptation Measures.

For funding, adaptation to climate change still focus on sources from national and regional budgets (APBN and APBD). In addition, other sources of funding which can be cultivated derived from ICCTF (Indonesia Climate Change Trust Fund). It is expected that in the future there are sources of funding from the private sector in order to participate in the implementation of mitigation and adaptation to climate change. Funding for RAN-API is greater than RAN-GRK, which is 800 trillion rupiah for RAN-API and 300 trillion rupiah for RAN-GRK. This is an overview that the costs spent for the greater adaptation than mitigation. Of the existing budget, effective utilization should be done so that the programs and activities that have been planned can run optimally.
Questions and Comments

Sumaryono (BIG)
1. Climate change adaptation was a less beneficial program for local administrators and parliament. It also had long-term investment projects that were hard and difficult to be implemented because the term of office for the major was only 5 years. Meanwhile, the project should carry on at least 25 to 100 years. How do we convince and inform the city administrator that the program and investment is worth being implemented?
2. Has the climate change aspect been combined into Semarang spatial planning (RTRW Kota Semarang)?
3. There was a lot of criticism about the sectoral approach to deal with climate change. How can we accommodate the entire district to be analyzed with geospatial analysis, so that the sectoral approach could become spatial approach, which can be used effectively?

Daniel Schensul (UNFPA)
1. There are a lot of data used in the study such as household to explain their conditions, education, and their livelihood. Based on adaptation programs, which already described, how can Semarang execute the adaptation programs if using household unit?

Arifin Zainal (Bappenas)
Bappenas always encourages Indonesian cities to implement sustainable development, by giving attention to social, economic and environmental aspects. It also needs to notice that Indonesia position was in line with Ring of Fire on tropic area and very vulnerable to climate change.
1. There were a lot of climate change studies with Semarang city as the case study. How has Bappeda applied and implemented those studies in the development planning. How then to conduct coordination with another local government unit to address climate change?
   This action needed to integrate RAD-API with local planning development that had presented by Ibu Virgi.
2. How has the Semarang Planning Agency involved universities and academics concerned with climate change impact in the planning process and climate change program?
   This is needed because universities and academics could generate better solutions that can be used by local government. Those processes would eliminate the gap between local administrator and academics.
3. Indonesia had RAN-GRK, but the Government could not encourage RAN-GRK implementation in the local level because of decentralization. Therefore local government had significant role to implement RAD-GRK. Had the Government mapped vulnerable area to climate change and how to regulate the area? Vulnerable areas need special attention from the Government.
4. Have Bappenas assisted the local government in integrating RAD-API into local planning documents? It was highly hoped that RAD-GRK would be implemented in the future.
Agus Wibowo (BNPB)
1. Bappenas had established RAN-GRK and RAN-API to tackle climate change. BNPB also had established RAN-PRB as disaster risk reduction regulation in the national level. Was there any correlation between those documents?

Answers
Purnomo (Bappeda Kota Semarang)
The climate change program integration with local planning document was begun by linking the program to the poverty alleviation program. The preliminary study was to analyze climate change vulnerability. The community who are poor and live in vulnerable areas had become the stakeholder in the study because Semarang city government needs to provide the recommendations on adaptation in order to make them resilient to the climate change impacts. The establishment of City Team (Tim Kota) helped the government to facilitate coordination with stakeholders effectively. The team was established due to ACCCRN in 2009 and the members were from local government unit, academics, NGOs and private sector.

The involvement of academics in the City Team was based on the educational background where most of Bappeda representatives in the team had studied on urban and regional planning. It was easier to communicate if we had the same vision. However, Bappeda still tried to communicate with local parliament about the climate change because there was a gap if using political bureaucracy.

When formulating Semarang spatial planning (completed in 2010), Bappeda was late to include climate change issues in the planning. Bappeda also had the studies on climate change impacts related with service sectors such as drainage.

The greatest impact of climate change in Semarang was flooding and tidal flood. Therefore the program proposed to address floods. Recently, Semarang had developed Polder Banger to gather water from the upstream to downstream before it flows to the sea.

Another example of climate change adaptation projects in the household was the rainwater harvesting project. The rainwater harvesting scheme was conducted on every house or communal. It was needed as water reception for the community, as well as to reduce rainwater runoff into the drainage system so that it could reduce water drainage loading. Another technique to reduce water runoff was by water recycling. Amaris Hotel had the permission to apply water recycling. Rainwater was not used for consumption, but for watering the flowers and other activities related to hotel cleanliness. If all people in the city had rainwater harvesting or water recycling, it would reduce the load on drainage and reduce the flooding.

There were a lot of climate change studies in Semarang, but it was difficult to be implemented because the people’s mindset had not much changed. The officials from the government unit must have the same mindset about the climate change and how to handle mutation and rotation in every government unit to have more effective coordination. The big assignment was to convince climate change impacts into every development sector.

Virgiyanti (Bappenas)
Sectoral approaches in the RAN-API were expected to be not only about socio-economic aspects, but also environment aspects. The budget allocation for all the programs in RAN-API had been distributed to relevant Ministries. Therefore, sectoral
approaches were important because every activity proposed in the RAN-API was associated with the role of a particular sector.

RAN-API had a vulnerability analysis section even though the funding is very limited. However, the document had showed the priority location where spatial analysis could be assisted by BIG. We know that each Ministry/ Agency had spatial data, such as Ministry of Public Works, Ministry of Maritime and Fisheries, Ministry of Forestry, Ministry of Environment, BNPB, and etc. From that existing data, it was expected that RAN-API would have a more comprehensive map in the future.

Bappenas was working on the vulnerability mapping to determine priority areas that have high vulnerability and will be set as pilot project. In the preparation, Bappenas would also organize discussion with other Ministry/Agencies and other relevant institutions. Bappenas also requires data and information from relevant Ministry/ Agencies (such as the Ministry of Environment and Geospatial Information Agency) to complete the analysis.

RAN-API and RAN-GRK should be interrelated. Bappenas was trying to collaborate on both documents. Basically RAN-API and RAN-GRK had the same source from RAN-PI (National Action Plan on Climate Change).

Bappenas has a lot of climate change mitigation programs (RAN-GRK) in the local area with adequate funding. The mitigation team coordinated those activities with members from crosscutting areas. The RAN-API implementation would follow the similar scheme as the RAN-GRK.

RAN-API and RAN-PRB API had similar linkages. Therefore, RAD-API formulation should be relevant to RAN-API and RAN-PRB because many disasters in Indonesia were affected by climate condition.
Prof. Adrian explained that the profiles of CO$_2$ emissions in Indonesia and the comparison internationally as follows: A population perspective on CO$_2$ emissions and the Kaya identity; four major demographic drivers are population growth, population age, urbanization, and the rise of the consuming classes; as well as how the mitigation, adaptation, and sustainable development in Indonesia.

When compared with other countries, Indonesia still rated low in greenhouse gas emissions. Conditions with emissions in Indonesia are almost the same as Australia. China is producing the highest greenhouse gas emissions and the emissions increase from year 2000 to 2009.

Regarding the density of population, Tokyo in Japan is a city that has the highest population density but the rate of fossil fuel consumption is very low. In contrast, cities in America have a low population density but fossil fuel consumption is very high. People who live in urban public services must expect the best for their activities. And people's activities may have an impact on the urban environment (see Figure 24).

We can calculate the amount of emissions in a city with an indicator named GDP. Each unit in GDP reflects the amount of activity in the urban population. Other units were used for calculation of emissions is directly related to the unit of emissions namely energy. Formulation to calculate the CO$_2$ emissions in a country in detail can be seen in the formula below.

$$CO_2 \text{ emissions} = \text{Pop x GDP/Pop x Energy/GDP x CO}_2/\text{Energy}$$

GDP/population is a country's per capita income. Energy/GDP is used to determine how much energy expended for each a dollar. And CO$_2$/energy is used to determine how carbon is released every energy utilized. The multiplication of all formulas multiplied by the number of people will result in total CO$_2$ emissions in the country.
There are four major drivers of demographics: population growth, population age structure, urbanization and rising consumer class. The numbers of inhabitants in each country tend to increase each year. In general, developing countries are experiencing rapid population growth compared to developed countries. Population growth in Indonesia compared to other countries in several continents still under China, India and USA. However, when compared with other countries in Southeast Asia, Indonesia is a country that experienced the highest population growth.

Population growth will directly affect the amount of carbon emissions produced. In the calculation of carbon emissions, the total population is also used to determine the per capita income of a country. Developing countries in general have a lower per capita income in developed countries. Indonesia's per capita income is considered very low compared to other countries in the world, including Southeast Asia.
FIGURE 26.
GDP/Population (thousand US Dollars [using PPP] per capita per year 2009), Indonesia and Selected Countries, 1971 - 2009

Under certain conditions, population dynamics can increase a country’s GDP. The most important thing in identifying the impact of demographic change on economic performance is the distribution of changes in population age structure. In the productive age, the population will increase and a highly educated population will be growing. Educational background is a key factor in achieving high livelihood. Based on the predicted structure of the population by age and level of education, by 2050 there will be almost no people in Indonesia who do not have any educational background (no school), and the proportion of those with secondary and tertiary education will be higher. When comparing the population pyramid between 1990 and 2050 (see figure below), you will see a very noticeable difference.

FIGURE 27.
Population Dynamic and Human Capital Formation

Many cities in several countries, particularly developing countries, have undergone massive urbanization. Currently the majority of the population in each country is in urban areas. Indonesia is one country experiencing a rapid urbanization process, with rates that are almost the same with China. Currently, Indonesia’s urban population...
is 50%, and by 2050 is expected to increase by more than 65%. The high urban population growth will have an impact on the high consumption of fuel oil needed for transportation and other energy. It will directly increase carbon emissions.

**FIGURE 28.** Percent of Urban Population, Estimates and Projections, Indonesia and Selected Countries, 1950 - 2050

An example of urban population growth in Indonesia is the development of Jabodetabek (Jakarta, Bogor, Depok, Tangerang, and Bekasi). Development of urban areas of Jakarta is now spreading to the cities around it (Bogor, Depok, Tangerang, and Bekasi) and because of the high dependence of the populations in these cities to Jakarta, the number of commuters has also increased. Urban development around Jakarta is getting higher because of the density in central Jakarta. Lots of new growth centers in the cities around Jakarta have come up in the form of new city and industrial areas. The impact of the growth of urban areas and the number of commuters increases the carbon emissions from industry and transportation.

Based on the calculation of the carbon generated from each energy used (CO\textsubscript{2} / Energy), Indonesia is still far below developed countries such as Australia, USA and Germany, but it is also still under India, which is one of the developing countries. Meanwhile, when compared with other countries in Southeast Asia, Indonesia is still a lower carbon producer than Malaysia and Thailand.

**FIGURE 29.** CO\textsubscript{2} / Energy (tCO\textsubscript{2} per trillion joules) in Indonesia and Selected Countries, 1971 - 2009

Source: Hayes’ slide presentation on the workshop.
The more a country develops, the higher the pressure on the environment because of the intensity of energy consumption, and impacts on water, soil and other materials that can cause pollution and waste. Many things must be done to reduce pressure on the environment, such as pollution control, process changes and initiatives towards increasing efficiency, structural changes in the economy and the dematerialization of consumption patterns. Such actions need to be performed for all countries in the world in order to recover the environment and sustainable development realized.

**FIGURE 30.**
Pollution Levels, Environmental Transitions, and Development

The other demographic driver is a rapidly growing consumer class because population dynamics is also related to consumer behavior. Tim Jackson (2009) stated: “material and non-material dimensions of prosperity are inextricably intertwined with each other through the language of goods. Though it is essentially a social rather than a material task, our ability to participate in the life of society depends on this language. Access to the life of society is mediated by sheer stuff.” An example of the behavior of classes who have high consumption is consumers of Hermes bag, which is very well known in developed countries. For most high-society ladies in Indonesia, Hermes bags are not only luxury items, but also status symbols that can help to cement their position in society (Alexandra Dewi, 2011).

Population dynamics affect CO₂ emissions through multiple pathways, including the number and rate of population growth, age structure, urbanization, and the rapid growth of consumption classes. The dynamics of the population in each region will affect economic development, governments in determining policy, as well as the values and lifestyles of people based on consumption patterns (see FIGURE 31).

As a response to the challenges of population dynamics in the region, policy makers need to consider the population dynamics of four lines when drawing up scenarios BAU (business-as-usual). The most important thing is policy makers considering...
population dynamics in formulating mitigation strategies, and taking advantage of any synergies that may exist between the population-related policies and mitigation policies ("policy convergence"). In fact, there is a need to engage in the population dynamics in developing mitigation and adaptation strategies, and the need to do this in all relevant scales and administrative levels.

**FIGURE 31.**
Population Dynamics and the Kaya Identity

Source: Hayes’ slide presentation on the workshop.
Question
Sumaryono (BIG)
1. How do we calculate the emission in Indonesia, while Indonesia’s largest emissions is deforestation and very low from fossil fuels?

Answers
Adrian C. Hayes (ADSRI)
Usually emissions come from the fossil fuels combustion, but Indonesia is one of an exception. Although only 20% of Indonesian emissions come from fossil fuels, that figure is growing rapidly. If deforestation were the real problem, the emission calculation would use another method. Forest fire is also an important factor in creating CO emissions. But in this presentation, Adrian only explained the fossil fuel emissions calculation. Fossil fuel resources need over billion years to produce, and there was no cycle process to reduce the emission. It’s contrary to reforestation.
The goals of the first day of the workshop were to disseminate the result of vulnerability and adaptation study in Semarang Metropolitan Area, and share the research to get input and views from related stakeholders on the importance of demographic dynamics in climate change.

All of the topics generated ideas, such as:
1. Population dynamics is an important aspect that should be noted in climate change adaptation and mitigation;
2. From today’s presentations, further research should be done with accurate base data and with the same data resources so it will be accessible to related parties, and we should consider how to follow up the results of the research;
3. The population dynamics and climate change study that was done in Semarang gave the understanding that climate change causes vulnerability and provided input for decision makers to set effective adaptation policy;
4. Population dynamics and climate change studies need to consider the phenomenon of urban sprawl in sub-urbanization and to view the borders dynamically; all factors causing vulnerability need to be elaborated further according to available data, to use the study results for planning input and other needs;
5. Demographic factors such as urbanization, population growth, age structure, and the growth of middle class are related to one another in affecting climate change caused by human beings;
6. Climate change policy should consider how population dynamics contributes to increasing vulnerability and affects community capacity to adapt to threats.
7. Spatial and demographic analysis on vulnerability and climate change adaptation shows some variations about risk explanation related to climate change (such as flooding and landslide), which are related to the demographic characteristics influencing the level of vulnerability of the area (such as: population dependence ratio, resettlement safety and population density);
8. Demographic characteristics such as education, migration, household composition and economic activities could influence environmental potential to adapt in eliminating risks;
9. The understanding on the relationship between population dynamics and vulnerability on climate change was done by using demographic data and information and hazard risk supported by Geo-References Information Systems (GIS). Although there is a limitation regarding the method and dependency on aggregate data, this approach can be developed and applied further in other areas with a lower budget and significant benefit to assess the vulnerability and adaptation plan;
10. On the local level, sustainable development policy in the framework of resilience on climate change can be executed by activity programs, either on structural (such as the construction of dam, polder, pond, dyke, BRT, levee) or non-structural action (such as early warning systems, community capacity improvement), which involve all stakeholders (central government, local government, donor institution, nonprofit organizations and the community);
11. Climate resilience development and low emission at the city level could be a sustainable activity which needs support from all parties by mainstreaming
the climate change issues in all development sectors, national adaptation and mitigation policy, institutional support and climate change financing, development of networking and local wisdom.

12. The Government of Indonesia has done some efforts for climate change mitigation and adaptation by setting up policy documents on addressing climate change including RAN GRK and RAN API as policy direction and guidelines for all stakeholders;

13. The local governments support the dissemination and facilitation to improve the local capacity in setting up the policy and climate change adaptation strategy at the local level with the priority on pilot project of climate change adaptation in areas which have undergone vulnerability study and mainstreaming of climate change issues in local development plan;

14. Population dynamics also influences the increase of CO₂ emission by some ways (not only in the amount and the population growth), whereas this issue is very important to be considered in setting up the development scenario based on BAU assumption (business-as-usual);

15. Policy makers should think of population dynamics in composing the mitigation strategy and synergizing demographic policy and mitigation policy in all administration level.
PARALLEL DISCUSSION
On the second day of the workshop, there were group discussions with 3 sub-topics to study the problems associated with Population Dynamics and Climate Change.

**PARALLEL DISCUSSIONS DAY 2**

**Implication of Population Dynamics for Reducing Risks to Disasters and Climate Change**

Moderator: Ari Mochammad (DNPI)

Members:
1. BIG
2. BKKBN
3. BLH
4. Media
5. LIPI
6. UNDIP
7. Ministry of Home Affair
8. BPBD of Central Java Province
9. BPS-Statistics Indonesia
10. Health Agency of Central Java Provinces
11. Urban Planning Agency of Semarang City
12. Cleaning Service Agency of Semarang City
13. Bappeda of Semarang City

Rapporteur: Ika Rachmawati S (URDI)

1. **Negative dimensions of population context and used as well in the vulnerability variable of climate change or disaster risk reduction.**

There was a discussion of views and experiences of their institutions about the statement that the population context always has negative dimension and is used as the vulnerability variable on climate change or disaster risk reduction. Large population growth unaccompanied by productivity, education, and high unemployment could lead to potential conflict. If not managed properly, it becomes
a factor that can induce environmental damage. LIPI, BKKBN, Diponegoro University and Bappeda Semarang delivered responses to the above statement.

a) Population growth variable is non-linear in nature and directly related to negative effects on the environment, because there are many other factors of influence. Impact of climate change does not directly affect people’s lives. For instance reduced income of fishermen is indirectly affected by climate change, but there are other factors such as the uncertainties of the season and coral reefs damage.

b) Related to health, the occurrence of temperature rise may trigger the onset of diseases such as malaria. In some cases, population growth and migration are very influential. High population growth and migration will affect the upgrades and expansion of the spread of disease.

c) In some small islands, there are some conflicts identified at the local level due to the migrants. At the level of policy makers, they are still waiting for normal and safe condition, but at the community level, this potential conflict must be resolved immediately.

d) Uneven development creates less distribution of service in remote and border areas. We must support services to improve nutrition, education, and health, so as to enhance the capacity of communities in remote areas.

e) Migration and livelihood change towards urban areas without good education and understanding will result in urban environmental damage. Increasing the capacity to give the people the option of moving is very necessary considering the cost, access, livelihoods and so on.

f) The population dynamics must be understood as a whole, not just the population growth, but also the structure and composition.

g) Productive age in Central Java is quite high, so they need education advocacy and enhancement of skills in order to engage in the labor market easily, both at home and abroad.

2. **Perspectives on education, health, social capital, and economic differentiation to respond to population dynamics problems.**

Education role as a solution of population growth and climate change. What kind of education does the community need?

a) Education is capacity building, and is beneficial for stakeholders (students, bureaucrats, legislators, and private sector) to have better understanding of climate change and be able to anticipate the risks.

b) Education is not just formal but also informal. Using the media to educate the community is very important. Society does not need high-level information, but instant information can be delivered immediately. The community does not need the information about why climate phenomenon occur but rather on what activities can be implemented straight away, directly on real examples to provide economic benefits.

c) Formal education is not always able to answer the problems occurred. In some cases, higher education will increase social status. This is correlated with low social interaction. Motivation of highly educated community is lower to make implementation on site.

d) Connectivity patterns of population growth and environmental degradation are highly correlated when viewed from the calculation of emissions. Accumulation of high emissions due to the high number of residents is implicated on the high use of natural resources.
What are the factors that make social capital stronger?

a) The public dichotomy is strong. The poor communities tend to have a strong kinship system and they generally believe the community leaders. Such characteristics can be leveraged to strengthen community capacity to reduce environmental damage.

b) What always forgotten is how to use intermediary institution to establish a link between the people and the government.

How to harness the productivity of work, endurance, and government’s rule as a solution.

a) Policy on community level is very important to directly implement and empower the community. Community-based (bottom-up) development planning is very important and becomes a national priority.

b) Improvement of education requires a comprehensive policy, so that the knowledge gained can be an attitude and then practiced.

c) Social capital in the urban area is highly heterogeneous, therefore it needs the common interest in order to make highly educated sectors with strong social capital contribute. The trick is to use local wisdom and to create community cohesion.

3. **Spatial instruments solution to create limitation of population growth and create high productivity within the framework of climate change adaptation.**

a) Development should consider the carrying capacity of the city. Space in each region is unique and cannot be generalized. Semarang City has is near a river, with susceptibility, and hard limited nature. So we should encourage investment that supports spatial planning. Spatial planning should consider local wisdom and regional limitations.

b) Disincentives and incentives instruments should be built.

c) To develop a low impact development - developing areas with minimal negative impact to the environment, but with maximum economic benefits with including technology in development.

d) The process of RTRW preparation is already optimized the interests from all sectors. In the context of the climate resilient cities development, tolerance will only ruin a city. All policies need public awareness to participate in the implementation and evaluation.
Imlications of Population Dynamics for Achieving Low Emission Climate Resilient Development

Moderator: Doddy S. Sukadri (DNPI)

Members:
1. BKKBN
2. BNPB
3. DNPI
4. BPS-Statistics Indonesia
5. LIPI
6. Bappeda of Semarang City
7. UNDIP
8. UNES
9. NGO

Rapporteur: Nila Ardhyarini H. Pratiwi

Population Dynamic Issues
The interaction of emissions and population dynamics of a city relates to quantity, quality, and mobility. The quantity factor indicates that the more the population in a city increase, the more emissions increase, for example, the population growth which leads to large-scale land conversion would increase the emissions. Quality can be seen from the infrastructure used by residents whether the emission is low or not. Mobility can be defined as the movement of resident or migration, for example urbanization which changed green rural condition to become modern urban where emissions increased.

Population is not adequately taken into consideration in decision-making on climate change. Population issues in this case are not about mainstreaming, but the perspectives of population in urban development. It must be possible to define the issues to be considered in the demographic aspect. With an example of family planning, in the development plan there should have been development guidelines for family planning in the future. Population dynamics is not a label in the context of emissions, but it is a driver.

Low emission issues in policy
Availability of national electricity power currently is around 43%. If the government issued a policy to use coal energy, then this is not an action to reduce emissions because every usage of coal will produce emissions continuously; it is the same with petroleum. Indonesia should look to low emissions energy like nuclear energy for electricity and take advantage of renewable energy such as energy from wind, water, sea, and sun. The government needs to conduct socialization and assistance in this regard.
The commitment of National Government or Local Government for low emissions development should have started at beginning of policy making process, not only at the end of the process. If we want to incorporate population dynamics in a low emission development policy, it is necessary to initiate a dialogue among BKKBN, DNPI, Bappenas, and other related institutions, because the synergy between sectors is essential.

For reducing emissions in urban development policy, strategic issues in the Medium Term Development Plan (RPJM) of Central Java Province include energy self-sufficient villages and renewable energy. It means that the development of low-emission electricity has been entered in the RPJM at Provincial level, and the regency/city in the province should do the same.

**Energy services issues**

In the Energy and Mineral Resources Roadmap, there is a target to reduce the use of coal, which reached 34%, down to 15% in 2025. However, there is no real action from the government to reduce the use of coal.

The reservation of geothermal power plants in Indonesia is very large, but its utilization is not optimal. And when compared to other countries, such as Philippines, the electricity with geothermal power development is less advanced in Indonesia. Geothermal development in Indonesia is hindered by tensions between the policy of the forestry sector and the energy and mineral resources sector because geothermal sites are generally found in forests.

In addition, the potential of Micro Hydro Power Plant (MHP) in Indonesia is also very large, such as in the southern part of Central Java. However, the permit process is more difficult for the provision of MHP than other power plants. This may imply that there is no political will of the Government to encourage the development of MHP in Indonesian cities. Provision must also consider the power generation capacity of the power plant because MHP depends on the availability of water, so it is not possible to operate them during the dry season. The condition is also associated with adaptation to climate change, namely how electricity supply from hydropower can continue even when rainfall is minimal, or due to other constraints associated with the climate.

In 2012, the electrification ratio in Central Java Province was 80.3 % and there are still 20% of households in the regency/city in Central Java Province without electricity. Considering population dynamics, there will be a growing demand for electricity. Households cannot access electricity will use fuels that could lead to higher emissions, such as the use of firewood and kerosene. Although there has been a conversion program from kerosene to gas, the effectiveness of its use should be reviewed to see whether it has been implemented in all regions. The government needs to supply the electricity to residents who have no access to electricity to realize sustainable development. In addition to electricity supply, the electricity service quality should also be considered because the electricity is not only used domestically, but also for industrial and commercial uses that provide revenue.

Population growth will lead to large-scale land conversion, not only for industry but also for settlement. There is need for new innovations in the provision of housing in line with population growth.
Sharing Ideas

Low emission development should not only be contained in the RAN-GRK, RAD-GRK and RAN-API, but also must be included in the spatial policy (RTRW) and policy development (RPJM and RPJP) at National, Provincial and Regency/City level, in order for low emission development to have a time frame the implementation and ensure the sustainability for 5 years or 20 years ahead in every area. However, there is still a problem between spatial planning and development planning in several areas because the two planning documents have not been integrated.

Population mobility is one population dynamics aspect considered in spatial planning because it can lead to urban sprawl. Spatial engineering to streamline the mobility of residents is required, both for population mobility within cities and between cities. It is also useful to reduce the level of emissions in urban areas. The high mobility of people is caused by the desire of urban residents get the best services (facilities). For example, residents in Jabodetabek - Greater Jakarta (Jakarta, Bogor, Depok, Tangerang and Bekasi), where many residents outside central Jakarta work and conduct activities in central Jakarta every transit of residents would produce emission, such as from vehicles. Efforts that can be done to reduce the mobilization of residents in order to reduce emissions include increasing the local resources in every area and local employment in every city.

In discussing the relationship between population dynamics and urbanization, it is necessary to understand the dynamics of urbanization in Indonesia. The current pattern of urban population density is a decrease in the city center to the outskirts of the city, while the higher density areas have cross-state administration. The current spatial plan has more local administrative planning so that regional planning becomes weak; coupled with the absence of a full decentralization, regulation-making powers are at the local level. Currently, city development has been at regional level but the administrative structures are an obstacle to effective planning. Every local government should think about planning for the area needed to deal with urbanization and population dynamics (particularly related to the mobilization of population). Another thing that must be done at the regional level is inter-regional cooperation, such as Jabodetabek and Kedungsepur (Kendal, Demak, Semarang, Ungaran, and Purwodadi).

In addition, policy-makers should distinguish between policies for areas of high population dynamics with to those with low population dynamics. For example, policies for the high population density areas are certainly not the same with low population density areas, so policy interventions in the region should be in accordance with existing conditions in each of these areas. This case requires the participation of a university or other institution to conduct in-depth research, so that proper urban design can be planned for the different areas.

To improve human resource capacity in understanding the population dynamics of urban development for achieving low-emission, the comprehensive capacity building at the national level, provincial, and regency/city is needed. There should also be resources mobilization so that every city is has adequate means to do their work.

In addition, climate change awareness needs to be embedded in the mindset so should be included in the curriculum of public education from elementary through high school levels. The reduction of emissions cannot be done in a short period of time, but it is a habit that takes place over a long period of time. Thus, the existence
of the educational curriculum on climate change can provide an understanding and awareness on everyone within a longer time period, thus encouraging them to mitigate or adapt to climate change through habits of their daily lives.

Energy utilization for the industry sector requires a new innovation in terms of energy efficiency. For example, in the cities there are always a lot of five-star hotels that use a lot of air conditioning. Heat from the air conditioner can be used for other energy e.g. for heating water in the hotel. However, some hotels have not been interested in doing this kind of energy efficiency.

Socialization of emission reduction must occur so that people can understand what causes emissions and how to reduce these emissions. The easiest way for the community to reduce emissions is to know the level of emissions from their vehicle. But a vehicle emission gauge, which is easy to use by community, is not yet available. The Government should create vehicle emissions gauges in order for users to measure emissions and for increasing public awareness of emission reduction.

To achieve sustainable development and address climate change there must be a green economy, and green investment by the private sector. To support this, Corporate Social Responsibility (CSR) should become Corporate Shared Value (CSV) so that the resulting activities are more effective and valuable.
Members:
1. BPS-Statistics Indonesia
2. ITB
3. BIG
4. BAPPENAS
5. BPLHD Kota Semarang
6. BBC Media Action
7. UNFPA

Rapporteur: Narwawi Pramudhiarta (UNFPA)

Data availability and database development needs following BPS-Statistics Indonesia initiatives and interests

BPS-Statistics Indonesia currently has plans to develop a new SUSENAS module (to be run on a recurrent basis every three years) to collect data on people’s attitude and behaviors related to climate change and any associated issues of interest. It might eventually also be possible to include some questions from the module into the core component of the SUSENAS if there was sufficient demand for more frequent data. The SUNESNAS has a sufficiently large sample to provide district government level data for measures derived from all respondents. BPS-Statistics Indonesia called for contributions from all interested users in developing the content of this module and put forward the idea that UNFPAs technical assistance would be valued in forwarding this data development activity.

BPS-Statistics Indonesia and DNPI have discussed developing data related to climate change in Indonesia. BPS-Statistics Indonesia had the capacity to produce household level data, while climate change data and indicators at the local level should become the responsibility of local government. The local government had limited capacity and indeed limited appreciation of the need for such data.

Specific recommendations arose from this discussion were:

i) The Ministry of Environment should organize an assessment of the capacity of local governments to develop and provide climate change related data; and
ii) As assistance to develop local government capacity as data providers and users, local governments should be provided with a suitable training that would raise the appreciation of the importance of climate change and population related issues, and the importance of collecting data to monitor climate change and evaluate its effects.

Generally it was agreed that there was a need for an overarching conceptual framework to guide data development activities (that is, the collection and integration of data) in the whole area of concern. Therefore, UNFPA is expected to play a leadership or significant supportive role in the preparation of the framework. Based on those reasons, BPS-Statistic Indonesia and Ministry of Environment could work to build an integrated population and climate change hazard databases.

Mr. Wynandin (BPS-Statistics Indonesia) noted that PODES survey could be used as new data sources by including some climate change related indicators. He also informed that the global statistical community will be working to develop the content of the 2020 Census and will consider demand for any climate change related variables that may arise. While Mr. Tommy Firman (ITB) informed that there was a great deal of data around, but its need to be standardized and integrated to make it more useable/accessible.

In response to the interests for obtaining more refined location specific data raised by Mr. Sumaryono (BIG), Mr. Wynandin advised that there would be a possibility of providing geo-code references (GPS coordinates) for households in BPS-Statistics Indonesia social surveys. The possibility arose because BPS-Statistics Indonesia would move to Computer Assisted Personal Interviewing (CAPI) technologies, and the software associated with the computers can automatically provide the location data at the time of the interview. But it still needs to be discussed about how and whether this data could be provided to the users in view of confidentiality and other issues.

Ibu Syarifah (BBC Media) informed that BBC Media Action had undertaken innovative multinational study on climate change. The study work had been stored in the portal provided at http://www.bbc.co.uk/mediaaction/climateasiadataportal. It was noted that BBC data collection instrument could provide useful ideas for the yet to be developed SUSENAS climate change related module discussed above.

Regarding the various GIS data-access platforms, it was acknowledged that there was a need to increase the capacity of users to utilize the data visualization analysis and technology. This included the provision of further case study examples (such as the Semarang study) about how the data might be used to support the local planning processes. The idea of a single data “One Map” concept promoted by BIG was applauded. But it needs topic-specific portals that provided task-specific data directories. Analysis and information of all relevant data access and evaluation tools was vital in ensuring the effective use of the data.

Timely and reliable data that well describes social, economic and physical environment are vital to inform decision-makers to mitigate climate change and to prepare for the consequences. These factors need to be considered in making good decisions to face climate change:

Type of hazard exposure (floods, droughts, sea level rise, storm surges etc.), the level of risk from these hazards, and where and when they will impact the most;
Who will be affected – where and how many people are at risk of hazard exposure and their characteristics, especially whether or not they have special needs; there also needs to be consideration of those who would have difficulties in adjusting to the new circumstances (perhaps due to poverty, low education, disability, frailty or poor health and so on) and which groups is likely to have a lesser capacity to adapt to the change in order to provide appropriate support;

Over time, what progress is being made in increasing the resilience and readiness of communities for the impending changes (data to support the progressive monitoring and evaluation of conditions and how well remedial programs may be working); and

Energy utilization and CO2 emission levels from sources of emission (industry, land use type or population groups) to assist planning and mitigation action.

Those are big challenges. There are many data items that need to be brought together in spatially relevant and easy to understand.

What are the challenges on this work and how might they best be overcome?

Data
i) The sufficiency of the data. What other data is needed? Do we have adequate conceptual frameworks to guide the collection of data and identify data gaps?
ii) In addition to PODES and Census data, are there other useful sources of data, particular data items (perhaps administrative data) that are known to be available but have not yet been accessed and might be incorporated into the databases that have been seen?
iii) How can the choice of summary measures/social indicators be improved? Are the measures we have now adequate for measuring the concepts such as vulnerability and resilience?
iv) Did data accessibility become an issue? (Is there any data available that cannot be easily accessed and why?)
v) Are the data collected sufficiently standardized in order to will enable comparability over time and between different areas?

Building GIS based platforms – Next steps: How might these be enhanced to support the analysis of problems at the national, regional and local levels.
Examples of the relevant platforms include:
1) The Semarang case study platform shown by Sainan Zhang (UNFPA)
2) The UNFPA “Popclimate” data access and evaluation tools
3) The One Map initiative (GOI-BIG)
4) The Disaster Data and Information (Didi) GIS platform developed by UNFPA, BNBP and BPS-Statistics Indonesia.
THE WAY FORWARD
Having conducted the parallel roundtable discussions and the closing remarks by Bappeda Semarang, the workshop agenda continued with internal meeting of Steering Committee discussing the follow-up studies.

This meeting was chaired by Jose Ferraris (UNFPA) and Farhan Helmy (DNPI), and was attended by other SC members:

1. the National Population and Family Planning Board (BKKBN)
   a. Suyono Hadinoto: Director of Population Impact Analysis; and
   b. Flourisa Juliaan Sudrajat: Head of Research and Development Center

2. BPS – Statistic Indonesia
   a. Wynandin Imawan: Deputy of Social Statistics

3. the United Nations Population Funds (UNFPA)
   a. Jose Ferraris: Representative;
   b. Richard J. Makalew: National Programme Officer for Population and Development;
   c. Daniel Schensul: Technical Specialist of Population and Development Branch at UNFPA Headquarters;
   d. Sainan Zhang: Data Analyst of Population and Development Branch at UNFPA Technical Division;
   e. Horst Posselt: Programme Analyst for Population and Development;
   f. Narwawi Pramudhiarta: Programme Officer for Humanitarian and Data; and
   g. Dikot P Harahap: Research Associate.

4. The International Institute for Environment and Development (IIED)
   a. David Dodman: Senior Researcher

5. Urban and Regional Development Institute (URDI)
   a. Wahyu Mulyana: Managing Director
   b. Aris Choirul Anwar: Researcher

6. Academics
   a. Adrian C. Hayes: Australian Demographic and Social Research Institute - ADSRI/ANU
   b. Tommy Firman: Professor at School of Architecture, Planning and Policy Development, Bandung Institute of Technology (ITB)

The internal meeting was began with introductions, and then proceeded in three stages:

(i) A summary of outcomes from the workshop on population dynamics and climate change;
(ii) A review and discussion of related research and data in existence; and
(iii) Deliberation on priorities for the project agenda.
Outcomes from Workshop on Population Dynamics and Climate Change

Climate change is about people as well as climate, therefore population issues are closely linked with climate change. A nuanced and evidence-based perspective on population dynamics will assist policy makers for national and district climate change responses.

Key messages from the workshop include:

a. Population dynamics affect climate change through multiple paths (not just population size and growth). A population perspective also helps to integrate the many human dimensions of climate change (economic, political, social and cultural, as well as demographic) into a common framework that can be used in policy formulation. The workshop also considers the implications of trends in urbanization, population growth, age structure, and the growth of the middle class for human-influenced climate change.

b. The case-study concisely illustrates how population dynamics influence both causes and consequences of climate change, through an analysis that examines vulnerability to climate change. Using population information for programme adaptation, this case-study demonstrates innovative thinking and contributes significantly to the climate change agenda, prompting us to account for population dynamics as Indonesia builds its national response to climate change. This study denotes that:
   1. vulnerability to climate change is unevenly distributed between age-structure, gender, and urban-rural populations;
   2. population change therefore affects vulnerability;
   3. densely-populated urban areas can become an important ally in to adapt to and mitigate climate change;
   4. compactness and economies of scale in cities can reduce per capita costs and energy demand, while minimizing pressures on surrounding land and natural resources;
   5. urbanization is a powerful factor in climate change; and
   6. An understanding of those things provides a change in the nature of adaptation—building and adaptive capacity among people and communities.

c. The seminar echoes the International Conference on Population Development (ICPD) principle on sustainable development, population and environmental inter-linkages: “Sustainable development as a means to ensure human well-being, equitably shared by all people today and in the future, requires that the interrelationships between population, resources, the environment and development should be fully recognized, appropriately managed and brought into harmonious, dynamic balance. To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate policies, including population-related policies, in order to meet the needs of current generations without compromising the ability of future generations to meet their own needs” (ICPD Programme of Action, Chapter II, Principle 6)

d. Policy makers need to consider population dynamics in the design of adaptation and mitigation strategies, and take advantage of any synergies which might exist between population-related policies on one hand and policies to reduce energy intensity and carbon intensity on the other ("policy convergence").
Review and Discussion of Related Research and Data in Existence

One of the foremost challenges in understanding the linkages between population dynamics and climate change is in identifying, collecting and integrating data. Narwawi Pramudhiarta, Programme Officer for Humanitarian and Data at UNFPA, presented the data and information system developed by National Disaster Management Agency (BNPB), BPS-Statistics Indonesia and UNFPA. This data platform provides information related to population spectacles and natural hazards & disaster management using merging data between Population Census 2010 (SP2010) and Village Potential Survey (PODES 2011). The data platform is accessible and can be accessed online: http://dibi.bnpb.go.id/DesInventar/data_profil_wilayah.jsp

The committee also highlights that data can be used for the analysis of factors that will improve both mitigation and adaptation efforts, such as BPS-Statistics Indonesia data (Population Census, Agriculture Census, National Social Economic Survey (SUSENAS) and PODES), Geospatial Information Agency (BIG), the Indonesian Meteorological, Climatological and Geophysical Agency (BMKG) data, and Ministry of Environment data. BPS-Statistics Indonesia has been developing ways to incorporate the knowledge, attitude, and practice of population on climate change into Inter-censal population survey (SUPAS) and National Social Economic Survey (SUSENAS).

This steering committee also underscored the importance of integrating satellite, survey, and census data (support of improved data streams and technical assistance is essential in this connection), climate modeling and socio-demographic data in order to understand the linkages between population dynamics and climate change.

Deliberation on Priorities for the Project Agenda

The following recommendations were made for the development of a project document regarding Indonesian climate change and population challenges and to promote overall sustainable development:

1. Set up and enhance strong coordination amongst institutions (in particular DNPI, BKKBKN, BAPPENAS, and UNFPA) for climate change and population work;
2. The project document should focus on adaptation, mitigation and population policies and should apply two approaches:
   (i) Population is the crucial environmental problem, and
   (ii) using Inter-governmental Panel on Climate Change (IPCC)’s approach in which each additional person is an undifferentiated unit contributing to one more unit of GHG emission;
3. Include attention to population and integrated strategies as part of the longer-term enhanced adaptation and mitigation programmes.
4. Spatial and social information is necessary to understand both direction of the population-climate change linkages (causes and consequences), policy targeting, and planning & provision of services. This spatial information should integrate satellite data, census data, survey data, vital events data, and models (such as climate, hydrological, and so on).